Northern Cape Province
DEPARTMENT OF ENVIRONMENT & NATURE CONSERVATION

Porofensi Ya Kapa Bokone
LEFAPHA LA TIKOLOGO LE TSHOMARELO YA TLHAGO

BASIC ASSESSMENT REPORT

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(For official use only)

File Reference Number:	
Application Number:	
Date Received:	

BASIC ASSESSMENT REPORT

Basic Assessment Report in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2010.

Kindly note that:

1. This **basic assessment report** is a standard report that may be required by a competent authority in terms of the EIA Regulations, 2010 and is meant to streamline applications. Please make sure that it is the report used by the particular competent authority for the activity that is being applied for.
2. The report must be typed within the spaces provided in the form. The size of the spaces provided are not necessarily indicative of the amount of information to be provided. The report is in the form of a table that can extend itself as each space is filled with typing.
3. Where applicable **tick** the boxes that are applicable or **black out** the boxes that are not applicable in the report.
4. An incomplete report may be returned to the applicant for revision.
5. The use of "not applicable" in the report must be done with circumspection because if it is used in respect of material information that is required by the competent authority for assessing the application, it may result in the rejection of the application as provided for in the regulations.
6. This report must be handed in at offices of the relevant competent authority as determined by each authority.
7. No faxed or e-mailed reports will be accepted.
8. The report must be compiled by an independent environmental assessment practitioner.
9. Unless protected by law, all information in the report will become public information on receipt by the competent authority. Any interested and affected party should be provided with the information contained in this report on request, during any stage of the application process.
10. A competent authority may require that for specified types of activities in defined situations only parts of this report need to be completed.

SECTION A: ACTIVITY INFORMATION

Has a specialist been consulted to assist with the completion of this section?	[redacted]	NO

If YES, please complete form XX for each specialist thus appointed:
Any specialist reports must be contained in Appendix D.

1. ACTIVITY DESCRIPTION

Describe the activity, which is being applied for, in detail:

The Assmang Black Rock Mine Operations (BRMO) proposes to establish approximately 115 residential dwelling units at their operations north of Hotazel in the Northern Cape (proposed development footprint of 15ha in extent). Each dwelling unit would house 4 people (Figure 1). The project would thus ultimately provide housing for 460 Assmang employees and contractors over the operational lifetime of the mine (life of mine estimated at approximately 30 years). The proposed development (preferred site alternative, S1) would occur on Ptn. 3 of the farm Nchwaning 267 (Appendix 1 – Locality Map, refers). A second site alternative was investigated on Ptn. 1 of the farm Santoy; where this site is also owned by the BRMO.

Figure 1: Photograph of 4 sleeper 'Housing Unit' Demo Model

The construction and development of the residential units is proposed in a phased manner; whereby Assmang's immediate priority is to establish an initial 40 units (Phase 1 - housing for 160 people) with an approximate development footprint of 3.5ha in extent. These 40 units are required in order to relocate staff living in hostel accommodation at the BRMO to more suitable accommodation in line with the requirements of the Mining Charter (i.e. one person per room with their own bathroom / shower and kitchenette, etc.). Phase 2 would constitute the development of an additional 25 dwelling units (housing for 100 people), and phase three 50 units (housing for 200 people).

S1 – Preferred Site Alternative:
The proponent's preferred development site is an undisturbed ('green-fields') site located immediately east of the Santoy Rec. Club, and north and east of the associated soccer field and

pavilion (Figure 2). The development of such residential units elsewhere on the BRMO surface rights area is limited largely by land ownership, as well as the current operational mining activities taking place on the greater site. The preferred development site would be effectively fenced off from remaining mining activities/sites at the BRMO; whereby staff housed at the facility would need to enter the mine site through an access control point.

The proposed development would tie in with the existing sewage reticulation and associated treatment plant at the Black Rock Village (new pump station required). There would be no immediate need to upgrade the sewage treatment plant capacity as part of the development and occupation of the first 40 units (phase 1); where the treatment demand is merely being moved geographically from the hostels to the new development site, and no additional burden will be placed on the treatment plant. The development of the further 80 units (Phases 2 and 3) would potentially require the proponent to upgrade the plant and apply for any requisite licences in terms of the 'Waste Act' (Act 59 of 2008)[NEM:WA] to do so (as necessary).

Similar to the above, the potable water- and electrical demand for the development would be sourced from existing connections for each in close proximity to the site. The proposed development also makes provision for parking and hard landscaping associated therewith (e.g. internal roads, parking bays, walking paths, etc.). Access to the preferred development site would be established along the northern side of the BRMO Recreation Club.

	
S1 – Preferred (Feasible) Site Alternative	S2 – Site Alternative 2

Figure 2: Aerial Imagery Showing Site Alternatives

S2 - Site Alternative 2:
The possibility of re-furbishing the current BRMO hostel complex (as well as expanding such to meet future housing needs) is investigated as ‘site alternative S2’ in the Basic Assessment EIA process (Figure 2). The existing hostel complex is located within the ‘active’ mine area itself, to the south of the Black Rock ‘Koppie’. The potential expansion of the existing hostel could potentially take place to the west thereof; where this area is subject to significant previous disturbance and land degradation through previous mining activities.

Similarly to S1, this alternative would tie in with existing BRMO service infrastructure in the area. Ready access to the site exists, but this requires that one go through mine access control prior to entry/exit to and from the site.

2. FEASIBLE AND REASONABLE ALTERNATIVES

“alternatives”, in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to—
(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity; and
(f) the option of not implementing the activity.

Describe alternatives that are considered in this application. Alternatives should include a consideration of all possible means by which the purpose and need of the proposed activity could be accomplished in the specific instance taking account of the interest of the applicant in the activity. The no-go alternative must in all cases be included in the assessment phase as the baseline against which the impacts of the other alternatives are assessed. The determination of whether site or activity (including different processes etc.) or both is appropriate needs to be informed by the specific circumstances of the activity and its environment. After receipt of this report the competent authority may also request the applicant to assess additional alternatives that could possibly accomplish the purpose and need of the proposed activity if it is clear that realistic alternatives have not been considered to a reasonable extent.

Paragraphs 3 – 13 below should be completed for each alternative.

3. ACTIVITY POSITION

Indicate the position of the activity using the latitude and longitude of the centre point of the site for each alternative site. The co-ordinates should be in degrees and decimal minutes. The minutes should have at least three decimals to ensure adequate accuracy. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection.

List alternative sites if applicable.

Alternative:	**Latitude (S):**		**Longitude (E):**	
Alternative S1[1] (preferred or only site alternative)	27 °	7.363’	22 °	50.773’
Alternative S2 (if any)	27 °	7.971’	22 °	50.265
Alternative S3 (if any)				

In the case of linear activities: <u>N/A</u>

Alternative:	**Latitude (S):**		**Longitude (E):**	
Alternative S1 (preferred or only route alternative)				
• Starting point of the activity	°	‘	°	‘
• Middle point of the activity	°	‘	°	‘
• End point of the activity	°	‘	°	‘
Alternative S2 (if any)				
• Starting point of the activity	°	‘	°	‘
• Middle point of the activity	°	‘	°	‘
• End point of the activity	°	‘	°	‘
Alternative S3 (if any)				
• Starting point of the activity	°	‘	°	‘
• Middle point of the activity	°	‘	°	‘
• End point of the activity	°	‘	°	‘

For route alternatives that are longer than 500m, please provide an addendum with co-ordinates taken every 250 meters along the route for each alternative alignment.

[1] “Alternative S..” refer to site alternatives.

4. PHYSICAL SIZE OF THE ACTIVITY

Indicate the physical size of the preferred activity/technology as well as alternative activities/technologies (footprints):

Alternative:	**Size of the activity:**
Alternative A1[2] (preferred activity alternative)	150 000m^2
Alternative A2 (if any)	150 000m^2
Alternative A3 (if any)	[redacted]

or, for linear activities:

Alternative:	**Length of the activity:**
Alternative A1 (preferred activity alternative)	[redacted]
Alternative A2 (if any)	
Alternative A3 (if any)	

Indicate the size of the alternative sites or servitudes (within which the above footprints will occur):

Alternative:	**Size of the site/servitude:**
Alternative A1 (preferred activity alternative)	[redacted]
Alternative A2 (if any)	
Alternative A3 (if any)	

5. SITE ACCESS

S1: PREFERRED ALTERNATIVE

Does ready access to the site exist?	[redacted]	NO
If NO, what is the distance over which a new access road will be built	75m	

Describe the type of access road planned:

A surfaced road (tarmac, or paving), of approximately 8m in width, would be established to provide access to the site. The access road would be established on the northern side of the existing Santoy Recreation Club (south of the existing tar road leading to the Black Rock Village).

Include the position of the access road on the site plan and required map, as well as an indication of the road in relation to the site.

S2: SITE ALTERATIVE 2

Does ready access to the site exist?	YES	[redacted]
If NO, what is the distance over which a new access road will be built		

Describe the type of access road planned:

N/A

Include the position of the access road on the site plan and required map, as well as an indication of the road in relation to the site.

6. SITE OR ROUTE PLAN

A detailed site or route plan(s) must be prepared for each alternative site or alternative activity. It must be attached as Appendix A to this document.

The site or route plans must indicate the following:

6.1 the scale of the plan which must be at least a scale of 1:500;
6.2 the property boundaries and numbers of all the properties within 50 metres of the site;
6.3 the current land use as well as the land use zoning of each of the properties adjoining the site or sites;
6.4 the exact position of each element of the application as well as any other structures on the site;
6.5 the position of services, including electricity supply cables (indicate above or underground), water supply pipelines, boreholes, street lights, sewage pipelines, storm water infrastructure and telecommunication infrastructure;
6.6 all trees and shrubs taller than 1.8 metres;
6.7 walls and fencing including details of the height and construction material;
6.8 servitudes indicating the purpose of the servitude;
6.9 sensitive environmental elements within 100 metres of the site or sites including (but not limited thereto):
- rivers;
- the 1:100 year flood line (where available or where it is required by DWA);

[2] "Alternative A.." refer to activity, process, technology or other alternatives.

- ridges;
- cultural and historical features;
- areas with indigenous vegetation (even if it is degraded or invested with alien species);

6.9 for gentle slopes the 1 metre contour intervals must be indicated on the plan and whenever the slope of the site exceeds 1:10, the 500mm contours must be indicated on the plan; and

6.10 the positions from where photographs of the site were taken.

7. SITE PHOTOGRAPHS

Colour photographs from the centre of the site must be taken in at least the eight major compass directions with a description of each photograph. Photographs must be attached under Appendix B to this form. It must be supplemented with additional photographs of relevant features on the site, if applicable.

8. FACILITY ILLUSTRATION

A detailed illustration of the activity must be provided at a scale of 1:200 as Appendix C for activities that include structures. The illustrations must be to scale and must represent a realistic image of the planned activity. The illustration must give a representative view of the activity.

9. ACTIVITY MOTIVATION

S1: PREFERRED ALTERNATIVE & S2: SITE ALTERNATIVE 2

9(a) Socio-economic value of the activity

What is the expected capital value of the activity on completion?	R15 million (All 3 phases)	
What is the expected yearly income that will be generated by or as a result of the activity?	N/A	
Will the activity contribute to service infrastructure?	[redacted]	NO
Is the activity a public amenity?	[redacted]	NO
How many new employment opportunities will be created in the development phase of the activity?	30	
What is the expected value of the employment opportunities during the development phase?	R to be determined	
What percentage of this will accrue to previously disadvantaged individuals?	% to be determined	
How many permanent new employment opportunities will be created during the operational phase of the activity?	10	
What is the expected current value of the employment opportunities during the first 10 years?	[redacted]	
What percentage of this will accrue to previously disadvantaged individuals?	[redacted]	

9(b) Need and desirability of the activity

Motivate and explain the need and desirability of the activity (including demand for the activity):

The need and desirability of the proposed development is thus deemed to be integrally linked with the ultimate need and desirability of the greater BRMO; where the activities being applied for are supportive of the mining operations undertaken in one manner, or another.

The activities need and desirability thus lies in ensuring that the BRMO functions as an effective economic entity and thus contributes positively to continued employment in the region and contribution to the National GDP.

The need and desirability of the proposed development (certainly so far as concerns phase 1 thereof) also lies in the legal requirement for the BRMO to adhere to the provisions of the mining charter (so far as concerns the minimum requirements set by the Department of Mineral Resources for the housing of employees on site).

Indicate any benefits that the activity will have for society in general:

The establishment of 10 permanent employment opportunities and several construction phase opportunities may benefit the surrounding communities.

The activities being applied for do not necessarily have direct benefits to society in general, or the local communities in the vicinity thereof, but they do indirectly benefit society and surrounding communities indirectly through ensuring the efficient and effective functioning of the BRMO, such that the continued employment opportunities and contribution to National GDP that BRMO offers are indeed realized.

Indicate any benefits that the activity will have for the local communities where the activity will be located:

Limited short-term (6-12 months) employment would be created during the construction phase of the project for members of the local community (as available skills allow).

DESIRABILITY:			
1.	Does the proposed land use / development fit the surrounding area?	YES	
2.	Does the proposed land use / development conform to the relevant structure plans, SDF and planning visions for the area?		NO
3.	Will the benefits of the proposed land use / development outweigh the negative impacts of it?	YES	
4.	If the answer to any of the questions 1-3 was NO, please provide further motivation / explanation:		
	According to the (2011) John Taolo Gaetsewe District Municipality environmental management framework (EMF), …"*towns like Kuruman and Kathu should be prioritized as further development and investment areas, as opposed to creating new development areas where new infrastructure, services and facilities need to be provided. This is particularly important in the District where mining houses develop small settlements adjacent to the mine to house mine workers and associated service providers. Kuruman in particular, should be further developed as the major urban centre*". It should be noted that the service infrastructure necessary to establish the housing development is already largely in place, with any upgrades/modifications thereof necessary for project implementation to be borne at the proponent's cost. The proposed development will replace existing hostels. The proposed development can be viewed as an extension to an existing, serviced, urban settlement (albeit a mining village).		
5.	Will the proposed land use / development impact on the sense of place?		NO
6.	Will the proposed land use / development set a precedent?		NO
7.	Will any person's rights be affected by the proposed land use / development?		NO
8.	Will the proposed land use / development compromise the "urban edge"?		NO
9.	If the answer to any of the question 5-8 was YES, please provide further motivation / explanation.		
	No formalized 'urban edge', in terms of a town planning ordinance, relevant to the proposed development.		

BENEFITS:			
1.	Will the land use / development have any benefits for society in general?	YES	
2.	Explain:		
	The establishment of 10 permanent employment opportunities and several construction phase opportunities may benefit the surrounding communities. The activities being applied for do not necessarily have direct benefits to society in general, or the local communities in the vicinity thereof, but they do indirectly benefit society and surrounding communities indirectly through ensuring the efficient and effective functioning of the BRMO, such that the continued employment opportunities		

	and contribution to National GDP that BRMO offers are indeed realised.		
3.	Will the land use / development have any benefits for the local communities where it will be located?	YES	
4.	Explain:		
	Limited short-term (6-12 months) employment would be created during the construction phase of the project, and 10 permanent employment opportunities, for members of the local community (as available skills allow).		

10. APPLICABLE LEGISLATION, POLICIES AND/OR GUIDELINES

S1: PREFERRED ALTERNATIVE & S2: SITE ALTERNATIVE 2

List all legislation, policies and/or guidelines of any sphere of government that are applicable to the application as contemplated in the EIA regulations, if applicable:

Title of legislation, policy or guideline:	Administering authority:	Date:
National Environmental Management Act, 1998 (Act No. 107 of 1998)[NEMA], as amended	Northern Cape Department of Environment and Nature Conservation (NC DENC)	29 January, 1999
2010 NEMA EIA Regulations: • GN. R. 543; • GN. R. 544; and • GN. R. 546.	Northern Cape Department of Environment and Nature Conservation (NC DENC)	18 June, 2010
Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)[MPRDA]	Department of Mineral Resources (DMR)	10 October 2002
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)[NEM:BA]	Northern Cape Department of Environment and Nature Conservation (NC DENC)	7 June, 2004
Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)	Northern Cape Department of Environment and Nature Conservation (NC DENC)	18 March, 2010
National Heritage Resources Act (Act No. 25 of 1999)[NHRA]	South African Heritage Resources Agency (SAHRA)	28 April, 1998
National Forests Act (Act No. 84 of 1998)[NFA]	Department of Agriculture, Forestry and Fisheries (DAFF)	30 October, 1998
National Environmental Management: Waste Act (Act No. 59 of 2008)[NEM:WA]	Northern Cape Department of Environment and Nature Conservation (NC DENC)	3 July, 2009
The South African 'Mining Charter', as amended	Department of Mineral Resources (DMR)	September, 2010

11. WASTE, EFFLUENT, EMISSION AND NOISE MANAGEMENT

S1: PREFERRED ALTERNATIVE & S2: SITE ALTERNATIVE 2

11(a) Solid waste management

Will the activity produce solid construction waste during the construction/initiation phase?
If yes, what estimated quantity will be produced per month?

YES	[redacted]
$10m^3$	

How will the construction solid waste be disposed of (describe)?

Solid waste (general waste) produced during the construction phase of the project will be disposed of at the existing, licensed, BRMO General Landfill Site at the Black Rock Mine. Such waste will be stored on site in water-tight skips/containers and collected weekly (or at greater frequency if the need arises) by the BRMO for disposal to the said landfill site (Please refer to Appendix G for a copy of the aforementioned waste management license).

Any hazardous waste produced during the construction phase (although none is anticipated) would be stored temporarily at the Black Rock Mine salvage yard (in appropriately bunded/roofed storage areas), and collected by a hazardous waste management contractor for disposal to a suitably licensed waste disposal facility. Safe disposal certificates will be kept for record purposes of all hazardous waste removed from the BRMO.

Where will the construction solid waste be disposed of (describe)?

The licensed BRMO General Landfill Site.

Will the activity produce solid waste during its operational phase?
If yes, what estimated quantity will be produced per month?

YES	[redacted]
$50m^3$ (1.25kg/person/day @ $330kg/m^3$ general waste produced)	

How will the solid waste be disposed of (describe)?

Solid waste (general/domestic waste) produced during the operational phase of the project will be collected weekly (or at greater frequency if the need arises) by the BRMO for disposal to the aforementioned landfill site (Please refer to Appendix G for a copy of the aforementioned waste management license).

Where will the solid waste be disposed if it does not feed into a municipal waste stream (describe)?

The licensed BRMO General Landfill Site.

If the solid waste (construction or operational phases) will not be disposed of in a registered landfill site or be taken up in a municipal waste stream, then the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Can any part of the solid waste be classified as hazardous in terms of the relevant legislation? [redacted] NO

If yes, inform the competent authority and request a change to an application for scoping and EIA.

Is the activity that is being applied for a solid waste handling or treatment facility? [redacted] NO

If yes, then the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

11(b) Liquid effluent

Will the activity produce effluent, other than normal sewage, that will be disposed of in a municipal sewage system? [redacted] NO

If yes, what estimated quantity will be produced per month? [redacted]

Will the activity produce any effluent that will be treated and/or disposed of on site? Yes [redacted]

If yes, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Will the activity produce effluent that will be treated and/or disposed of at another facility? [redacted] NO

If yes, provide the particulars of the facility:

Facility name:

Contact person:			
Postal address:			
Postal code:			
Telephone:		Cell:	
E-mail:		Fax:	

Describe the measures that will be taken to ensure the optimal reuse or recycling of waste water, if any:

Treated sewage effluent (i.e. from sewage to be treated at the Black Rock Sewage Treatment Works) will be re-circulated to the mine's process water circuit for reuse.

11(c) Emissions into the atmosphere

Will the activity release emissions into the atmosphere?	[redacted]	NO
If yes, is it controlled by any legislation of any sphere of government?	[redacted]	

If yes, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.
If no, describe the emissions in terms of type and concentration:

11(d) Generation of noise

Will the activity generate noise?	YES	[redacted]
If yes, is it controlled by any legislation of any sphere of government?	[redacted]	NO

If yes, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.
If no, describe the noise in terms of type and level:

There will be limited noise during the construction period.

12. WATER USE

S1: PREFERRED ALTERNATIVE & S2: SITE ALTERNATIVE 2

Please indicate the source(s) of water that will be used for the activity by ticking the appropriate box(es)

[redacted]	water board	[redacted]

If water is to be extracted from groundwater, river, stream, dam, lake or any other natural feature, please indicate the volume that will be extracted per month:	0 litres	
Does the activity require a water use permit from the Department of Water Affairs?	[redacted]	NO

If yes, please submit the necessary application to the Department of Water Affairs and attach proof thereof to this application if it has been submitted.

13. ENERGY EFFICIENCY

S1: PREFERRED ALTERNATIVE & S2: SITE ALTERNATIVE 2

Describe the design measures, if any, that have been taken to ensure that the activity is energy efficient:

No detailed specifics provided by the proponent; however energy efficient lighting and low flow showers are expected to be used.

Describe how alternative energy sources have been taken into account or been built into the design of the activity, if any:

The installation of solar geysers for each of the dwelling units is proposed in order to off-set the electrical demand of the proposed activity.

SECTION B : SITE/AREA/PROPERTY DESCRIPTION

Important notes:

1. For linear activities (pipelines, etc) as well as activities that cover very large sites, it may be necessary to complete this section for each part of the site that has a significantly different environment. In such cases please complete copies of Section C and indicate the area, which is covered by each copy No. on the Site Plan.

Section C Copy No. (e.g. A):

2. Paragraphs 1 - 6 below must be completed for each alternative.

3. Has a specialist been consulted to assist with the completion of this section? | YES | [redacted] |

If YES, please complete form XX for each specialist thus appointed:
All specialist reports must be contained in Appendix D.

1. GRADIENT OF THE SITE

Indicate the general gradient of the site.

Alternative S1:

Flat	[redacted]	[redacted]

Alternative S2 (if any):

Flat	[redacted]	[redacted]

Alternative S3 (if any):

[redacted]	[redacted]

2. LOCATION IN LANDSCAPE

S1: PREFERRED ALTERNATIVE & S2: SITE ALTERNATIVE 2

Indicate the landform(s) that best describes the site:

~~2.1 Ridgeline~~
~~2.2 Plateau~~
~~2.3 Side slope of hill/mountain~~
~~2.4 Closed valley~~
~~2.5 Open valley~~
2.6 Plain
~~2.7 Undulating plain / low hills~~
~~2.8 Dune~~
~~2.9 Seafront~~

3. GROUNDWATER, SOIL AND GEOLOGICAL STABILITY OF THE SITE

Is the site(s) located on any of the following (tick the appropriate boxes)?

	Alternative S1:		**Alternative S2 (if any):**		**Alternative S3 (if any):**
Shallow water table (less than 1.5m deep)	[redacted]	NO	[redacted]	NO	[redacted]
Dolomite, sinkhole or doline areas	[redacted]	NO	[redacted]	NO	[redacted]
Seasonally wet soils (often close to water bodies)	[redacted]	NO	[redacted]	NO	[redacted]
Unstable rocky slopes or steep slopes with loose soil	[redacted]	NO	[redacted]	NO	[redacted]
Dispersive soils (soils that dissolve in water)	[redacted]	NO	[redacted]	NO	[redacted]
Soils with high clay content (clay fraction more than 40%)	[redacted]	NO	[redacted]	NO	[redacted]
Any other unstable soil or geological feature	[redacted]	NO	YES (Potential under-mining)	[redacted]	[redacted]
An area sensitive to erosion	[redacted]	NO	[redacted]	NO	[redacted]

If you are unsure about any of the above or if you are concerned that any of the above aspects may be an issue of concern in the application, an appropriate specialist should be appointed to assist in the completion of this section. (Information in respect of the above will often be available as part of the project information or at the planning sections of local authorities. Where it exists, the 1:50 000 scale Regional Geotechnical Maps prepared by the Council for Geo Science may also be consulted).

4. GROUNDCOVER

S1: PREFERRED ALTERNATIVE

Indicate the types of groundcover present on the site:

4.1 Natural veld – good condition [E]
~~4.2 Natural veld – scattered aliens [E]~~
~~4.3 Natural veld with heavy alien infestation [E]~~
~~4.4 Veld dominated by alien species [E]~~
~~4.5 Gardens~~
~~4.6 Sport field~~
~~4.7 Cultivated land~~
~~4.8 Paved surface~~
~~4.9 Building or other structure~~
4.10 Bare soil

The location of all identified rare or endangered species or other elements should be accurately indicated on the site plan(s).

Natural veld - good condition[E]	[redacted]			
				Bare soil

If any of the boxes marked with an “[E] “is ticked, please consult an appropriate specialist to assist in the completion of this section if the environmental assessment practitioner doesn’t have the necessary expertise.

S2: SITE ALTERNATIVE 2

Indicate the types of groundcover present on the site:

~~4.1 Natural veld – good condition [E]~~
~~4.2 Natural veld – scattered aliens [E]~~
~~4.3 Natural veld with heavy alien infestation [E]~~
~~4.4 Veld dominated by alien species [E]~~
~~4.5 Gardens~~
~~4.6 Sport field~~
~~4.7 Cultivated land~~
4.8 Paved surface
4.9 Building or other structure
4.10 Bare soil

The location of all identified rare or endangered species or other elements should be accurately indicated on the site plan(s).

[redacted]				
		Paved surface	Building or other structure	Bare soil

If any of the boxes marked with an “E “is ticked, please consult an appropriate specialist to assist in the completion of this section if the environmental assessment practitioner doesn’t have the necessary expertise

5. LAND USE CHARACTER OF SURROUNDING AREA

S1: PREFERRED ALTERNATIVE

Indicate land uses and/or prominent features that does currently occur within a 500m radius of the site and give description of how this influences the application or may be impacted upon by the application:

5.1 Natural area
5.2 Low density residential
~~5.3 Medium density residential~~
~~5.4 High density residential~~
~~5.5 Informal residential [A]~~
~~5.6 Retail commercial & warehousing~~
5.7 Light industrial
~~5.8 Medium industrial [AN]~~
~~5.9 Heavy industrial [AN]~~
~~5.10 Power station~~
~~5.11 Office/consulting room~~
~~5.12 Military or police base/station/compound~~
~~5.13 Spoil heap or slimes dam [A]~~
~~5.14 Quarry, sand or borrow pit~~
~~5.15 Dam or reservoir~~
~~5.16 Hospital/medical centre~~

~~5.17 School~~
~~5.18 Tertiary education facility~~
~~5.19 Church~~
~~5.20 Old age home~~
~~5.21 Sewage treatment plant[A]~~
~~5.22 Train station or shunting yard [N]~~
5.23 Railway line [N]
~~5.24 Major road (4 lanes or more) [N]~~
5.25 Airport [N]
~~5.26 Harbour~~
5.27 Sport facilities
~~5.28 Golf course~~
~~5.29 Polo fields~~
~~5.30 Filling station [H]~~
~~5.31 Landfill or waste treatment site~~
~~5.32 Plantation~~
5.33 Agriculture
~~5.34 River, stream or wetland~~
~~5.35 Nature conservation area~~
~~5.36 Mountain, koppie or ridge~~
~~5.37 Museum~~
~~5.38 Historical building~~
~~5.39 Protected Area~~
~~5.40 Graveyard~~
~~5.41 Archaeological site~~
5.42 Mining and/or associated supporting infrastructure

If any of the boxes marked with an "[N] "are ticked, how this impact will / be impacted upon by the proposed activity.

If YES, specify and explain:	A non-electrified railway line is situated approximately 400m east of the eastern boundary of the proposed development. The railway line is located on the eastern side of the R380 road and would not be impacted upon by the proposed development, or *visa versa*. The BRMO 'air-strip' is located approximately 250m south west of the proposed development, and would similarly not impact upon the proposed development, or *visa versa*. The air-strip accommodates nominal light aircraft traffic during weekdays.

If any of the boxes marked with an "[An]" are ticked, how will this impact / be impacted upon by the proposed activity.

If YES, specify and explain:	NA

If any of the boxes marked with an "[H]" are ticked, how will this impact / be impacted upon by the proposed activity.

If YES, specify and explain:	NA

S2: SITE ALTERNATIVE 2

Indicate land uses and/or prominent features that does currently occur within a 500m radius of the site and give description of how this influences the application or may be impacted upon by the application:

5.1 Natural area
~~5.2 Low density residential~~
~~5.3 Medium density residential~~
5.4 High density residential
~~5.5 Informal residential[A]~~
~~5.6 Retail commercial & warehousing~~
~~5.7 Light industrial~~
~~5.8 Medium industrial [AN]~~
~~5.9 Heavy industrial [AN]~~
5.10 Power station
5.11 Office/consulting room
~~5.12 Military or police base/station/compound~~
~~5.13 Spoil heap or slimes dam[A]~~
~~5.14 Quarry, sand or borrow pit~~
5.15 Dam or reservoir
5.16 Hospital/medical centre
~~5.17 School~~
~~5.18 Tertiary education facility~~
~~5.19 Church~~
~~5.20 Old age home~~
5.21 Sewage treatment plant[A]
~~5.22 Train station or shunting yard [N]~~
5.23 Railway line [N]

~~5.24 Major road (4 lanes or more) [N]~~
~~5.25 Airport [N]~~
~~5.26 Harbour~~
~~5.27 Sport facilities~~
~~5.28 Golf course~~
~~5.29 Polo fields~~
~~5.30 Filling station [H]~~
5.31 Landfill or waste treatment site
~~5.32 Plantation~~
~~5.33 Agriculture~~
~~5.34 River, stream or wetland~~
~~5.35 Nature conservation area~~
5.36 Mountain, koppie or ridge
~~5.37 Museum~~
~~5.38 Historical building~~
~~5.39 Protected Area~~
~~5.40 Graveyard~~
~~5.41 Archaeological site~~
5.42 Mining and/or associated supporting infrastructure

If any of the boxes marked with an "[N] "are ticked, how this impact will / be impacted upon by the proposed activity.

If YES, specify and explain:	A non-electrified railway line (connects Nchwaning II- and Black Rock Mines with line to Hotazel) is located approximately 400m north east of S2 and would not be impacted upon by the proposed development, or *visa versa*.

If any of the boxes marked with an "[An]" are ticked, how will this impact / be impacted upon by the proposed activity.

If YES, specify and explain:	NA

If any of the boxes marked with an "[H]" are ticked, how will this impact / be impacted upon by the proposed activity.

If YES, specify and explain:	NA

6. CULTURAL/HISTORICAL FEATURES

S1: PREFERRED ALTERNATIVE & S2: SITE ALTERNATIVE 2

Are there any signs of culturally or historically significant elements, as defined in section 2 of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), including Archaeological or paleontological sites, on or close (within 20m) to the site?	[redacted]	NO
	Uncertain	
If YES, explain:		
If uncertain, conduct a specialist investigation by a recognised specialist in the field to establish whether there is such a feature(s) present on or close to the site.		
Briefly explain the findings of the specialist:		
Will any building or structure older than 60 years be affected in any way?	[redacted]	NO
Is it necessary to apply for a permit in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999)?	[redacted]	NO

If yes, please submit or, make sure that the applicant or a specialist submits the necessary application to SAHRA or the relevant provincial heritage agency and attach proof thereof to this application if such application has been made.

SECTION C: PUBLIC PARTICIPATION

1. ADVERTISEMENT

The person conducting a public participation process must take into account any guidelines applicable to public participation as contemplated in section 24J of the Act and must give notice to all potential interested and affected parties of the application which is subjected to public participation by—

(a) fixing a notice board (of a size at least 60cm by 42cm; and must display the required information in lettering and in a format as may be determined by the competent authority) at a place conspicuous to the public at the boundary or on the fence of—
  (i) the site where the activity to which the application relates is or is to be undertaken; and
  (ii) any alternative site mentioned in the application;
(b) giving written notice to—
  (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;

(ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
(iii) owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
(iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
(v) the municipality which has jurisdiction in the area;
(vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
(vii) any other party as required by the competent authority;

(c) placing an advertisement in—
(i) one local newspaper; or
(ii) any official *Gazette* that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;

(d) placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or local municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official *Gazette* referred to in subregulation 54(c)(ii); and

(e) using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is desiring of but unable to participate in the process due to—
(i) illiteracy;
(ii) disability; or
(iii) any other disadvantage.

2. CONTENT OF ADVERTISEMENTS AND NOTICES

A notice board, advertisement or notices must:

(a) indicate the details of the application which is subjected to public participation; and
(b) state—
(i) that the application has been submitted to the competent authority in terms of these Regulations, as the case may be;
(ii) whether basic assessment or scoping procedures are being applied to the application, in the case of an application for environmental authorisation;
(iii) the nature and location of the activity to which the application relates;
(iv) where further information on the application or activity can be obtained; and
(iv) the manner in which and the person to whom representations in respect of the application may be made.

3. PLACEMENT OF ADVERTISEMENTS AND NOTICES

Where the proposed activity may have impacts that extend beyond the municipal area where it is located, a notice must be placed in at least one provincial newspaper or national newspaper, indicating that an application will be submitted to the competent authority in terms of these regulations, the nature and location of the activity, where further information on the proposed activity can be obtained and the manner in which representations in respect of the application can be made, unless a notice has been placed in any *Gazette* that is published specifically for the purpose of providing notice to the public of applications made in terms of the EIA regulations.

Advertisements and notices must make provision for all alternatives.

4. DETERMINATION OF APPROPRIATE MEASURES

The practitioner must ensure that the public participation is adequate and must determine whether a public meeting or any other additional measure is appropriate or not based on the particular nature of each case. Special attention should be given to the involvement of local community structures such as Ward Committees, ratepayers associations and traditional authorities where appropriate. Please note that public concerns that emerge at a later stage that should have been addressed may cause the competent authority to withdraw any authorisation it may have issued if it becomes apparent that the public participation process was inadequate.

5. COMMENTS AND RESPONSE REPORT

The practitioner must record all comments and respond to each comment of the public before the application is submitted. The comments and responses must be captured in a comments and response report as prescribed in the EIA regulations and be attached to this application. The comments and response report must be attached under Appendix E.

6. AUTHORITY PARTICIPATION

Authorities are key interested and affected parties in each application and no decision on any application will be made before the relevant local authority is provided with the opportunity to give input. The planning and the environmental sections of the local authority must be informed of the application at least 30 (thirty) calendar days before the submission of the application.

List of authorities informed:

1. John Taolo Gaetsewe District Municipality 2. Joe Morolong Local Municipality 3. Department of Water Affairs 4. South African Heritage Resources Agency 5. Department of Mineral Resources 6. Department of Agriculture, Forestry and Fisheries 7. Northern Cape Department of Environment and Nature Conservation

List of authorities from whom comments have been received:

No comments have been received from any of the authorities informed of the application to date.

7. CONSULTATION WITH OTHER STAKEHOLDERS

Note that, for linear activities, or where deviation from the public participation requirements may be appropriate, the person conducting the public participation process may deviate from the requirements of that sub regulation to the extent and in the manner as may be agreed to by the competent authority.

Any stakeholder that has a direct interest in the site or property, such as servitude holders and service providers, should be informed of the application at least 30 (thirty) calendar days before the submission of the application and be provided with the opportunity to comment.

Has any comment been received from stakeholders? [redacted] NO

If "YES", briefly describe the feedback below (also attach copies of any correspondence to and from the stakeholders to this application):

No comments were received in the prescribed 30 day initial comment period.

SECTION D: IMPACT ASSESSMENT

The assessment of impacts must adhere to the minimum requirements in the EIA Regulations, 2010, and should take applicable official guidelines into account. The issues raised by interested and affected parties should also be addressed in the assessment of impacts.

1. ISSUES RAISED BY INTERESTED AND AFFECTED PARTIES

List the main issues raised by interested and affected parties.

No issues have been raised by interested and affected parties to date.

Response from the practitioner to the issues raised by the interested and affected parties (A full response must be given in the Comments and Response Report that must be attached to this report):

N/A

2. IMPACTS THAT MAY RESULT FROM THE PLANNING AND DESIGN, CONSTRUCTION, OPERATIONAL, DECOMMISSIONING AND CLOSURE PHASES AS WELL AS PROPOSED MANAGEMENT OF IDENTIFIED IMPACTS AND PROPOSED MITIGATION MEASURES

List the potential direct, indirect and cumulative property/activity/design/technology/operational alternative related impacts (as appropriate) that are likely to occur as a result of the planning and design phase, construction phase, operational phase, decommissioning and closure phase, including impacts relating to the choice of site/activity/technology alternatives as well as the mitigation measures that may eliminate or reduce the potential impacts listed.

Construction Phase:

Alternative (preferred alternative – S1)

Direct impacts:

AIR QUALITY:

Introduction

During construction, the undertaking of ground- and civil works would lead to the generation of vehicle and wind entrained dust. Although the impact is likely to be localised to the site, dust suppression techniques such as wetting roads, or application of dust palliatives, would be required. Other emissions, such as construction vehicle and machinery exhausts are not anticipated to be significant. Vegetation stripping exposes bare soils surfaces to wind action, such that dust generation may increase where development areas are stripped of vegetation. It must, however, also be noted that the extent of vegetation cover in naturally vegetated habitat of this area is low when compared to other vegetation types (i.e. % bare ground is significant for the *status quo*). Any vegetation stripping will still contribute to cumulative dust generation, particularly in windy conditions, irrespective of the nominal natural vegetation cover.

The nearest residential receptors to the development site are located approximately 100m north east, and 200m south west of the development site respectively. It must be noted that that the proponent would need to ensure that dust fallout during construction does not exceed the limit for residential land use specified in SANS1929:2005 (i.e. < 600mg/m^2/day – 30 day average).

Impact Discussion & Significance Assessment

The impact will be of a low intensity and isolated to the site and its immediate surrounds. Effective mitigation, in the form of accepted dust suppression techniques, can be applied, but will not likely mitigate the potential occurrence of the impact in its entirety (i.e. residual impacts may be noticeable, but will be negligible relative to the original impact). The residual impacts will occur up until the point at which construction activities cease and when concurrent rehabilitation of applicable affected areas has been completed (i.e. some areas affected by vegetation clearance and topsoil stripping could feasibly be rehabilitated immediately thereafter once construction ceases).

Table 1:Impacts on Air Quality – Significance Rating			
Nature (N)	Negative impact on ambient air quality.		1
Extent (E)	Locally: Localised to the site and immediate surrounds		2
Duration (D)	Medium term: Construction phase (conservatively anticipated for up to a year)		3
Intensity (I)	Minor: Natural processes or functions will hardly be affected		2
Probability (P)	Likely: Impact will likely occur, to the extent that provisions must be made for the mitigation thereof		2
Mitigation (M)	Well mitigated: Effective dust suppression methods readily available		4
Enhancement (H)	N/A		-
Reversibility (R)	Irreversible: Not practical to reverse the impact once it has occurred		1
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	8
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	20
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

The Proponent will institute effective dust suppression measures on all un-surfaced access and haul roads for the duration of the construction phase. Compliance thereto will be measures against draft dust control standards (SANS1929:2005 – 'residential') and associated thresholds.

SURFACE- AND GROUNDWATER QUALITY:

Introduction

The inappropriate storage, management and handling of fuel, oil and other potentially hazardous chemicals and substances during the construction period could result in potentially negative impacts on surface- and ground water quality; where spillages of such could enter the groundwater environment in particular, through the ready infiltration of contaminated surface run-off into the groundwater environment. Poorly managed vehicle workshops and wash bays too would impact negatively on ground- and surface water quality. Contamination of this nature, associated with the construction phase of a project of this magnitude, would typically be hydrocarbon based (i.e. petrol, diesel and oil leaks and spillages to bare soil surfaces). Temporary concrete batching plants can also impact negatively on ground water quality.

Poor placement and maintenance of temporary sanitary arrangements (i.e. portable toilets) can also result in detrimental impacts on water resources in one or another of the following ways (Fuggle and Rabie, 2009), depending on the nature and extent of potentially affected water resources:

- Eutrophication – referring to "*the enrichment of water with nutrients, such as nitrates and phosphates, which give rise to excessive growth of aquatic algae and cyanobacteria in surface water resources in particular*";
- Nitrification – referring to "*the contamination of drinking water supplies with elevated levels of nitrates;* and
- Microbial contamination – referring to the contamination of drinking water supplies with harmful pathogenic agents, such as *E. coli* bacteria and other faecal coliforms.

Groundwater contamination would generally be restricted to the confines of the site, or in severe cases the immediate surrounds of the site. The presence of a major aquifer system beneath the site makes groundwater pollution prevention essential during the construction phase. In the absence of a significant, continuous, point source of pollution, a groundwater pollution plume would likely develop and extend (i.e. in terms of lateral geographic extent) slowly within the underlying geo-hydrological regime.

In addition, during construction, temporary stockpiles of building material, excavated sand and rock, as well as waste, will be produced. It is important that these stockpiles are located in a centralised area where temporary measures such as berms will prevent sediment run-off, specifically during heavy rainfall episodes. These particular waste streams are, however, not expected to be hazardous, or pose a contamination risk to groundwater.

Impact Discussion & Significance Assessment

The anticipated extent of potentially contaminated surface water run-off will be negligible. This is as a result of the sandy nature of the underlying soils; where surface water will readily infiltrate soil surfaces in close proximity to the point of contamination, as opposed to travelling any significant distance at surface. The potential for the contamination of any surface water resources through contaminated surface water flows during construction is thus deemed negligible. The potential for water resource contamination would take place primarily at the level of the ground water environment. Should groundwater contamination occur, the impact would persist almost into perpetuity/forever (i.e. given the 'endorheic' nature of the catchment).

Table 2: Impacts on Surface- and Ground Water Quality – Significance Rating			
Nature (N)	Negative impacts on surface- and ground water quality.		1
Extent (E)	Site and immediate surrounds: Ready infiltration of storm water into sandy underlying soils will limit the extent of the potential impact to the site itself (i.e. groundwater environment)		2
Duration (D)	Long term: Treatment of groundwater contamination (i.e. once occurred) is a long and arduous process		4
Intensity (I)	Major: Adjacent farmers/farming communities reliant on groundwater for their livelihood		4
Probability (P)	Likely: Impact likely to occur, to the extent that provisions must be made for it		2
Mitigation (M)	Well mitigated: A comprehensive range of effective mitigation measures is readily available		4
Enhancement (H)	N/A		-
Reversibility (R)	Irreversible: No amount of time or money will sustainably reverse the impact		1
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	19.2
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	48
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

The remediation of contaminated groundwater is a long, arduous and costly process. Any such remediation efforts may also likely leave significant residual contamination, despite any such remediation attempts (dependant on the nature and extent of the contamination itself). As such, the Proponent's management actions should focus on the prevention of any such potential hydrocarbon contamination, rather than post impact remediation thereof. A comprehensive range of effective, proven, mitigation measures will be implemented in this regard, which are in principle as follows:

- All hazardous substances to be stored within appropriately sized, impermeable, bund walls;
- Storm water control measures to be implemented that prevent the free movement of 'clean' storm water run-off through the aforementioned storage areas, as well as any service yards and wash bays (if at all required);
- Hazardous substances spill kits to be readily available at all points where hazardous substances will be stored and/or transferred (e.g. refuelling points);
- Vehicle and plant servicing to only take place in dedicated service yards on impermeable surfaces coupled with appropriate 'dirty' water containment systems/sumps and oil/water separators; and
- Drip trays to be appropriately placed under vehicles and plant that over-night on bare soil surfaces.

Contractors will also be required to provide a method statement in respect of how they propose to manage fuel storage and workshop areas to minimise the potential for groundwater pollution. Such a method statements would need to be signed off by competent site environmental personnel / environmental control officer (ECO), prior to the start of construction activities.

The BRMO furthermore have an extensive groundwater monitoring network in place.

BIODIVERSITY:

Introduction

According to Fuggle and Rabie (2009) the loss of biodiversity brings significant costs through damage to the services that ecosystems provide. Biodiversity conservation efforts in South Africa are largely species, or area, based. In the former, legal protection is given to species by providing prohibitions or restrictions to listed threatened or protected species (Fuggle and Rabie, 2009). In support of the above, no person in South Africa may "*carry out a restricted activity (e.g. remove, destroy, transport or trade) involving a specimen of a listed threatened or protected species without a permit*".

Project implementation will require the stripping of approximately 15ha of indigenous vegetation during the construction phase for subsequent earthworks and the construction of the proposed housing units. At least two protected tree species are known to occur on the greater BRMO mine site (*Acacia erioloba* and *Acacia haematoxylon*), as well as four protected plant species (*Ammocaris coranica*, *Harpagophytum procumbens, Babiana hypogea* and *Boophane distichia*) - Figure 3 and Table 7 have reference. These species were identified on the greater BRMO mine site in a 2012 biodiversity assessment by Scientific Aquatic Services (SAS); where such lead to the development of the BRMO biodiversity action plan (BAP) – attached hereto under Appendix D. The aforementioned species are reasonably inferred by the EAP to occur on the preferred site location, with the presence of *Acacia erioloba* and *Acacia haematoxylon* having been confirmed by the EAP.

The proposed development area has seen little anthropogenic activity (evidence on aerial imagery of historic product stockpiling), and is considered to be in a moderate ecological condition as a result.

Figure 3: Protected Floral Species Known to Occur in the Area.

Table 3: Protected Floral Species Identified on the greater BRMO Mine Site

Scientific Name	Common Name	Regulation
Acacia erioloba	Camel Thorn	National Forests Act (1998)
Acacia haemotoxylon	Grey Camel Thorn	National Forests Act (1998)
Boscia albitrunca	Shepherd's tree	National Forests Act (1998)
Ammocaris coranica	Karroo Lily	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)
Harpogophytum procumbens	Devil's Claw	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)
Babiana hypogaea	Bobbejaanuintjie	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)
Boophane disticha	Bushman's poison bulb	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)

The construction phase of the project will potentially have both direct and indirect impacts on indigenous site flora and fauna, as follows:

- Reduction in floral biodiversity:
  - Fire related impacts (informal, unmanaged/indiscriminate, fires/burning regime by site contractors and construction personnel);
  - Soil and indigenous vegetation disturbances, leading to proliferation of alien vegetation; where such aliens would compete for space and available resources;

- Removal/destruction of Red Data Listed (RDL) and protected floral species through site preparations (i.e. vegetation clearance);
- Increased harvesting pressures on known medicinal plant species associated with the presence of contractors on site; and
- Increased harvesting of protected tree species, such as *Acacia erioloba, by* contractors for firewood.

- Reduction in faunal biodiversity:
  - Fire related impacts (i.e. indiscriminate fires by contractors may lead to veld fires and the subsequent destruction of habitat to indigenous faunal species);
  - Increased human activity associated with construction activities (contractors and construction workers) may lead to increased poaching and trapping;
  - Clearance of vegetation results in the destruction of suitable faunal habitat;
  - Impacts on faunal habitat may lead to loss of migratory routes for more mobile faunal species;
  - The potential proliferation of alien invader floral species as a result of poorly managed construction activities could influence the relative availability of food for grazing and browsing fauna; and
  - Noise generated through mining activities may impact on relative faunal distribution and faunal population integrity.

Impact Discussion & Significance Assessment

A 2012 specialist Biodiversity Impact Assessment (BIA) undertaken for the BRMO '*Mine Expansion and Sinter Plant'* project concluded that "*any impacts which occur as a result of the project will affect the local area for a long duration and are likely to affect the receiving environment. If mitigation measures are implemented* (i.e. as prescribed in the said specialist assessment*), the likelihood of impacts occurring and the consequence of the impacts are significantly reduced to a low level and the duration of impacts becomes significantly reduced*". Given the homogeneity of the Kalahari Thornveld and Shrub Bushveld veld type (Acocks, 1990) across the greater BRMO mine site, the aforementioned conclusions are reasonably deemed to hold true for the current development proposal, provided that the mitigation put forward in this document and the attached EMP are appropriately implemented by the proponent.

Table 4: Impacts on Biodiversity – Significance Rating			
Nature (N)	Negative impacts on site biological diversity		1
Extent (E)	Nationally: Six floral species suspected, or known, to occur on site are afforded protection, in terms of law, on a National scale.		5
Duration (D)	Very long term: The impact will be largely reversed at the end of life of mine, but it may take several decades thereafter for floral species (particularly woody species) to re-establish.		5
Intensity (I)	Major: The disturbance to site flora and fauna will disrupt functions and processes at a localised level, thereby reducing diversity. Required removal of protected floral species.		4
Probability (P)	Definite: Vegetation clearance is required for the establishment of the dwelling units.		4
Mitigation (M)	Moderately mitigated: The impact can be substantially off-set/mitigated through the establishment of an indigenous tree nursery LED project, as well as concurrent rehabilitation respectively, but the residual impact will still be noticeable or significant, relative to the original impact		3
Enhancement (H)	N/A		-
Reversibility (R)	Mostly reversible: Rehabilitation efforts at closure will largely reverse the impact, although this may never entirely return the site to its 'natural', pre-development, condition		4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	45.71
Significance Rating without Mitigation -	N x (E+D) x I x P ÷ ½(M+R)	**High**	64

Negative Impact (S)			
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

The following recommendations are made in respect of mitigating the potential impacts on biodiversity:

- The existing integrity of flora surrounding the proposed development should be upheld and no activities should be carried out outside the required footprint of any construction areas;
- Educate construction personnel about the importance of the floral and faunal species and also how to identify red data listed (RDL) species;
- If any RDL species are to be disturbed, ensure effective relocation of such species that can indeed be relocated (i.e. where it is practical and feasible to do so) to suitable off-set areas;
- Obtain relevant permits for cutting and destroying, or the rescue and relocation, of each protected or endangered floral species identified within the proposed development footprint;
- Use of a contractor specializing in the removal of protected tree species should be made. The contractor should provide a detailed rescue and relocation plan which should be overseen by a suitably qualified ecologist. Future tender documents should include rescue and relocation plans for protected plant species*;*
- An environmental control officer (ECO), or suitably qualified ecologist, should oversee the rescue and relocation of all protected flora to be moved;
- All un-authorised collection of firewood and medicinal plants must be prohibited; and where collection is to take place, it must be overseen by a suitably qualified staff member;
- All areas affected by construction should be rehabilitated upon completion of the construction phase of the development. Areas should be re-seeded with indigenous grasses as required;
- As much vegetation growth as possible should be promoted within the proposed development area in order to protect soils and to reduce the percentage of the surface area which is paved. In this regard special mention is made of the need to use indigenous floral species as an imperative for landscaping;
- In terms of the amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998, landowners are legally responsible for the control of invasive alien plants on their properties and it is, therefore, recommended that declared weed and invader species be removed from the subject property;
- Vehicles should be restricted to travelling only on designated roadways, in order to limit the ecological footprint of the proposed development activities;
- No fires whatsoever should be lit within the subject property;
- No animal trapping should be allowed during development activities;
- An indigenous tree nursery must be established by the BRMO for the propagation of floral species to be used in concurrent and end of life of mine rehabilitation.

<u>NOISE:</u>

Introduction

The holder of a mining right must comply with the provisions of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996), as well as any other national norms and standards regarding noise management (Fuggle and Rabie, 2009). Predominant construction related noise impacts are anticipated from the following sources:

- Heavy vehicle movement and operation associated with ground works and building activities (i.e. dump trucks, excavators, TLBs, cranes, graders, earth compacters, etc.); and
- Drilling (e.g. structural works).

The closest residential receptors to the site are located approximately 100m north east, and 200m south west of the development site respectively. The area is subject to much existing noise generation, particularly in the form of traffic along the R31 and Black Rock Village access road. Day- and night time ambient noise levels recorded by dB Acoustics (2012) in close proximity to the site (corner R380 and Black Rock Village access road) where in the order of 60 and 54dB respectively. These ambient, pre-construction, measurements should be used as a baseline against which to measure any potential construction related ambient noise impacts; where the difference between actual noise, the ambient noise level, the time of the day and the duration of the activity, will determine how people will respond to sound and what the noise impact will be. In order to evaluate such, there must be uniform guidelines to evaluate each scenario. To this end SANS10103 of 2008 has laid down sound pressure levels for specific districts and has provided the following continuous noise level limits for district types.

The Noise Control Regulations (R 154 GG 13717 of 10 January 1992) promulgated in terms of ECA, defines:

- Nuisance noise, as "*any sound which disturbs or impairs or may disturb or impair the convenience or peace of any person*"; and
- Disturbing noise, as "*any noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more*".

Regulation 4 states '*No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof.*' In addition, Section 28 of NEMA imposes a 'duty of care' on every person who may cause significant pollution to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

An increase of 7dB above current ambient noise levels would thus be unacceptable, and the proponent would need to take appropriate noise reduction measures to avoid creating ' disturbing noise' during the construction period; where construction phase noise monitoring would be required if complaints arise from around noise during the construction phase.

Impact Discussion & Significance Assessment

Two aspects are important when considering the potential noise impacts of a project and these are as follows:

- The anticipated increase in the ambient noise level; and
- The overall ambient noise level produced.

Table 5: Impacts of Construction Noise – Significance Rating

Nature (N)	Negative impacts of construction related noise on sensitive receptors		1
Extent (E)	Locally: Within the vicinity of the site		2
Duration (D)	Medium term: Construction phase (bulk of work conservatively anticipated for up to a year)		3
Intensity (I)	Moderate: Ambient noise levels would likely be increased over the short-term, but function and process would continue, albeit in a modified way.		3
Probability (P)	Likely: There is a possibility that the impact will occur, to the extent that provisions must be made for it.		2
Mitigation (M)	Slightly mitigated: Limited avoidance and minimisation techniques available		2
Enhancement (H)	N/A		-
Reversibility (R)	Reversible with the cessation of the activity		4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	10
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	12
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

The following measures must be considered by the Proponent prior to the acquisition of earthmoving equipment:

- Enclosure of engine bays;
- Modification of radiator fan design and materials;
- Installation of louvers on radiator and hydraulic cooling fans; and
- Re-engineering of exhaust systems.

The following are the Environmental, Health and Safety Guidelines of the IFC of the World Bank, which should be taken into consideration during the construction phases of the project:

- Selecting equipment with lower sound power levels;
- Installing suitable mufflers on engine exhausts and compressor components;

- Installing vibration isolation for mechanical equipment; and
- Develop a mechanism to record and respond to complaints.

The proponent must also restrict construction activities to within 7:00am and 5:00pm on weekdays, and 8:00am to 13:00pm on Saturdays.

HERITAGE RESOURCES:

Introduction

A 2009 Heritage Impact Assessment (HIA) of the greater BRMO mine site, undertaken by African Heritage Consultants cc. (Appendix D refers), did not identify any elements of cultural or heritage significance at the preferred site alternative, or site alternative 2. The applicability of the 2009 study, in terms of the geographic scope thereof, has been verified by the EAP (The figure on page 22 of the HIA in Appendix D has reference).

Impact Discussion & Significance Assessment

Figure 4 that follows shows the geographic distribution of identified elements of cultural or heritage significance across the Black Rock Mine (i.e. relative to the development site alternatives). It is clear that the preferred, as well as the alternative site location, will not impact upon any of these elements.

Figure 4: Identified elements of cultural / heritage significance at Black Rock Mine

Table 6:Impacts on Heritage Resources – Significance Rating		
Nature (N)	Negative Impacts on Elements of Cultural/Heritage Significance	1
Extent (E)	Regionally: Archaeological elements in the area are known to typically be of regional significance.	3
Duration (D)	Very long term: Disruption of archaeological elements would be permanent if they occurred.	5
Intensity (I)	Negligible: No discernable impacts	1
Probability (P)	Unlikely: The possibility of the impact occurring is very low, due to the fact that no elements of significance have been identified on the development site footprint	1
Mitigation (M)	Slightly mitigated: No formal mitigation is planned, or required. Basic training to be given to vehicle operators as a pro-active safe-guard in the event of unforeseen occurrence through on site activities.	2
Enhancement (H)	N/A	-

Reversibility (R)	Irreversible: Not reversible		1
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	3
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	4
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

Although no sites of cultural heritage significance were identified in the area, they could be present, or could have been missed as a result of the grass and vegetation cover in certain areas making visibility difficult at the time of the 2009 assessment. This is especially true for low stone packed, or unmarked graves. Two historical graveyards in the larger BRMO geographical area were identified during the 2009 HIA, and a lookout should be kept for similar sites during the construction period for this project. Where either archaeological or paleontological finds are made during the construction phase, works in those areas should cease until such time as a relevant specialist has been consulted as to the significance and potential regulatory implications thereof.

Basic training is to be given to vehicle operators, as a pro-active safe-guard in the event of unforeseen occurrence of elements of cultural/heritage through on site activities.

Indirect impacts:

CONSTRUCTION AND INSTALLATION WASTE GENERATION (CONTRIBUTION TO LANDFILL):

Introduction

Nominal volumes of construction and installation waste will be generated during the construction of the proposed housing development. The waste would predominantly comprise of building rubble, packaging and fabrication waste/s. Steel and electric cabling waste, and packaging waste is also expected from installation. It is likely that most, if not all, of the waste generated would be non-hazardous/general waste. The generation of such waste could indirectly impact on the operational lifespan of the Black Rock waste disposal facility, through the permanent occupation of remaining available airspace at this facility. The same principle would apply to the applicable hazardous landfill facility/ies to which hazardous waste generated during construction will be taken for disposal. Note: Impacts of temporary onsite waste storage on surface- and ground water quality will be assessed under 'surface- and ground water quality'.

Impact Discussion & Significance Assessment

The impact will have National extent; where hazardous wastes are concerned (i.e. in the absence of a suitably licensed hazardous landfill facility in the Northern Cape). The intensity of the impact will, however, be low relative to cumulative National and regional waste generation volumes (general and hazardous waste generation).

Table 7: Impacts of Construction Waste Generation – Significance Rating

Nature (N)	Indirect negative impact on landfill airspace availability.	1
Extent (E)	National: Use of hazardous landfill beyond the provincial boundary	5
Duration (D)	Medium term: Construction phase (conservatively anticipated for up to a year, or possibly two)	3
Intensity (I)	Negligible: The anticipated impact will be negligible, with no discernable effect on relative airspace availability.	1
Probability (P)	Definite: The generated of waste during the construction phase is largely unavoidable (the amount generated can, however, be managed)	4
Mitigation (M)	Slightly: A small reduction in the volumes of waste generated can likely be effected during construction	2
Enhancement (H)	N/A	-

Reversibility (R)	Moderately reversible through reuse, recovery and/or recycling initiatives: Where the impact relates to contribution to landfill, any measure implemented to reuse, recover, or recycle such waste would constitute the reversal of the impact		3
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	12.8
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	16
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

The contractor will be required to provide a method statement specific to waste minimisation, reuse, recovery and recycling, as well as temporary storage and disposal; where such plans would need to be signed off by competent site environmental personnel / environmental control officer (ECO), prior to the start of construction activities.

All construction and installation waste will be stored temporarily in a way that protects surface- and groundwater, and appropriately disposed of at the permitted Black Rock disposal site (i.e. where the waste in question is classified as general waste), or stored temporarily prior to collection by a suitably licensed waste disposal contractor in the event that hazardous waste is generated. Temporary waste storage areas will be sited under the guidance of site environmental personnel prior to the start of construction activities. Construction personnel will be trained in their correct use and the sites will be regularly inspected to ensure that they are being appropriately managed.

Cumulative impacts:

TRAFFIC:

Introduction

The R31 between Kuruman and Hotazel has experienced significant traffic growth of between 20% and 30%, year on year, for the period 2006-2011. Heavy vehicle growth contribution to the aforementioned figures is estimated at 60-70% increases year on year. The current traffic loading on this road section far exceeds the original designed volume, which is the probable reason why the road is presently in a poor condition.

Poor road condition and user safety is attributed to varying incidences/degrees of the following road conditions along the applicable 63km road section:

- Road edge breaks;
- Poor quality of edge break repairs;
- Block cracking;
- Dry and brittle condition of road surface;
- 'Crocodile cracks' and 'pumping';
- Rutting;
- Surface water ponding;
- Sever shoulder drop-offs;
- Poorly maintained / non-existent guard rails;
- Stray animal occurrence; and
- Narrow road width (2.8m per lane) relative to design standard appropriate to the type of vehicles traversing the R31 (3.7m per lane), which is further exacerbated by edge break effects.

The establishment of the structures and infrastructure proposed as part of the project would require the transport of construction materials and large pieces of equipment, pre-fabricated elsewhere, to the site. This, in addition to the daily transport of construction workers, would lead to an increase in heavy vehicle traffic to the site, although temporary in nature (i.e. during construction). The increased traffic volumes and/or slow moving heavy vehicles could cause a nuisance to other road users, as well as contributing toward further degradation of the condition of the R31 road, as well as inferred road user safety.

Impact Discussion & Significance Assessment

It is evident that the present poor condition of certain sections, as well as overall inadequate design, of the R31 already impacts upon road users, and particularly the safety thereof. Several complexities arise through out of an assessment of the individual project's impacts on traffic and road user safety during the construction period. These are detailed as follows:

- In isolation, the impacts of the project on traffic and road user safety could be seen as significant, but relative to the existing traffic volumes and present poor condition of the R31, the cumulative negative impact could be viewed as being relatively insignificant;
- There are several mines and industrial operations within a 10km radius of the BRMO that make substantial use of the R31 between Kuruman and Hotazel. Any impact of the specific project on the localised road network and users thereof thus needs to be viewed as a relative additive contribution to the impacts of other existing operations on the overall cumulative impact. Such an approach is made cumbersome and impractical at the level of an EIA undertaken for single operation;
- Assigning responsibility, in terms of the required upgrade/repair and on-going maintenance of the R31, cannot be laid solely at the door of any one individual mining house, or industrial operation, in the area; and
- The relevant District- and Local Municipalities are essentially responsible for the up-keep of the R31. Any strategic initiative by Private entities to upgrade the R31 needs to be done in close collaboration with, and under consent from, these municipal parties.

Table 8: Cumulative impact on R31 Road Condition – Significance Rating			
Nature (N)	Additive contribution to negative cumulative impact associated with increased traffic volumes (light and heavy vehicles)		1
Extent (E)	Regionally: Potential impact as far as Kuruman/Kathu		3
Duration (D)	Medium term: Construction phase (bulk of work conservatively anticipated for up to a year)		3
Intensity (I)	Moderate: The R31 will still be available for use by other road users, albeit with increased construction related traffic thereon.		3
Probability (P)	Very likely: It is highly anticipated that existing, regular, road users will experience the increased volumes of traffic as a nuisance, but this is not certain.		3
Mitigation (M)	Slightly mitigated: Restriction of delivery times to off-peak traffic periods, as well as car pooling/bussing of construction workers to the site on a daily basis		2
Enhancement (H)	N/A		-
Reversibility (R)	Slightly reversible: With respect to R31 road condition deterioration.		2
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	27
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	36
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

Assmang has in the past contributed to the up-keep of roads in the area and would continue to do so into the future, to an extent based on proportional road use by their vehicles. A 'Preliminary Status Quo Report' for the Kuruman-Hotazel road (i.e. R31), inclusive of a proposed upgrade strategy, was compiled in April 2011 by VELA VKE Consulting Engineers, at the request of the District Municipality, BHP Billiton and Assmang Manganese Mines. The latter two being the more established mining entities in the Hotazel area.

While little project specific mitigation is proposed, or deemed feasible, the Proponent should continue to seek strategic solutions to the problem in conjunction with other prominent road users and the relevant Local Authorities. A potential solution to alleviating the poor road condition and implementing on-going maintenance of the R31 is put forward in terms of potential immediate (0-1 years), short (1-3 years), medium (3-10 years) and long term (10-20 years) measures in a 2011 VELA VKE road upgrade strategy. It would not be appropriate for this EIA, to commit Assmang to the sole implementation of the aforementioned plan, nor would it be appropriate (or have legal standing) to commit other mining houses to the joint implementation of the upgrade strategy. It is, however, in Assmang and other mining houses' own interest to ensure that the condition of the R31 is upgraded in a sustainable manner that will optimise their own individual operations and improve safety for their own employees along this route.

Seeking a solution to this matter is deemed well beyond the scope of this EIA, as the route of the problem extends well beyond the battery limits of the study and involves several other parties' commitment to such. As such a strategic solution amongst all parties concerned needs to be sought, that partitions relative

involvement in implementation.

Alternative (Site Alternative 2 – S2)

The potential construction phase impacts of pursuing site alternative 2 would mirror those of the preferred site alternative in all material respects, with the exception of the following aspects:

Positive aspects relative to S1:

1. Biodiversity: S2 is situated on a 'brown-fields' area of the BRMO which is largely devoid of any appreciable indigenous vegetation in a natural condition. The potential impact on biodiversity for this alternative would thus be negligible (Figure 2 refers), predominantly by virtue of a significantly reduced impact probability, as well as likelihood; and
2. Dust and Noise: S2 is further removed from any potential ambient noise- and dust receptors in a residential setting. So although similar dust- and noise generation will be realised at either site, the increased distance between S2 and potentially sensitive noise- and dust receptors would act to reduce the impact intensity to 'negligible' on both accounts; thereby reducing the overall impact significance to negligible levels for both aspects.

Negative aspects relative to S1:

1. Geo-technical stability: S2 is located in close proximity to, and indeed partially above, the historic underground Black Rock Mine workings at the BRMO. This poses a potential problem to the proponent pursuing this site alternative, as this may present a potential fatal flaw to the site resulting from unstable/unsuitable prevailing geo-technical conditions over the site. There is also evidence to support the potential for such risk, in the form of surface subsidence observed immediately north west of the site boundary (Figure 5). The nature and extent of under-mining at S2 has, however, not been quantified by a geo-technical engineer to date.

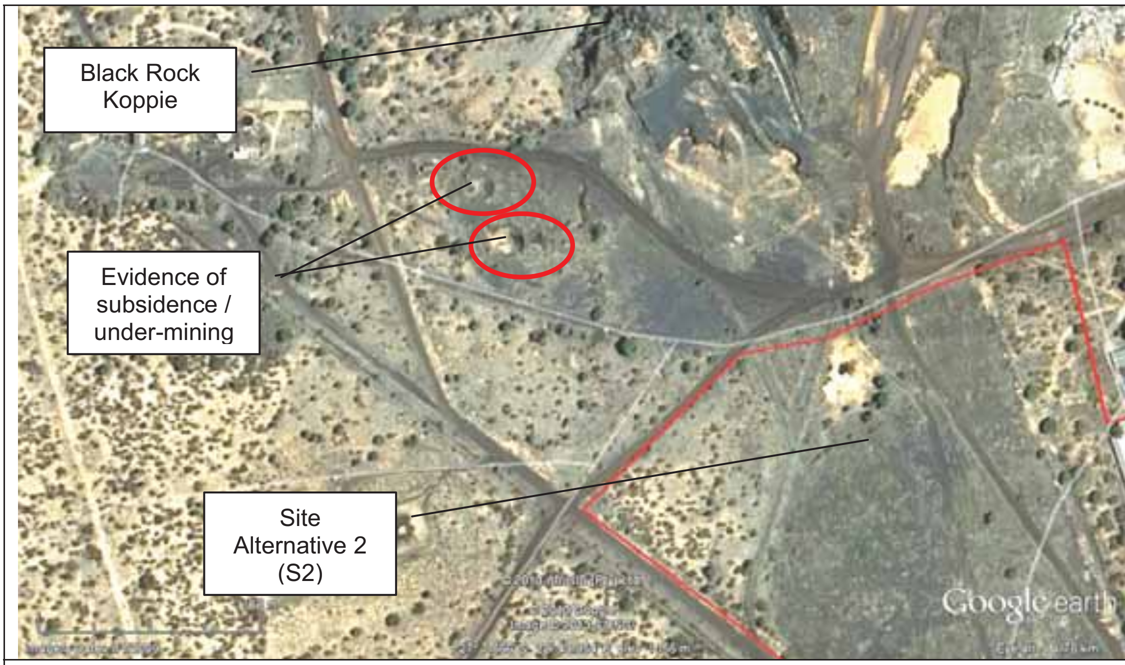


Figure 5: Aerial image showing subsidence to the north west of site alternative 2 (S2)

2. Mineral Resource Sterilisation: The proponent has also identified S2 as being potentially fatally flawed from an operational perspective, in that it may act to sterilise shallow manganese deposits in and around the area of the black rock 'koppie'; where on-going investigations are aimed at determining the feasibility of mining such through open-cast mining methods in future.

Operational Phase:

Alternative (preferred alternative – S1)

Direct impacts:

VISUAL AND AESTHETIC CHARACTER:

Introduction

The establishment of the facility on what is presently an undisturbed, green-fields, site will have a potentially negatively impact upon the visual and aesthetic character of the development footprint and immediate surrounds. This significance of the potential impact needs to, however, be assessed in the context of existing land use(s) in the area, as well as the presence / absence of potential sensitive receptors in the area.

The proposed development would predominantly be viewed by road users along the Black Rock Mine access road from the R380, as well as the property owner (general dealer) on the north western corner of the aforementioned roads. The flat topography of the area, in combination with the physical height of the dwelling units (limited to a single story) and relative visual absorption capacity of the remaining thornveld to the north, east and south of the development, will mean that the proposed development would not be visible from any significant distance from the site.

Impact Discussion & Significance Assessment

The impact will have local extent. The intensity of the impact will, however, be low in the context of the existing land uses in the area (mining, general dealer, existing residential), with the preferred development footprint essentially being positioned between BHP Billiton's Wessels mine to the east, and the Black Rock Mine (incl. associated mine village) to the west thereof. The presence of a single visual receptor (i.e. other than road users who would predominantly be involved in the mining industry or supporting services in the area) in the area of anticipated influence, as well as the nature of the commercial activities undertaken by that receptor (general dealer) also renders the intensity of the potential impact negligible.

Table 9: Impacts on Visual and Aesthetic Character– Significance Rating			
Nature (N)	Direct negative impact on visual and aesthetic quality through structural establishment on a green-fields site		1
Extent (E)	Local: Within the vicinity of the site		2
Duration (D)	Long term: Operational life of mine (approximately 30 years)		5
Intensity (I)	Negligible: The anticipated impact will be negligible, with no discernable effect on existing visual and aesthetic quality of the local environment		1
Probability (P)	Definite: The development will be visible from the R380 and Black Rock Mine access road, as well as potentially from the general dealer to the north of the site.		4
Mitigation (M)	Slightly: A small reduction in the impact is achievable through visual screening (trees, colour choices, etc.)		2
Enhancement (H)	N/A		-
Reversibility (R)	Mostly reversible at the end of life of mine, when the subject development and associated footprint will need to be rehabilitated to as close to pre-construction conditions as possible (legal requirement under the MPRDA).		4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	9
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	11
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

Very little mitigation is available, or indeed advocated by the EAP. The development footprint would need to be rehabilitated at the end of life of mine (rehabilitation plan in the BRMO EMPR has reference), unless an alternative use for the housing is agreed upon in writing between Assmang and a third party, and agreed to by the Department of Mineral Resources (DMR).

LEGAL COMPLIANCE / SOCIO-ECONOMIC

Introduction

The amendments to the South African 'Mining Charter', as promulgated in September 2010 by the Department of Mineral Resources (DMR), requires mining companies to, *inter alia,* implement measures to improve the standards of housing and living conditions for mine workers, as follows:

- Convert or upgrade hostels into family units by 2014;
- Attain the occupancy rate of one person per room by 2014; and
- Facilitate home ownership options for all mine employees in consultation with organised labour by 2014.

The above measures advocate that human dignity and privacy for mineworkers are the hallmarks to enhance productivity and expedite transformation in the mining industry in terms of housing and living conditions.

The Assmang BRMO presently accommodate approximately 120 mine employees in an existing hostel at the Black Rock Mine; where more than one person is accommodated per room, and communal ablution and kitchen facilities are provided.

Impact Discussion & Significance Assessment

The construction of the proposed facility would significantly improve the living conditions of these employees, and ensure the BRMO's compliance with the requirements of Section 2.7 of the Mining Charter, as amended.

Table 10: Positive Impact on Living Conditions of Present Day Hostel Dwellers			
Nature (N)	Positive		-.025
Extent (E)	Site: Applicable to housing improvements on the BRMO mine site		1
Duration (D)	Long term: Anticipated life of mine of 30 years		5
Intensity (I)	Major: The relocation of the hostel dwellers to the proposed facility would mark a significant improvement in their present living conditions, as well as access to amenities in the area.		4
Probability (P)	Definite: The improvement of living conditions for mine workers is an imperative under the Mining Charter, and will be implemented by the BRMO		4
Mitigation (M)	N/A		-
Enhancement (H)	Slightly enhanced through the provision of individual ablution facilities and kitchenettes within each unit (i.e. over and above single room occupancy alone)		2
Reversibility (R)	N/A		-
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**N/A**	-
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**N/A**	-
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).	**Moderate**	-48

Management Actions

N/A

Indirect impacts:

DOMESTIC WASTE GENERATION (CONTRIBUTION TO LANDFILL):

Introduction

Approximately 50m^3 / month of domestic waste will be generated upon full occupation of the proposed housing development. The waste generated would be regarded as 'general' waste in respect of Annexure 1 under the draft Waste Classification and Management Regulations. The generation of such waste could indirectly impact on the operational lifespan of the Black Rock waste disposal facility, through the permanent occupation of remaining available airspace at this facility.

The domestic waste generated by residents in the facility would be managed in accordance with the existing waste management procedures in effect at the BRMO; where waste containers would be provided to residents and collected weekly by the BRMO waste management services.

Impact Discussion & Significance Assessment

The impact will have local extent. The intensity of the impact will, however, be low relative to cumulative National and regional waste generation volumes.

Table 11: Impacts of Operation Phase Waste Generation – Significance Rating			
Nature (N)	Indirect negative impact on landfill airspace availability.		1
Extent (E)	Local: Within the vicinity of the site		2
Duration (D)	Long term: Operational phase (approximately 30 years)		5
Intensity (I)	Negligible: The anticipated impact will be negligible, with no discernable effect on relative airspace availability.		1
Probability (P)	Definite: The generation of waste during the operational phase is largely unavoidable (the amount generated can, however, be managed)		4
Mitigation (M)	Slightly: A small reduction in the volumes of waste generated can likely be effected during construction		2
Enhancement (H)	N/A		-
Reversibility (R)	Moderately reversible through reuse, recovery and/or recycling initiatives: Where the impact relates to contribution to landfill, any measure implemented to reuse, recover, or recycle such waste would constitute the reversal of the impact		3
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	11
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	14
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

The waste generated will be managed in accordance with the existing BRMO solid waste procedure, and disposed of the licensed BRMO general landfill site.

Cumulative impacts:

No potentially significant cumulative impacts identified, or assessed.

Alternative (Site Alternative 2 – S2)

The potential operational phase impacts of pursuing site alternative 2 would mirror those of the preferred site alternative in all material respects, with the exception of the following aspects:

Negative aspects relative to S1:

1. Mine Health and Safety: S2 is located within the bounds of the operational BRMO. This would present a potentially significant safety risk to the mine, in that mine employees housed in the facility would have ready access to the remainder of the Black Rock- and Nchwaning III mine sites in their personal time. This would also potentially hinder the residents' ability to readily receive visitors at S2.

S2 is also removed from the amenities (shops, bottle store, sporting- and recreational facilities) available to mine employees within the Black Rock Mine Village itself; where residents at S2 would have to walk up to 5km (round trip) to access such facilities (notwithstanding the need to go through security control, and the potential for an off duty employee to then subsequently gain access to the mine site if under the influence of alcohol – a serious risk which needs to be managed by the BRMO). S1 on the other hand is conveniently located to these facilities, and would only require residents to enter 'active' mine areas for the purpose of reporting for work; where they would then be reasonably expected to undergo a breathalyser test together with all other BRMO employees.

2. Visual and Aesthetic Quality: The intensity of potential visual impact in this regard would be less for S2 than it would for S1, given the relatively isolated locality of S2 relative to visual receptors; where the visual impact intensity for S1 is already deemed to be negligible in any event.

3. ENVIRONMENTAL IMPACT STATEMENT

Taking the assessment of potential impacts into account, please provide an environmental impact statement that summarises the impact that the proposed activity and its alternatives may have on the environment after the management and mitigation of impacts have been taken into account, with specific reference to types of impact, duration of impacts, likelihood of potential impacts actually occurring and the significance of impacts.

Alternative A (Preferred site alternative – S1)

The most significant impact of establishing the proposed development at the preferred site alternative would be the clearance of protected tree and plant species from the required development footprint, and the associated loss of biodiversity that would result (Figure 3). The socio-economic benefits of the project are, however, deemed to outweigh the potential impacts on regional biodiversity; where "*human dignity and privacy for mineworkers are the hallmarks to enhance productivity and expedite transformation in the mining industry in terms of housing and living conditions"* (Mining Charter, 2010).

The impacts on regional biodiversity can be moderately mitigated through the establishment of the BRMO indigenous tree and plant nursery, as well as well as a potential proportional financial contribution to the 'Biodiversity Off-set Initiative' implemented by the BRMO for their recent Mine Expansion and Sinter Plant project on the farm Gloria. The impact can, furthermore, be mostly reversed through requisite rehabilitation efforts by the BRMO at mine closure, although this would only occur over the very long-term and even then residual impacts are likely to remain (i.e. relative to pre-construction ecological conditions).

This alternative, furthermore, addresses the current safety risk that the mine experiences due to historically housing mine employees in hostels within the 'active' mine complex at Black Rock; where the preferred alternative would see the housing development effectively divorced from the mine works areas, with separate access control established for residents of this facility (Figure 2).

This alternative could potentially result in short-term nuisance associated with dust and noise generation during the construction period, although potentially sensitive receptors in this regard would be limited to the general dealer north east of the site and road users along the Black Rock Mine (Village) access road from the R380. These impacts are deemed to be of low intensity, and effective mitigation is readily available to reduce the impact significance thereof to within acceptable levels.

Alternative B (Site Alternative 2 – S2)

Site alterative 2 is the preferred alternative on biophysical criteria alone (i.e. development footprint would be established on a brown-fields site with no appreciable indigenous vegetation). This alternative does not, however, address the safety risks to the mine detailed above, which is an imperative requirement to the locality of the development (i.e. housing should be established such that it is geographically continuous with the existing BRMO mine village, and outside of active mining areas).

This alternative is furthermore potentially fatally flawed from a geo-technical perspective; where under-mining in the western reaches thereof could threaten the safety of construction workers, as well as the future residents of the housing units [finding based on empirical evidence (Figure 5), and not formally verified through geo-technical assessment].

This alternative, although initially attractive to the EAP from a biophysical perspective, was essentially subsequently shown to be potentially fatally flawed from a logistical (BRMO driven) and geo-technical perspective.

No-go alternative (compulsory)

The 'No-go' alternative would see the *status quo* remain; where:

- The living conditions of hostel dwellers would not improve, and the BRMO would not achieve compliance with the conditions of Section 2.7 of the mining charter [suitable accommodation is not readily available in Kuruman or Kathu for the numbers of employees (immediate need for 120 people) requiring accommodation;
- The green-fields area of S1 would remain in its natural state and continue to support ecosystem functions and provide habitat to faunal species;
- The risk, in terms of mine health and safety, experienced by the BRMO in having employees housed in the 'active' mine area in hostel accommodation would persist; and
- The temporary nuisance (dust, noise, etc.) potentially created during the construction period would not materialise.

On the basis of the negative socio-economic conditions alone that would perpetuate under the no-go alternative, as well as continuation of mine safety risks under the no-go alternative, this alternative is deemed neither reasonable or feasible in the context of the project proposal.

SECTION E. RECOMMENDATION OF PRACTITIONER

Is the information contained in this report and the documentation attached hereto sufficient to make a decision in respect of the activity applied for (in the view of the environmental assessment practitioner)?	YES
Is an EMPr attached?	YES

The EMPr must be attached as Appendix F.
If "NO", indicate the aspects that should be assessed further as part of a Scoping and EIA process before a decision can be made (list the aspects that require further assessment):

If "YES", please list any recommended conditions, including mitigation measures that should be considered for inclusion in any authorisation that may be granted by the competent authority in respect of the application:

1. Permits/licenses for the removal of protected plant and tree species from the preferred site alternative (S1) must be obtained prior to the commencement of construction, and such application(s) should be informed and supported by a plant/tree reconnaissance by a suitably qualified individual(s);
2. The electrical demand of each of the housing units should off-set through the installation of Eskom approved solar geysers;
3. The environmental management programme (EMP) attached hereto must be implemented by the proponent during the construction and operational phases of the development;
4. The construction of phase 2 and / or phase 3 of the proposed development should be made subject to the Department's receipt (and written approval) of an engineering services report specific to these phases; where such a report must detail the ability of the BRMO's existing service infrastructure to meet the additional demand of these phases at that time; and
5. The construction of phase 2 and / or phase 3 of the proposed development should be made conditional to the proponent obtaining any necessary environmental authorization for any required expansion/upgrade to service infrastructure at the BRMO (as necessary, in terms of the findings and recommendations of the engineering services report referred to above).

SECTION F: APPENDIXES

The following appendixes must be attached as appropriate:

Appendix A: Site plan(s)

Appendix B: Photographs

Appendix C: Facility illustration(s)

Appendix D: Specialist reports

2009 BRMO Heritage Impact Assessment
2012 BRMO Biodiversity Action Plan

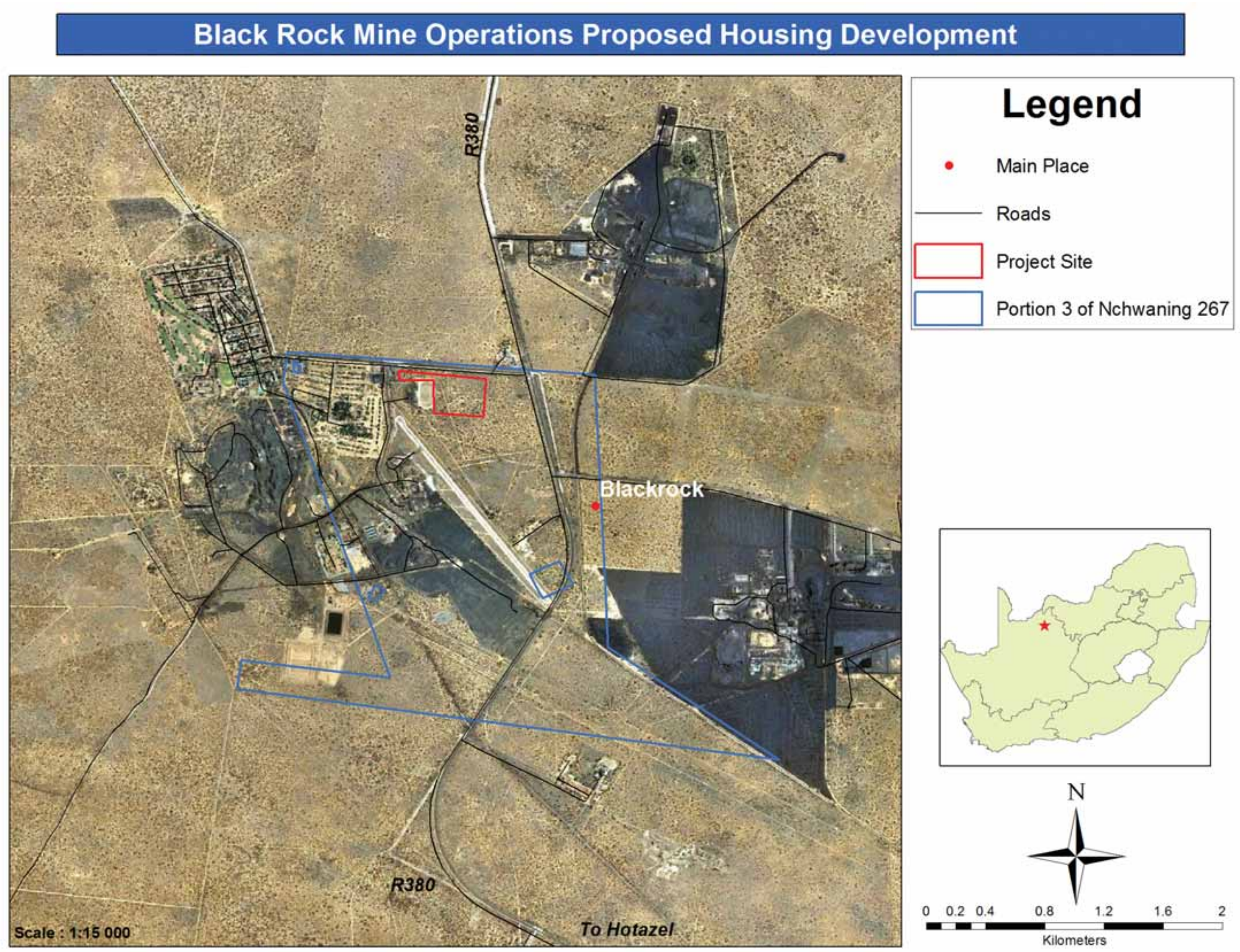
Appendix E: Comments and responses report

Appendix F: Environmental Management Programme (EMPr)

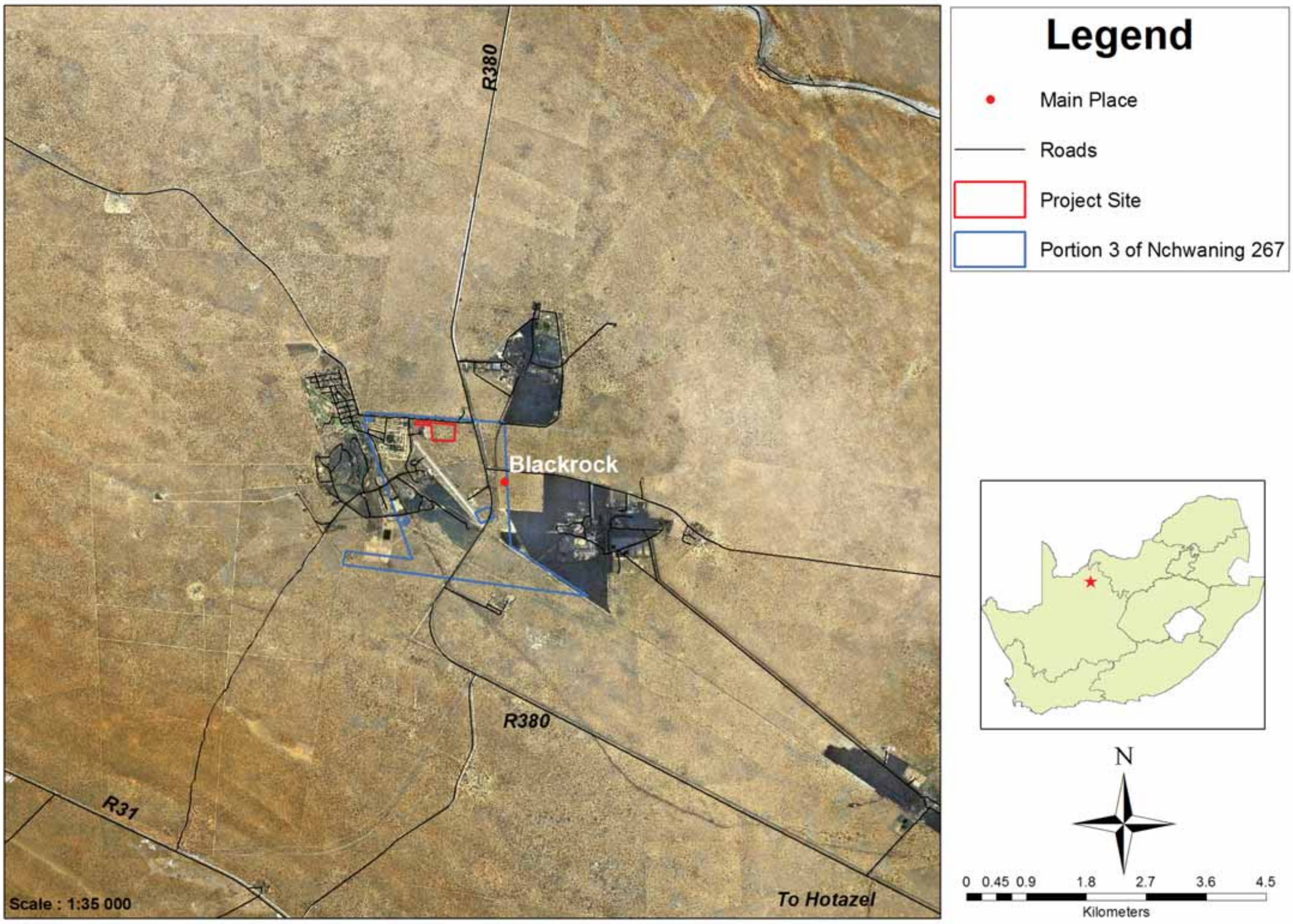
Appendix G: Other information

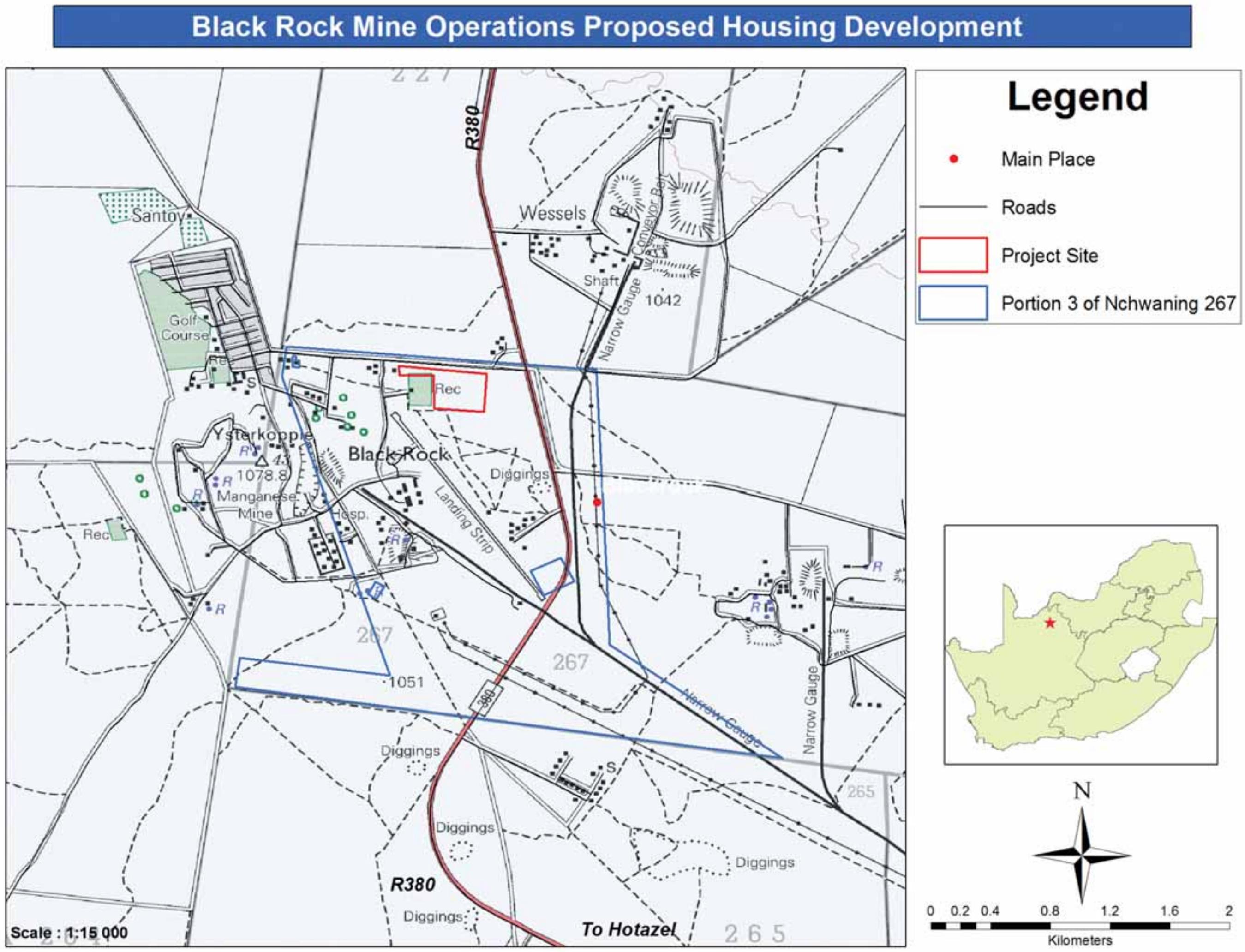
Impact Significance Assessment Methodology
BRMO General Landfill Site Waste Management License
Mining Charter

APPENDIX A: SITE PLANS



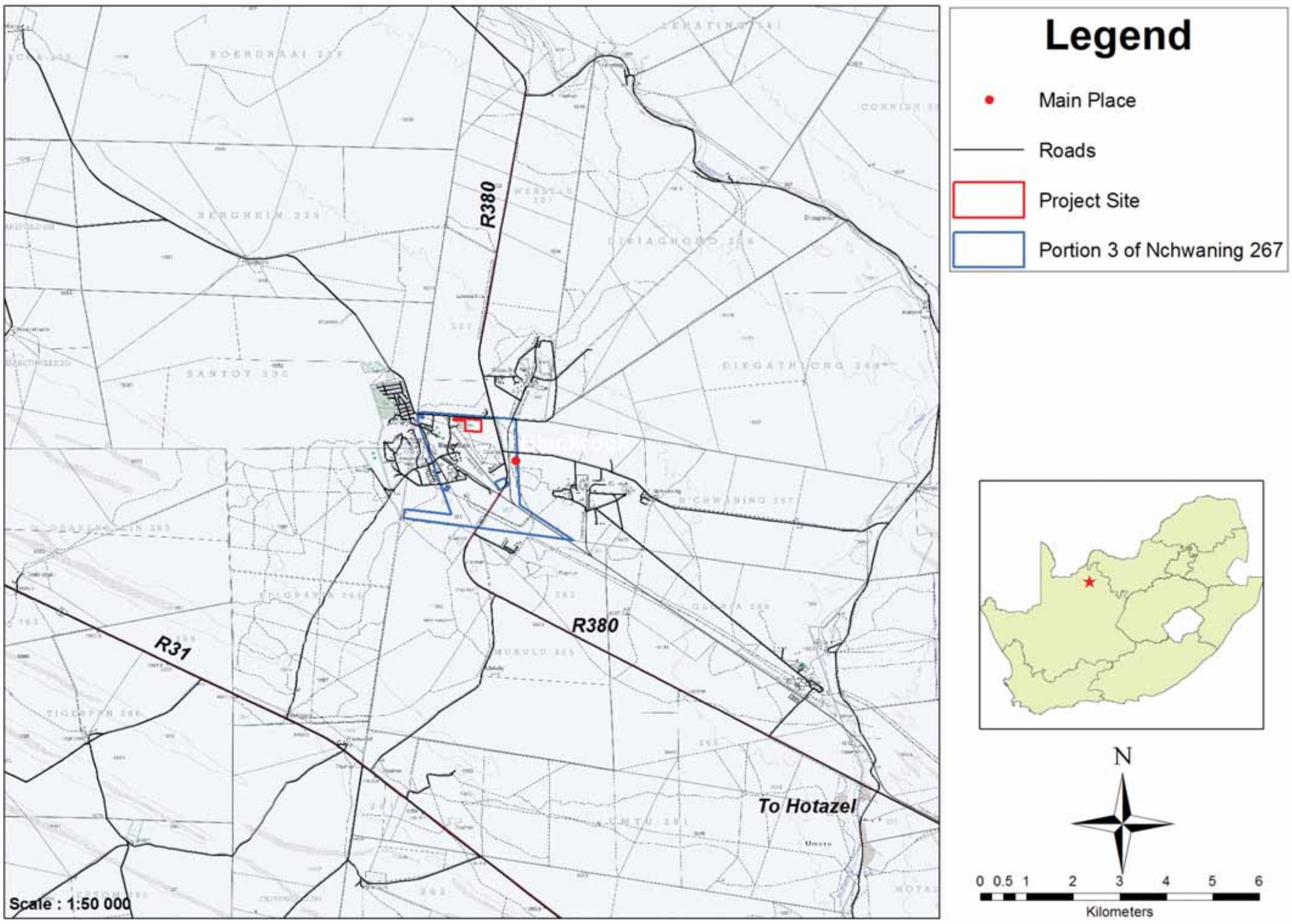
Black Rock Mine Operations Proposed Housing Development



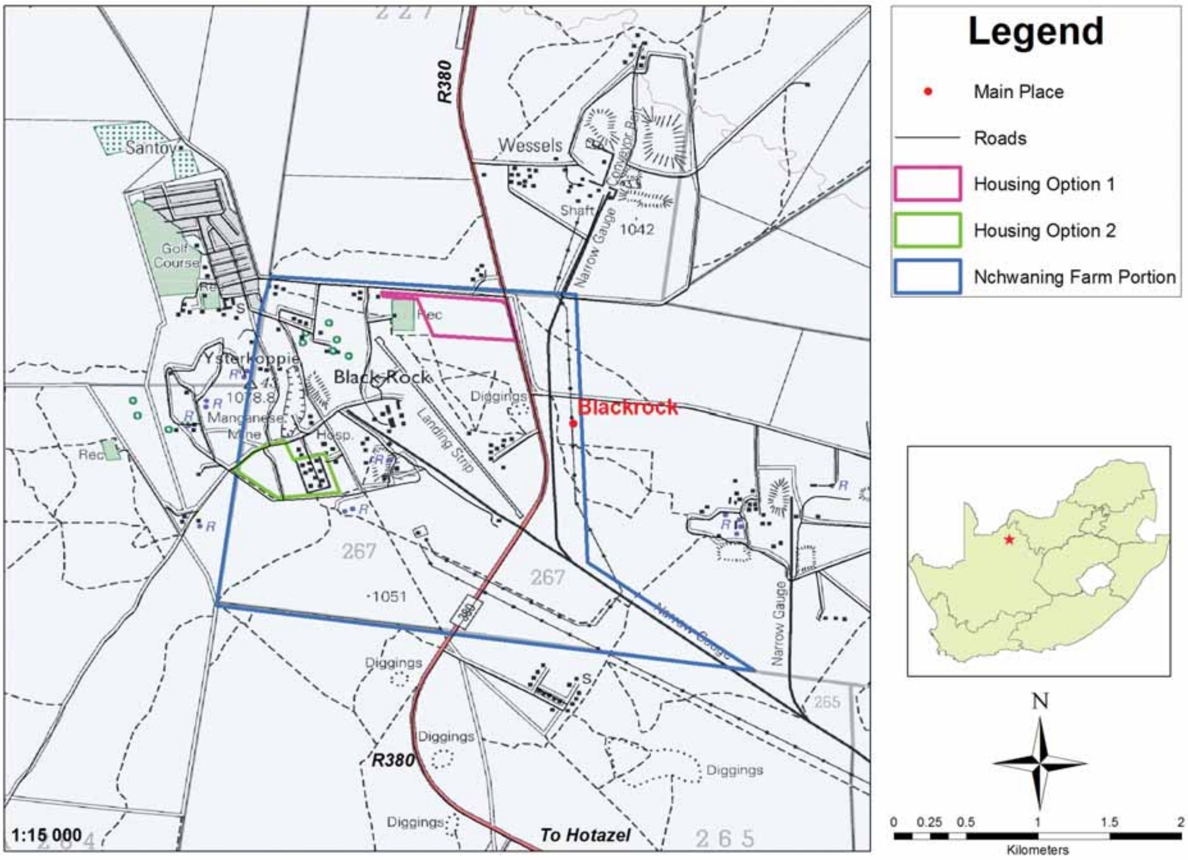


Black Rock Mine Operations Proposed Housing Development
Legend
Main Place
Roads
Project Site
Portion 3 of Nchwaning 267
R380
Wessels
Santoy
Golf Course
Shaft
1042
Narrow Gauge
Conveyor Belt
Rec
Ysterkopple
Black Rock
1078.8
Manganese Mine
Hosp.
Landing Strip
Diggings
267
1051
265
R380
To Hotazel
Scale : 1:15 000
N
0 0.2 0.4 0.8 1.2 1.6 2
Kilometers

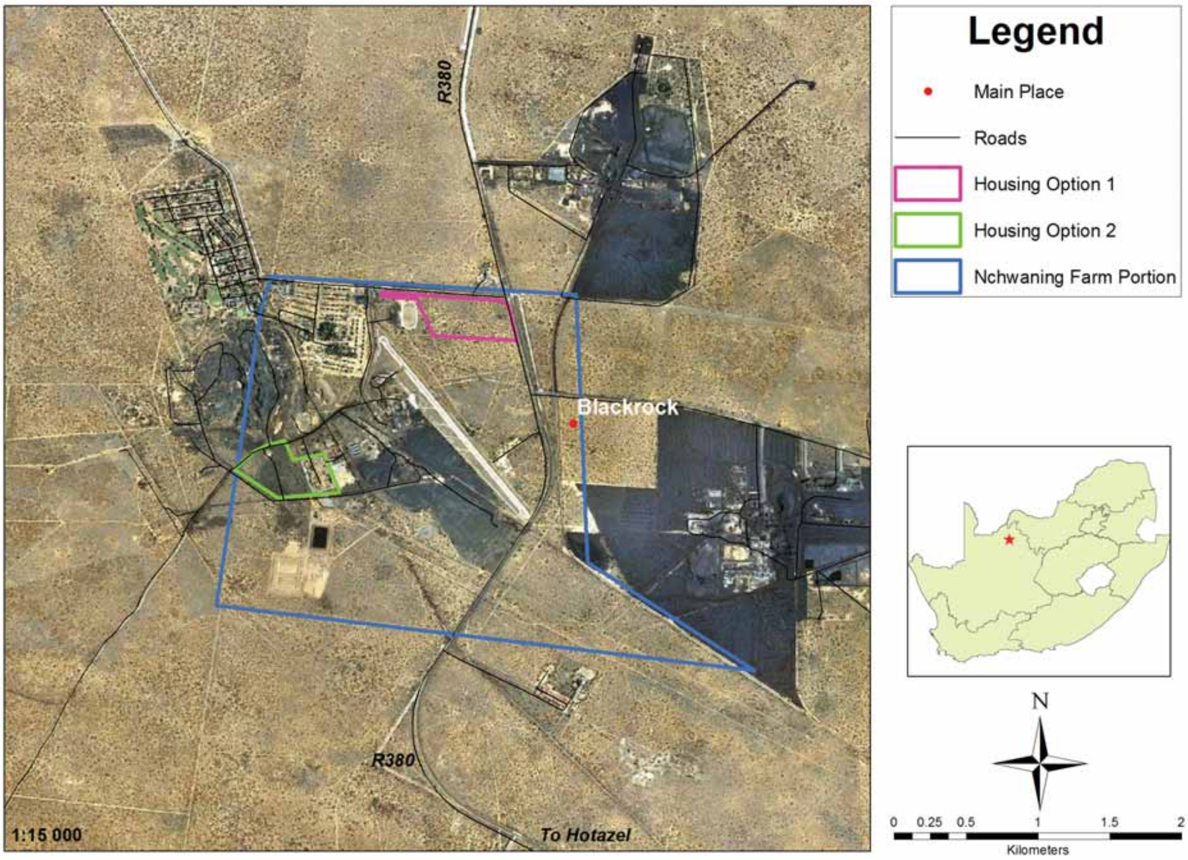
Black Rock Mine Operations Proposed Housing Development



Black Rock Mine Operations Proposed Housing Development



Black Rock Mine Operations Proposed Housing Development



APPENDIX B: Photographs

	
S1 -North	S1 -North East
	
S1 - East	S1 - South East
	
S1 - South	S1 - South West

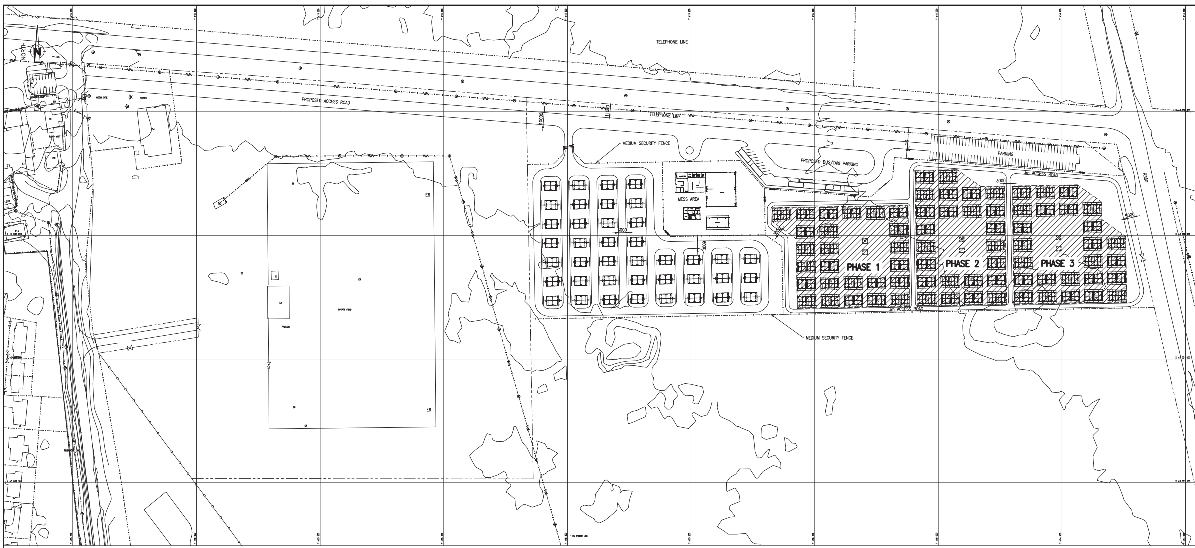
	
S1 - West	S1 - North West
	
S1 – Proposed Site Access	
	
S1 -Santoy Rec. Club Football Stadium	S1 – Transformer Yard

Dwelling Unit Demo. Unit

S1 - 360 Degree Development Site Panorama

APPENDIX C: Facility Illustration(s)



PLAN LAYOUT
SCALE 1:1000

KEY PLAN
SCALE: NTS

LEGEND:

POWERLINES
PERIMETER LOW SECURITY

holley & associates
CONSULTING CIVIL & STRUCTURAL ENGINEERS
CAD No.: HOL40-000-021-006-01-EX-A

H&A DESIGN REFERENCE	DRAWING NO.	DESCRIPTION	DRAWING NO.	DESCRIPTION	REV.	BY	DATE		CHK.	DATE	S.L.	DATE
			88-888-021-001-01	OVERALL PLOT PLAN								
					A	LL	18.03.13	ISSUED FOR COMMENTS ONLY				
DESIGN	REFERENCE DRAWINGS		REFERENCE DRAWINGS		REV.	BY	DATE	REVISIONS	CHK.	DATE	S.L.	DATE

APPROVAL	NAME	SIGNATURE	DATE
PROJ. ENG. AND PROCESS			
PROJ. ENG. (OPS)			

ASSMANG DWG NO. HOL40-000-021-006-01-EX-A

	NAME	SIGNATURE	DATE
PROJ. MANAGER			
DISCIPLINE ENG.			
PROF. ENG.			
DESIGN ENG.			
SECT LEADER			
CHECKER			
DRAWN	LL		13.03.13

DRA Mineral Projects (Pty) Ltd.
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Website: www.draglobal.com

We turn your resource into wealth

PROJECT BLACK ROCK EXPANSION PROJECT
AREA SURFACE INFRASTRUCTURE
TITLE BLACK ROCK – ACCOMMODATION FACILITY AT SANTOY – LAYOUT

A0
SCALE 1:1000 U.O.S.
DWG NO. C3680-40-000-021-006-01
REVISION A

APPENDIX D: Specialist Reports

AFRICAN HERITAGE CONSULTANTS CC

2001/077745/23

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September 2009

CULTURAL HERITAGE IMPACT ASSESSMENT OF MANGANESE MINING AREAS ON THE FARMS BELGRAVIA 264, SANTOY 230,GLORIA 226 AND NCHWANING 267, AT BLACK ROCK,NORTH OF KURUMAN, KGALAGADI DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

Report compiled by:

Dr Udo Küsel African Heritage Consultants

Dr Maria van der Ryst Dept of Anthropology and Archaeology University of South Africa

Siegwalt Küsel Ecotone Environmental Planning and Design.

1. DEFINITION

The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of paleontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

2. PROTECTED SITES IN TERMS OF THE NATIONAL HERITAGE RESOURCES ACT, ACT NO. 25 OF 1999

The following are the most important sites and objects protected by the National Heritage Act:

a. Structures or parts of structures older than 60 years.
b. Archaeological sites and objects.
c. Paleontological sites.
d. Meteorites.
e. Ship wrecks.
f. Burial grounds.
g. Graves of victims of conflict.
h. Public monuments and memorials.
i. Structures, places and objects protected through the publication of notices in the Gazette and Provincial Gazette.
j. Any other places or objects, which are considered to be of interest or of historical or cultural significance.
k. Geological sites of scientific or cultural importance.
l. Sites of significance relating to the history of slavery in South Africa.
m. Objects to which oral traditions are attached.
n. Sites of cultural significance or other value to a community or pattern of South African history.

3. METHODOLOGY

All relevant maps and documents on the site were studied. The site was visited and visually inspected.

4. RESULTS

The mining town of Black Rock lays some 80km north west of Kuruman and 20km north of Hotazel. The area is mainly Kalahari sand veld and dunes with mixed vegetation of grass and bushveld. According to mine officials the sand is up to 60 meters deep at places. It is a very arid region with no permanent rivers.

4.1 Historical Background.

The first Geologist to have surveyed the Northern Cape was Dr. A. W. Rogers of the Geological Commission of the Cape Colony in 1906. One of the features he noted was a small hill called Black Rock and reported on the presence of manganese ore at the base of the hill. In 1940 Associated Manganese Mines of South Africa acquired the manganese outcrop known as Black Rock and shortly afterwards started mining the deposit (Cairncross & Dixon 1999:61). The ore is extracted by both underground and open cast operations, mines in the area include Wessels, N'Chwaning I, N'Chwaning II, Black Rock, Hotazel, Langdon, Devon, Perth, Smartt, Adams, Mamatwan(largest opencast mine in the area), Middleplaats and Gloria (opened in 1978).

The stratabound ore deposits of the Kalahari Manganese field represent the largest land bound sedimentary manganese deposits in the world and originated from a single episode of manganese deposition about 2200 million years ago. A widespread hypothermal event occurred in the north western portion of the Kalahari Manganese field 1300 million years ago with temperatures reaching a maximum of 450 degrees centigrade in the Wessels, N'Chwaning and Black Rock areas. This event resulted in the upgrading of the Manganese-content of the ore and produced a wide range of rare minerals as well as mineral assemblages (Cairncross & Dixon 1999:63). Of the approximately 150 minerals, 10 have to date only been found in the Kalahari manganese field and a further 26 are found at four or fewer mineral localities worldwide (Cairncross & Dixon 1999:67).

4.2 Black Rock Mine

A large black outcrop of Manganese ore is the outstanding feature in the landscape of the Black Rock mining area. This outcrop was mined since the 1940's both by open cast (see photograph 1) and underground mining (see photograph 2). The outcrop and mine is situated at S27° 07’ 34.4” and E22° 49’ 59.6. The original mines are not in use any more and the site is used for water storage and communication masts.

At S27° 07’ 46.5” and E22° 49’ 57.5” is the main entrance to the incline shafts to the underground mining area (see photograph 3). This area is important from a mining and geological history point of view. The underground tunnels are at present used for water storage.

The original Black Rock outcrop and mining represent an important part of the mining history of Manganese mining in South Africa.

4.3 Cemeteries

Two cemeteries were recorded. The first cemetery is near the Black Rock outcrop at S27° 07’ 28.7” and E22° 49’ 45.9”. The area is fenced off and has some 60+ graves. The graves are those of black mine workers who died at the mine. The graves are unmarked with no tombstones. Only one grave has a date of 8/7/74. The cemetery most probably represents the graves of black mine workers from the 1940’s to the 1970’s (see photographs 4 and 5). The graves are not visited any more by relatives as no grave goods are present. Most probably these graves are from migrant mine workers from far afield. No information could be obtained from mine officials on the graves though the mine must have a record in its archives.

A second small cemetery is located in the mines’ nature reserve at S27° 10’ 29” and E22° 48’ 28.2” (see photograph 6). The one grave has a date of September 1926 and is the grave of Diederick Johannes Pretorius. What is strange about this cemetery is that we could find no remains of a homestead or settlement nearby. The cemetery is in open bushveld. This is very strange as early European cemeteries are always near a farm settlement.

4.4 Stone Age Archaeology

During the survey lithic occurrences were found to be localised. However, there is always the possibility that sub-surface archaeological sites may be revealed through the proposed mining activities. Should archaeological artefacts or skeletal material be found in the area during construction activities, such activities should be halted, and a cultural heritage practitioner notified in order for an investigation and evaluation of the find(s) to take place (*cf*. NHRA (Act No. 25 of 1999), Section 36 (6)).

The survey determined that stone artefacts were not prolific within the area of the proposed development and mainly isolated specimens were found. Only one locality with evidence of knapping/utilisation was identified within the footprint. The lithics occurred within pebble and gravel levels overlying the calcrete formations within the ancient river bed of the Ga-Mogara River (see photograph 7 and 8) (S27° 10’ 39.0” E22° 54’ 53.6”). The lithics apparently eroded from a borrow pit of approximately 500 x 100 meters in the river bed where materials for road construction/building purposes have been removed. The lithics occurred within a broad pebble band on the edge of the calcrete borrow pit and have evidently been exposed from an underlying horizon during the quarrying activities. Due to the density of good quality raw material in the form of pebbles significant knapping activities took place over time as evidenced by high frequencies of in particular cores.

The collection represents a mix of mainly ESA and MSA cores, flakes, blades and waste from stone tool knapping and other lithic reduction processes. Flakes, blades and bladelets are the main products of any stone reduction process. The collection includes one example that seems similar to a ESA chopper, but is more likely to be a pebble core with flake removals as the Oldowan is known from only a few sites. A number of formal ESA tool types were present among the exposed lithics. Most of the formal tools are typical ESA Acheulean handaxes, or large cutting tools (LCT’s). These handaxes/bifaces are classified as formal tools, because they have been shaped or transformed into a specific shape and have been given a cutting edge through secondary retouch (i.e. by removing small flakes). Significant numbers of the MSA flakes and blades retain faceted striking platforms that indicate the use of the core preparation technique. These tool types are accordingly discussed in more detail.

(For detail backgrounds on the Stone Age of the Northern Cape see Annexure A)

ESA Acheulean large cutting tools (see photograph 9)

The emergence of LCT manufacture was earlier in sub-Saharan African than elsewhere (N Rolland in McNabb et al 2004:670). Handaxes and cleavers were manufactured on a cobble/pebble core or on a flake. LCT’s varied considerably in size and shape. Some constraints on the morphology of the tool include the quality of available raw material, the size and shape of the pebble or core stone, the nature of the blank produced and the skill of the individual knapper. The majority of LCT’s received a minimum of secondary shaping. Cleavers were typically made on side-struck flakes obtained from large cores and minimally shaped. Handaxes with focus on the convergent tips were shaped through invasive flaking and secondary retouch and were most likely to be resharpened or trimmed to extend their use-life. Some bifaces were manufactured, transported and discarded without much resharpening (McNabb et al 2004:669). Resharpening results in size reduction and can account for smaller handaxes in a collection. However, small refined handaxes is also a characteristic of the Fauresmith industrical complex.

Some Acheulean handaxes were evidently shaped to obtain balance or symmetry (T Wynn in McNabb et al 2004:672). It is argued that symmetry or near-symmetry could reflect the handwork of more skilled artisans (McNabb et al 2004:668). Many of the handaxes from the Northern Cape certainly exhibit near-symmetry and examples from Kathu Pan made on banded jasper/ironstone are particularly fine.

MSA prepared cores and flaked pieces (see photographs 10 and 11)

The collection shows a high frequency of prepared cores characteristic of MSA technologies. The prepared core technique was used during the MSA to produce triangular flake blanks and blade blanks. Some of the flake and blade blanks from the Asmang locality do exhibit such faceted striking platforms that typify core preparation characteristic of Levallois-type cores. Levallois reduction technology is based on the preparation of a core by systematic shaping to produce a conical or convex shape with a continuous striking platform around most of the perimeter of the selected nodule. Multiple flakes can be systematically removed from the prepared platform, with the conical objective piece maintaining its shape so that minimal repreparation is required before subsequent removals (Andrefsky 2005:148-9). The detached flakes exhibit attributes such as a faceted platform that derives from the technology used in core preparation. The size of raw materials selected for a core influences the kind or reduction technology used (Andrefsky 2005:151-5). Levallois core reduction requires relatively large objective pieces, and the technique is not suitable for the generally small nodules of cryptocrystalline materials, which were the preferred rock types during the LSA.

It is not in all the examples possible to assign firm associations of the lithics with specific Stone Age periods. The relative high frequency of long flake-blades may, however, be significant. These tool types may either be ascribed to the Fauresmith Industrial Complex, which is transitory between the ESA and MSA, or forms part of a fully developed MSA (Mitchell 2002).

The collection is dominated by local cryptocrystalline silica rock types, which are fine-grained good knapping materials. Jaspers are particularly abundant and used for the bulk of the lithics. Local rock types were generally used at most Stone Age localities with small numbers of tools occasionally made on rocks imported to the region or manufactured at other localities and then brought back (Beaumont 2004).

In the Northern Cape ESA assemblages, including the Fauresmith, tend to occur as lag deposits on the margins of seasonal rivers, semi-permanent water holes or pans. Such assemblages commonly represent the accumulated remains of numerous reoccupations over possibly many thousands of years. The particular locality from where the hand axes in the collection originate reflects the correlation of Acheulean sites with sources of water and an environment that could provide animal and plant foods (Deacon 1988:643-647; Mason 1988:626-30; McNabb et al 2004:656).

In this region stone tools often occur within calcrete zones underlying the modern surface of unstratified red aeolian sands (Deacon 1988:643-647; Mason 1988:626-30). Previous research in the Hotazel area confirmed localised occurrences of low-density Stone Age scatters along the exposed calcrete areas in dry riverbeds (PGS Heritage Unit:2009).

During the Phase 1 Heritage assessment under review only one archaeological sensitive area was identified and which seemed to be restricted to a zone within the bed of the Ga-Mogara River. A representative collection of mostly ESA and MSA artefacts have been documented at this locality. The large cutting tools evidently form part of an Acheulean assemblage. However, the collection is not large enough for the MSA tools to be assigned to particularly phases within the MSA. The range of tool types, the diversity of raw materials used as well as the presence of formal tools types reflect various instances of site utilisation over a very long period of time. As the lithics were uncovered during quarrying it is probably that sub-surface assemblages may be present. The calcretes should accordingly be marked as archaeological-sensitive areas.

It has been pointed out that the collection contains tool types that may originate from the Fauresmith industry. However, the small size of the collection and the fact that it clearly exhibits a mix of tools from various periods preclude positive identification. The Fauresmith is represented by only a limited number of excavated sites. A lack of excavated and well-documented open air sites from the interior with regional representative stratigraphic sequences inhibits the identification of regional patterns within the various phases of the Stone Age. Reliable dates for the Fauresmith are also lacking and issues like typology need to be investigated (Mitchell 2002:229-230).

5. EVALUATION

5.1 Black Rock Mine

Black Rock Mine represents the worlds' largest land bound sedimentary manganese deposit. This manganese field also has 10 minerals which have been found nowhere else in the world as well as another 26 very scarce minerals. As such this manganese deposit and original mines at Black Rock are unique and not only of national but also of international geological importance.

5.2 Cemeteries

The two cemeteries are important from a local point of view. They are both fenced off and cared for by the mine.

5.3 Stone Age Site

The Stone Age site is representative of similar sites occurring near water. As such the site as well as possible sites all along the banks of the Ga-Mogara River represents a very long period of human occupation. These sites are at least of regional importance.

6. DISCUSSION AND RECOMMENDATIONS

6.1 Black Rock Mine

As already stated the black Rock Manganese deposit represents the largest land bound sedimentary manganese deposit in the world. The Black Rock mine also represents the earliest mine of its kind in the area. Together the geological deposit as well as the historic mine is of international importance. This is made even more important with the unique and scares minerals occurring in the associated mines. It is therefore recommended that as part of the mines public and community responsibility the original Black Rock mine be:

(a) Declared a National Heritage Site

(b) The original mine be made assessable to the public

(c) The history of the mine and its structures be fully documented in a Phase II cultural heritage resources impact assessment

(d) A heritage management plan be compiled for the original mine

(e) Geological specimens of associated mines be collected, preserved and exhibited in a mine building converted into a safe place as a museum. This exhibition facility can also exhibit the Stone Age and mining history of the area.

6.2 The cemeteries

The two cemeteries are already fenced in. The mine should upkeep and cleans the cemeteries on a regular basis. (For detail on grave legislation see annexure B)

6.3 Stone Age

A watching brief is recommended for the locality under review.
It is also recommended that no development, mining or quarrying should take place within a 100m distance from the middle of the Ga-Mogare River.

If any development should take place in the 100 metre zone a full phase II archaeological heritage impact assessment must be undertaken.

7. SITE INFORMATION

Owners contact details: Assmang Ltd **P.O.Box 104** **Santoy** **8491**

Developers contact details: **N/A**
Consultants contact details: **N/A**
Type of development (e.g. low cost housing project, mining etc.) **Mining**
Whether rezoning and/or subdivision of land is involved: **N/A**
Full location of Province, Magisterial District/Local Authority, property (e.g. farm, erf name and number: **Northern Cape, Kgalagadi District Municipality** **Belgravia 264 – Title deed T541/1940** **Santoy 230 – Title deed no 1491/1970** **Gloria 226 – Title deed no 506/1966** **Nchwaning 267 – Title deed no 541/1940** **Nchwaning 267 – Title deed no 1491/1970**
Location map must have the polygon of the area to be surveyed on it and full geographical coordinates for all relevant points and where applicable indication of the area to be developed (footprint): **See map**
If possible an aerial photograph of the specific area showing the location of all site. **See Google maps**

8. MAPS (see pages 20 - 21)

9. PHOTOGRAPHS (see pages 14 – 19)

10. REFERENCES

1/50 000 Maps 2722 BB and BD

Google Earth

Andrefsky, W. 2005. *Lithics. Macroscopic approaches to analysis.* 2nd ed. Cambridge: Cambridge University Press.

Arbousset, T and Daumas, F. 1968. *Narrative of an exploratory tour to the Cape of Good Hope*. Facsimile reprint. Cape Town: Struik.

Backwell, LR & d'Errico, F. 2001. Evidence of termite foraging by Swartkrans early hominids. *Proceedings of the National Academy of Science* 98(4):1358-63.

Barham, L and Mitchell, P. 2008. *The first Africans. African archaeology from the earliest toolmakers to most recent foragers.* Cambridge: Cambridge University Press.

Beaumont, P. 2004. Wonderwerk Cave. In: Morris, D and Beaumont, P. *Archaeology in the Northern Cape: some key sites*. Kimberley: McGregor Museum, 31.-36.

Beaumont, P. 2004. Kathu Pan and Kathu Townlands/Uitkoms. In: Morris, D and Beaumont, P. *Archaeology in the Northern Cape: some key sites*. Kimberley: McGregor Museum, 50-53.

Beaumont, P and Morris, D. 1990. *Guide to archaeological sites in the northern Cape*. Kimberley: McGregor Museum.

Beaumont, PB and Vogel, JC. 2006. On a timescale for the past million years of human

Burchell, W.1967 [1822-24]. *Travels in the interior of southern Africa*. Vol 2. Cape Town: Struik.history in centreal South Africa. *South African Journal of Science* 102(5-6):217-228.

Campbell, J. 1822. *Travels in South Africa.* Volume I and II. London: Francis Westley. Facsimile reprint 2004. Elibron Classics Series.

Cairncross B & Dixon R. 1999. Minerals of South Africa, geological Society of South Africa, Tien Wha Press, Sigapore.

Chase, PG. 2006. The emergence of culture: the evolution of a uniquely human way of life. New York: Springer.

Chazan, M, Hagai, R, Matmon, A, Porat, N, Goldberg, P, Yates R, Avery, M, Sumner, A and Horwitz, LK. 2008. Radiometric dating of the Earlier Stone Age sequence in Excavation I at Wonderwerk Cave, South Africa: preliminary results. *Journal of Human Evolution* 55(1):1-11.

Deacon, HJ. 1988. Geology of the Doornlaagte site. In: Mason, R. *Cave of Hearths, Makapansgat Transvaal*. University of the Witwatersrand Archaeological Research Uit Occasional Paper 21, 643-547.

Deacon, J. 1984. *The Later Stone Age of southernmost Africa*. Oxford: BAR International Series 213.

Deacon, HJ and Deacon, J. 1999. *Human beginnings in South Africa: uncovering the secrets of the Stone Age*. Cape Town: David Philip .

Dunn, EJ. 1931. *The Bushman*. London: Griffin.

Dunnell, RC. 1986. Methodological issues in Americanist artifact classification. In Schiffer, M (ed.) *Advances in Archaeological Method and Theory* 9:147-207.

Goodwin, AJH and Van Riet Lowe, P. 1929. The Stone Age cultures of South Africa*. Annals of the South African Museum* 27:1-289.

Humphreys, AJB and Thackeray, AI. 1983. *Ghaap and Gariep: Later Stone Age studies in the northern Cape*. South African Archaeological Society Monograph Series 2. Cape Town.

Mason, R. 1988. The Doornlaagte Early Stone Age Late Acheulean camp, Kimberley District. In: Mason, R. *Cave of Hearths, Makapansgat Transvaal*. University of the Witwatersrand Archaeological Research Uit Occasional Paper 21, 626-630.

McNabb, J, Binyon, F and Hazelwood, L. 2004. The large cutting tools from the South African Acheulean and the question of social traditions. *Current Anthropology* 45(5):653-677.

Mitchell, PJ. 2002. *The archaeology of southern Africa*. Cambridge: Cambridge University.

Morris, D. 1988. Engraved in place and time: a review of variability in the rock art of the Northern Cape and Karoo. *South African Archaeological Bulletin* 43:109-121.

Morris, D. 1990. Bllinkklipkop and Doornfontein: specularite mines. In: Beaumont, P and Morris, D. *Guide to archaeological sites in the northern Cape*. Kimberley: McGregor Museum, 65-74.

Morris, D. 2002. Driekopseiland and 'the rain's magic power': history and landscape in a new interpretation of a Northern Cape rock engraving site. Unpublished Masters dissertation, University of the Western Cape, Cape Town.

Morris, D. 2003. Rock art as source and resource: research and responsibility towards education, heritage and tourism. South African Historical Journal 49:193-206.

Morris, D. 2004. Tsantsabane: the Blinkklipkop specularite mine, and Doornfontein. In: Morris, D and Beaumont, P. *Archaeology in the Northern Cape: some key sites*. Kimberley: McGregor Museum, 54-60.

Morris, D and Beaumont, P. 2004. *Archaeology in the Northern Cape: some key sites*. Kimberley: McGregor Museum.

PGS Heritage Unit. 2009. *Ntsimbintle Mining (Pty) Ltd on Portions 1, 2, 3 and 8 of the farm Mamatwan 331 and the farm Moab 700 in the Kgalagadi District Municipality of the Northern Cape Province*.

Thackeray, AI. 1992. The Middle Stone Age south of the Limpopo River. *Journal of World Prehistory* 6:385-440.

Thackeray, AI, Thackeray, JF and Beaumont, PB. 1983. Excavations at the Blinkklipkop specularite mine near Postmasburg, Northern Cape. *South African Archaeological Bulletin* 38:17-25.

Van der Ryst, MM. 2006. *Seeking shelter: hunter-gatherer-fishers of Olieboomspoort, Limpopo, South Africa.* Unpublished PhD: University of the Witwatersrand

Wadley, L. 1993. The Pleistocene Later Stone Age south of the Limpopo. *Journal of World Prehistory* 7:243-96.

Watts, I. 2002.Ochre in the Middle Stone Age of southern Africa: ritualised display or hide preservative? *South African Archaeological Bulletin* 57:1-14.

Willoughby, PR. 2008. *The evolution of modern humans in Africa*. *A comprehensive guide.*

Plymouth, United Kingdom: AltamiraPress

PHOTOGRAPHS

No. 1 Opencast section on Black Rock kopje. One of the water reservoirs is also visible in the right hand top corner.

No. 2 Example of underground mining.

No. 3 Entrances to the main underground sections of the mine

No. 4 Unmarked graves of Black mineworkers

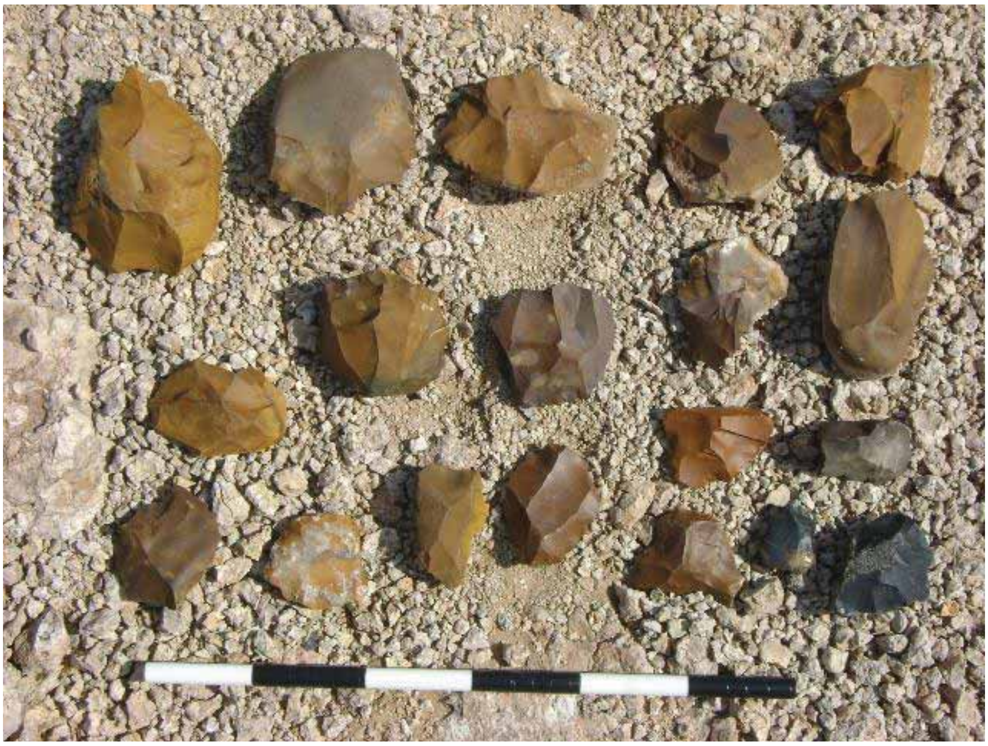
No. 5 Though the cemetery is fenced off it should be maintained

No. 6 Small cemetery in the nature reserve

No. 7 View over the quarry

No.8 The pebble and gravel level overlying the calcrete formation

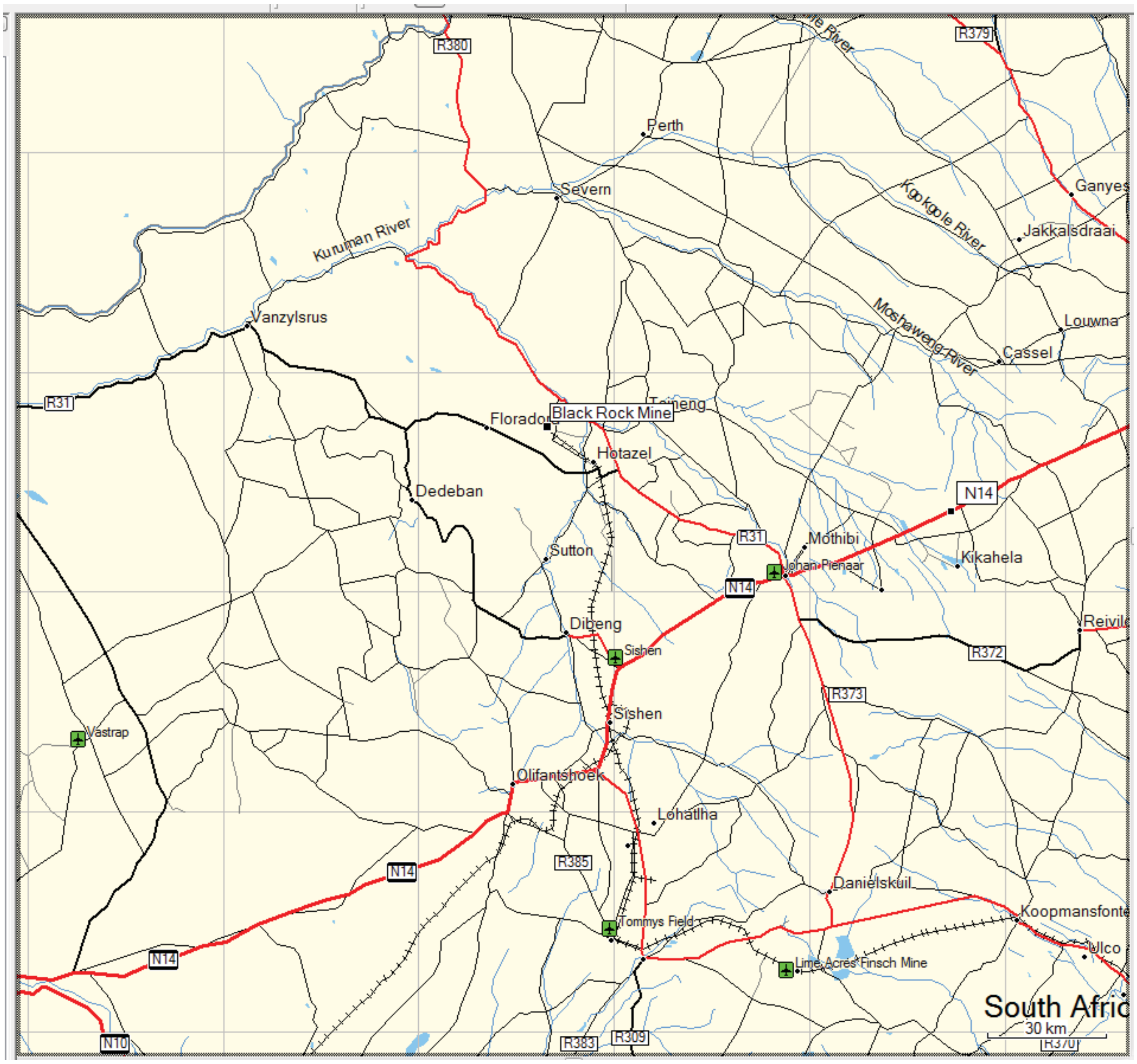
No. 9 Early Stone Age tools



No. 10 Middle Stone Age cores

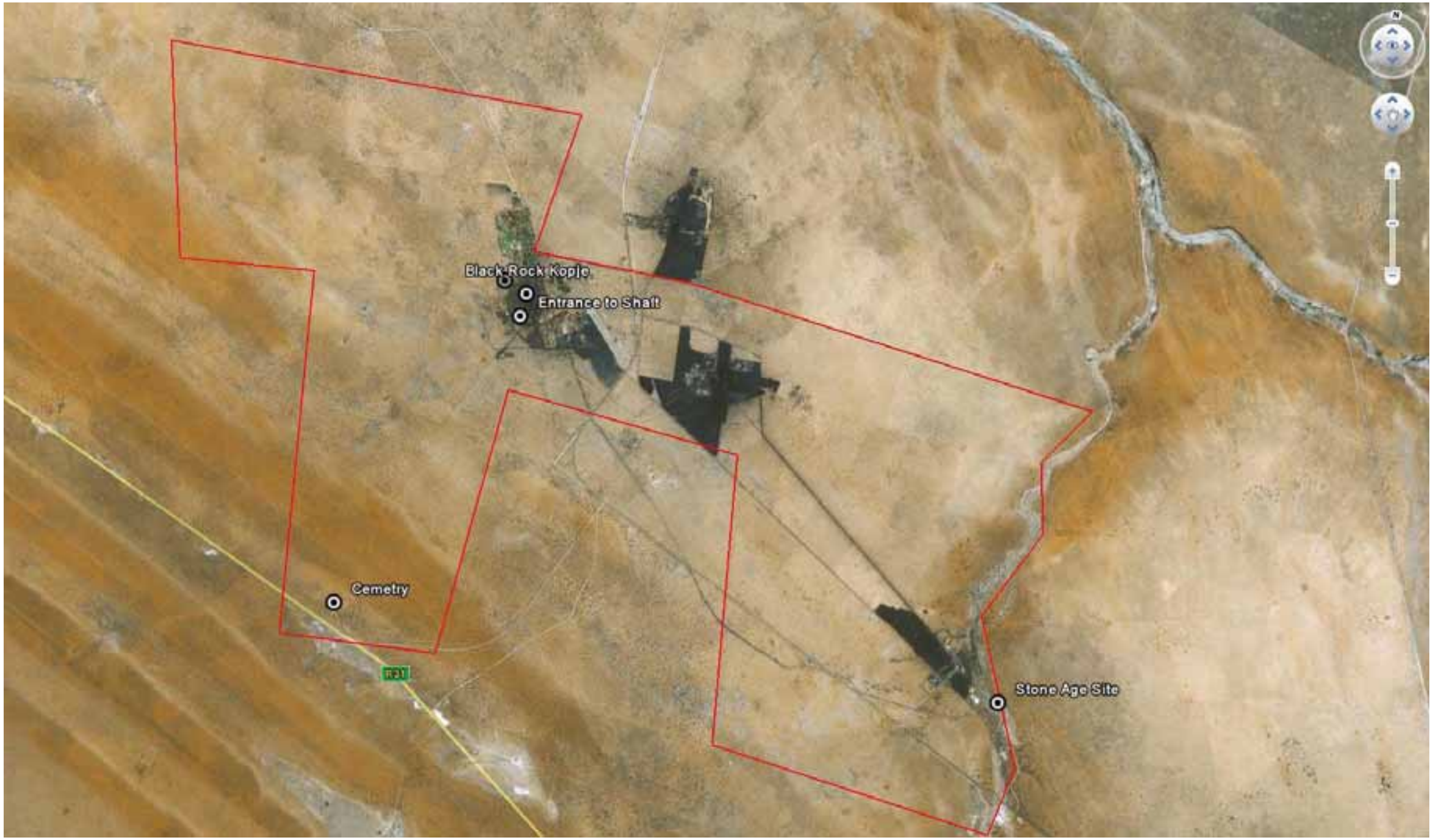
No. 11 Middle Stone Age flakes

MAPS



Route map to Black Rock

Detail map of the Black Rock mining area



General map of the area surveyed

Annexure A

Heritage Assessment for Asmang

Specialist report on the Stone Age of the Northern Cape

by

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The Stone Age sequence of the Northern Cape

Introduction: note on the chronology of the southern African Stone Age

Archaeological traces in the form of mostly stone tools suggest a widespread presence for tool-producing Plio-Pleistocene hominins[1] in the Northern Cape. The archaeology of this region is dominated by millions of stone tools that derived from the very early occupations by stone tool-manufacturing hominins up to the intensive utilisation by hunter-gatherers until the recent past. The upland savannas of southern Africa are seen as a focal region of biological and cultural evolution during this period (Beaumont and Vogel 2006).

This important part of the prehistory of southern Africa, known as the Stone Age, is chronologically divided into the Early (ESA), Middle (MSA) and Later Stone Age (LSA). The ESA is characterized by the use of large stone cutting tools, In particular handaxes and cleavers. The MSA represents greater specialization in the production of stone tools, with flake, blade and scraper tools and also a more extended range of formal tools. During the LSA small, microlithic tools and a range of decorative items as well as rock art were produced. Ceramics were used and/or produced by hunters and Khoekhoe herders towards the terminal phases of the LSA.

The Three-Age system

In 1929 Goodwin and Van Riet Lowe created time frameworks for the Stone Age archaeology of southern Africa at a stage when there were no chronometric dating methods available. They constructed a three-age division to describe variability and successive phases of stone tool use. The typology developed to construct these culture-historical frameworks was based on the formal attributes of the stone tools present in assemblages that were apparently from different, time-successive periods. *Fossiles directeurs* (Dunnell 1986) are constructed by the *ad hoc* selection of attributes relating to the shape of the lithic (lithic=stone) object. It was the use of such *fossiles directeurs* that enabled Goodwin and Van Riet Lowe (1929) to create a chronological division of the southern African lithics into the ESA, MSA and LSA. These terms are still widely used to describe the southern African lithic occurrences.

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[1] The term "hominin" instead of the customary term "hominid", acknowledge that African apes, including human ancestors, are closer to each other phylogenetically than any of them are to orang-utans (Mitchell 2002). The term hominid includes all the higher primates (chimps, gorillas, orang-utans, ancestral human types and ourselves), while hominin refers to those genera which evolved **after** the split with the chimps.

The functions of the various classes of artefacts within each of these periods are usually inferred by morphology and lithic tool names typically imply use for a specific task (and often a single function), for example a handaxe or a scraper. A term such as “scraper” refers to the morphological shape as well as to the function of the artefact. Different shapes of, for example scrapers, often result from use and the resharpening of tools rather than different mental templates. Such functional interpretations are often correct, but the form of an artefact does not necessarily match its inferred function. Lithic studies support multi-functional usage of tools with form not always equating assumed function (Andrefsky 2005:201).

An alternative framework: modes of stone tool production (based on Barham and Mitchell (2008)

For some time now researchers have been dissatisfied with the current Three-Age classificatory system that implies rigid boundaries and subsumes the similarities but also the diversities that are usually present within the various periods. Increasing evidence for a quite markedly time lag apparent in some regions for the transition into new industries, e.g. for a late continuation of the MSA in some regions in southern Africa, led to the revival of the use of **modes** to describe technological stages (Barham and Mitchell 2008:16).

In 1969 Grahame Clarke developed a system of five successive modes that describe **broad** patterns in stone tool manufacture. The system avoids the association of particular tools with bounded periods of time and emphasizes that processes of change were probably more gradual and continuous given that certain tool types are not restricted to a specific period so that developments within the various periods represent continuous processes of change. Any one assemblage can accordingly contain artefacts of various Modes, e.g. in an Acheulean assemblage there may be mostly Mode 2 bifacially-worked tools, but also Mode 3 (Levallois debitage) and Mode 5 (blades). An MSA assemblage can have all of these plus Mode 5 artefacts (Willoughby 2008).

However, our current use of the terminology proposed by Goodwin and van Riet Lowe (1929) is so widely cited in the literature and still applied by archaeologists working in southern African contexts that the following system of Modes as set out in Table 1 is merely an alternative framework that can be used in conjunction with the well-established terminology for the different stages of the southern African Stone Age.

Note that this classification system may be particularly applicable for CRM purposes and perhaps easier to understand for people outside the field of archaeology:

Table 1	**Modes of lithic technology (after JCD Clark 1969) (Barham and Mitchell 2008:16)**	**Notes on different Modes**
Mode 1	Pebble tool industries using choppers and simple flakes struck off pebbles	Mode 1 and 2: mostly **ESA**
Mode 2	Bifacially worked tools (handaxes and cleavers) produced from large flakes and cores	**ESA Acheulean** Transitional industries such as the **Fauresmith:** a blend of Mode 2 and 3
Mode 3	Flake tools produced from prepared cores	Mode 3 and 4: mostly **MSA**
Mode 4	Punch-struck blades that may be retouched into various specialised tool types	
Mode 5	Microlithic components of composite artefacts, often backed or otherwise retouched	Mode 5: mostly **LSA**, elements of Mode 4, particularly during the early stages, are quite prominent

Table 2 Basic stone tool terminology

A core is a block of raw material from which flake-blades or bladelets have been removed. It is classified as a core only if there are at least three negative flake removal scars. Cores generally show much morphological variability and the size of raw materials influences the kind or reduction technology used (Andrefsky 2005)

A flake is a fragment of stone which has been removed from a core. Such a blank can be used to manufacture a variety of tools. The tiny flakes removed when shaping a flake blank are also called flakes (see retouch below). Flakes, but also bladelets and blades, are the main products of any reduction process.

Detached flakes are often classified as debitage (Andrefsky 2005). However, flakes were undoubtedly used for a variety of tasks on wood, meat and bone as suggested by artefact function studies and supported by ethnographic accounts (Van der Ryst 2006).

Retouch is when small flakes or chips are removed from a blank flake in order to shape or transform a flake into a tool. Retouch shows in tiny regular negative scars on the tool.

Overview of the southern African Stone Age sequence

Table 3 Archaeological context: sequence and definitions

Period	**Approximate dates**
Early Stone Age	more than 2 million years ago - 250 000/200 000 years ago
Middle Stone Age	200 000/250 000 years ago – 25 000 years ago to around the Last Glacial Maximum (LGM) in some regions
Later Stone Age (Includes San Rock Art)	25 000 years ago - AD 200 and up to historic times in certain areas

The Early Stone Age

The two major stone tool industries associated with the ESA are the Oldowan and the Acheulean. The gracile and robust australopithecines are the earliest kinds of hominins to occur in southern African Plio-Pleistocene deposits at around 3 million years ago (mya) while specimens of the genus *Homo* are present at around 2 mya (Mitchell 2002:47). However, we cannot be sure which of the early hominin species produced the tools. The hand morphology of the early South African hominins exhibits precision gripping, which would have enabled tool manufacture. Chimpanzees both use and make tools, and it is therefore very likely that all hominins had this ability (Barham and Mitchell 2008).

The Oldowan

Oldowan assemblages, which are representative of some of the oldest type of stone tools from the ESA, have been recovered from only a few localities in southern Africa. Oldowan assemblages are informal and a restricted range of artefacts includes mainly hammer stones, chunks, chips, flakes (of which some exhibit retouching), as well as cores. This is the period during which both robust australopithecines and early *Homo* are found at these sites. It is generally assumed that the tools were made by *Homo habilis*.The most typical tool of this industry is the **chopper**, where both sides of a cobble were worked to obtain an irregular chopping edge. It is an all-purpose, generalised chopping tool with a sharp edge effective for cutting and chopping. Flake tools form part of Oldowan assemblages and could have been used for a variety of activities

Flaked and detached pieces: In ESA assemblages it can be difficult to distinguish between some tool types, for example between a chopper tool and a pebble core with negative flake removal scars. Some researchers accordingly prefer to call the cores/objective stone blocks from which flakes have been removed "**flaked pieces**" (FPs) while the flakes detached from the objective piece and the flakes, blades, etc. that have been removed are termed "**detached pieces**" (DPs) (Willoughby 2008).

The presence of cutmarks on animal bones, but also microwear and functional studies, suggest that flakes without any secondary retouch are multi-functional tools and employed in scraping, cutting and also butchering (Mitchell 2002:56). Bone tools are also a feature of these early assemblages. A study of wear patterns on long-bone bone flakes suggests their use in termite collecting (Backwell and d'Errico 2001).

The Acheulean

The Acheulean industry developed from the Oldowan industry. The transition from *Homo habilis* to *Homo erectus* appears to have been closely associated with the development of a new stone tool technology about 1.5 mya. The handaxes and cleavers that typify the Acheulean represent the first lithic expressions to have a wide geographic spread (Deacon and Deacon 1999). For more than a million years the characteristic Acheulean handaxes and cleavers were produced. Mitchell (2002:59) says that the Acheulean is "[p]robably the longest-lasting artefact tradition ever created by hominins" and found "from Cape Town to north-western Europe and as far as India between 1.4 and 0.2 mya". These large tools are considered a product of social learning within cooperating groups (McNabb et al 2004:653). Acheulean tools appear more standardized and to have been shaped by regular blows, rather than random strikes as in the case of the Oldowan. However, the 2.5 million-year-old artefacts from Gona in East Africa, associated with *Homo habilis,* are not obviously more rudimentary than the 1.8 million-year-old artefacts from Olduvai (Deacon and Deacon 1999:77).

Large cutting tools (LCT) of the Acheulean made their appearance nearly synchronous with that of *Homo ergaster* at 1.8 mya (McNabb et al 2004:653). The characteristic lithics of this period are collectively called **bifaces** as they show secondary flaking/retouch on both surfaces where flakes have been removed to shape and sharpen the tools. These artefacts were made to a pattern and according to Deacon and Deacon (1999:79) they "mark the beginnings of style". Pointed bifaces are known as **handaxes**, and bifaces with a wide, transverse cutting edge are termed **cleavers**. The handaxe is often a core tool made by removing many flakes off both sides of a pebble to produce a pear/almond-shaped tool with sharp cutting edges all the way around and a pick-like point. They were also made on flakes, particular during the later phases. The handaxe was a versatile tool and probably used for many different functions.

Flake tools were also used during the Acheulean period. There is evidence that flakes were not just the by-products of making core tools; rather, these flakes were deliberately struck from a core and then retouched to sharpen the edges. The Acheulean is characterised by a wider variety of tools, including chisels, anvils, awls and scrapers. The Acheulean toolmaker was also aware of the need to select materials carefully and fine-grained rocks, in particular igneous rocks, were chosen above any others for the manufacture of tools.

A new method of flaking was developed during this period. Instead of using a rock harder than the core from which the tool was to be made, the toolmaker used the soft-hammer percussion technique. By using a material like bone, wood or horn it is possible to knock flakes off with much greater precision than when using a harder rock. This basic toolkit remained the same for about 1.4 million years.

The Fauresmith

The Fauresmith is regarded to represent a transitional phase between the ESA and MSA, and have some technological and typological elements of the latter. There is a tendency towards smaller tools and small handaxes in particular seem to a characteristic feature of the Fauresmith. Assemblages include refined handaxes, long blades, convergent flakes/points, scrapers and prepared cores used in the manufacture of these tool types. This combination of Modes 2 and 3 makes it a likely transitional industry (Barham & Mitchell 2008:229).

The Middle Stone Age

Within the long span within of the MSA, older and younger assemblages are apparent. The earliest MSA assemblages date to around 250/200 000 years ago, but are more widespread from the Last Interglacial (OIS 5) (Mitchell 2002:80). A fourfold scheme is mostly used to describe subdivisions within the southern African MSA lithic assemblages. There is much variability in raw material usage and artefact morphology, and often low frequencies of formally retouched artefact types. During the MSA cores were prepared in order to produce pre-determined shaped blanks which were subsequently used to manufacture different tool types. The characteristic triangular flakes were used to produce retouched unifacial and bifacial points. Long narrow blade flakes occur in a range of sizes. They were used for different activities without any further trimming, but also shaped into specialised tool types.

Long MSA sequences from a particular site often do not exhibit clear technological and typological divisions and also may not contain all the different MSA sub-divisions (Thackeray 1992:397-8). Within the MSA regional traditions, such as Stillbay and the microlithic Howiesons Poort, have been identified. The origins of modern culture and language are associated with the emergence of anatomical modern humans, *Homo sapiens*, during the MSA.

The Later Stone Age

The major changes are the replacement of MSA lithic technologies by LSA microlithic stone-working traditions and the widespread signs of symbolic and ritual activity in the form of art and decorative items, and in particular objects made for personal adornment, such as pendants and the ubiquitous ostrich eggshell beads (Mitchell (2002:106),. The transition from the MSA to the LSA is vague. Dates proposed for the transitional period range from around 60/40 000-20 000 years ago and are based on a series of dates obtained through different dating methods, palaeoclimatic inferences, as well as lithic technologies and diagnostic tool types as artefactual markers of a particular period. LSA lithic technology is marked by the use of sophisticated knapping techniques, microlithisation, composite tools and a more varied range of raw materials for a greater range of tools as well as higher relative frequencies for bone and shell artefacts (Deacon 1984).

The Stone Age archaeology of the Northern Cape

The following framework provides an overview of major Northern Cape Stone Age sites in the general region of the survey area. The data are then applied to contextualise the archaeological occurrences identified within the footprint of the proposed development.

Wonderwerk Cave

One of the best-known sites in the region is the Wonderwerk Cave in the Kuruman Hills. The cave extends horizontally for 139 m and was formed by an ancient solution cavity in the dolomite formation (Beaumont 2004:31). Excavations since the 1940, which became more focussed as from 1976 to 1993, revealed a stratified series of deposits that accumulated up to a depth of about 7 metres and are divided into nine Major Units (Beaumont and Vogel 2006). The application of a range of dating methods points to an LSA at 1-12.5 kyr (kyr=thousand years ago), the MSA at around ~70 to >220 kyr ago, the Fauresmith to ~270-500 kyr ago and a ephemeral Acheulean at >0.78 myr BP (Beaumont and Vogel 2006). An interdisciplinary project initiated in 2004 aim at dating the ESA deposits in particular, using a range of radiometric techniques, and will also focus on analysing the lithic faunal and botanical remains recovered from these strata (Chazan et al 2008).

The lithic succession at Wonderwerk serves as a benchmark for the Stone Age sequence of the Northern Cape. It comprises an uppermost LSA sequence that contains Ceramic LSA, Wilton and Oakhurst. Some of the cave deposit has been removed by guano diggers, which destroyed some of the important archaeological levels. The MSA levels that were still intact yielded blades and unifacial MSA points. The ESA sequence contains the usual large cutting tools and includes a Fauresmith assemblage with blades, large scrapers and radially prepared cores. Whereas the paintings at Wonderwerk are in a poor state of preservation, the region has some good engraving and painted sites.

The Kathu region

The Kathu sites contain significant ESA Acheulean and Fauresmith assemblages. Archaeological and palaeoenvironmental data from Kathu Pan and Kathu Townlands were used to reconstruct changes over time in the prehistoric environment (Beaumont 2004:50. Associated faunal remains with some of the Acheulean include *Elephas recki recki*. These animals disappeared at sites in East Africa such as at Olorgesailie, Kenya, at around 600 000/800 000 years ago (Beaumont 2004: 51; McNabb 2004:656). This provides a relative date for the lithic assemblage. Biostratigraphy or faunal correlation is often used to date the southern African sites and gives some indication of the approximate age of the associated assemblages.

The LCT's from this area often contain very fine handaxes with some superb examples produced on banded ironstone. In some of the Acheulean deposits, but also in MSA levels, lithics display a shiny silica skin. One particular site at the Kathu Townlands covers a large area and contains an estimated minimum of 10 billion flaked items. This is ascribed to the use of the high-grade bedrock jasper as a source for raw materials and this is supported by the high incidence of handaxe roughouts (Beaumont 2004:52).

The prepared core technique was used to produce the spectacular small handaxes, long blades, convergent flakes/points, scrapers found in the Fauresmith collections. Some MSA tools were also recovered from the Kathu localities (Beaumont 2004).

Pigment mining

Pigments such as ochre and specularite were widely used and the specularite mines at Tsantsabane/Blinkklipkop and Doornfontein 1 near Postmasburg were rich and well-known ore sources that were quarried extensively over a long period of time (Beaumont and Morris 1990:65-74; Mitchell 2002:256-7; Morris 2004). Dunn (1931:110) was told that ‘it was from here that the Bushmen and other natives for hundreds of miles obtained their supplies of specular iron ore, which becomes red when burnt’. The pigment was bartered and exchanged for goods such as iron knives, assegais, axes, tobacco, copper and iron and copper ornaments and beads (Campbell 1822:Vol II; Burchell 1967; Arbousset and Daumas 1968). Investigations at Blinkklipkop established a date of AD 800 for the utilization of this particular rich source Thackeray et al 1983; Beaumont and Morris 1990).

The LSA at the pigment mines

The use of earth pigments, and in particular ochre and specular haematite, is universal (Watts 2002:1). Pigments, but moreover the exceptional pieces of engraved and ground incised pieces of ochre from MSA contexts at sites such as Wonderwerk attest to the time-depth of such practices (Mitchell 2002:99). Specular haematite was extensively mined by at least 40 000 BP at Ngwenya/Lion Cavern, Swaziland (Mitchell 2002:99). Quarrying of ore bodies often destroy earlier evidence for the utilisation of the resource. The investigations at Blinkklipkop near Postmasburg in the Northern Cape (Thackeray et al 1983; Beaumont and Morris 1990) established a date of AD 800 for the utilization of this particular rich source. The mainly late Holocene lithic sequences at the mining localities are characterised by informal tool types with low frequencies of formal tools. Some of these were most likely to have been used in the mining and processing of the pigments. Pottery and items of European origin have also been recovered (Morris 1990:67-70). The LSA of the Northern Cape is well researched (Humphreys and Thackeray 1983) but is not discussed in more detail in this report in view of the very low numbers of artefacts from this period found during the survey undertaken for Asmang.

The Stone Age archaeology of Asmang

During the survey lithic occurrences were found to be localised. However, there is always the possibility that sub-surface archaeological sites may be revealed through the proposed mining activities. Should archaeological artefacts or skeletal material be found in the area during construction activities, such activities should be halted, and a cultural heritage practitioner notified in order for an investigation and evaluation of the find(s) to take place (*cf*. NHRA (Act No. 25 of 1999), Section 36 (6)).

The survey determined that stone artefacts were not prolific within the area of the proposed development and mainly isolated specimens were found. Only one locality with evidence of knapping/utilisation was identified within the footprint. The lithics occurred within pebble and gravel levels overlying the calcrete formations within the ancient river bed of the Ga-Mogara River. The lithics apparently eroded from a borrow pit of approximately 500 x 100 meters in the river bed where materials for road construction/building purposes have been removed. The lithics occurred within a broad pebble band on the edge of the calcrete borrow pit and have evidently been exposed from an underlying horizon during the quarrying activities. Due to the density of good quality raw material in the form of pebbles significant knapping activities took place over time as evidenced by high frequencies of in particular cores.

The collection represents a mix of mainly ESA and MSA cores, flakes, blades and waste from stone tool knapping and other lithic reduction processes. Flakes, blades and bladelets are the main products of any stone reduction process. The collection includes one example that seems similar to a ESA chopper, but is more likely to be a pebble core with flake removals as the Oldowan is known from only a few sites. A number of formal ESA tool types were present among the exposed lithics. Most of the formal tools are typical ESA Acheulean handaxes, or large cutting tools (LCT's). These handaxes/bifaces are classified as formal tools, because they have been shaped or transformed into a specific shape and have been given a cutting edge through secondary retouch (i.e. by removing small flakes). Significant numbers of the MSA flakes and blades retain faceted striking platforms that indicate the use of the core preparation technique. These tool types are accordingly discussed in more detail.

ESA Acheulean large cutting tools

The emergence of LCT manufacture was earlier in sub-Saharan African than elsewhere (N Rolland in McNabb et al 2004:670). Handaxes and cleavers were manufactured on a cobble/pebble core or on a flake. LCT's varied considerably in size and shape. Some constraints on the morphology of the tool include the quality of available raw material, the size and shape of the pebble or core stone, the nature of the blank produced and the skill of the individual knapper. The majority of LCT's received a minimum of secondary shaping. Cleavers were typically made on side-struck flakes obtained from large cores and minimally shaped. Handaxes with focus on the convergent tips were shaped through invasive flaking and secondary retouch and were most likely to be resharpened or trimmed to extend their use-life. Some bifaces were manufactured, transported and discarded without much resharpening (McNabb et al 2004:669). Resharpening results in size reduction and can account for smaller handaxes in a collection. However, small refined handaxes is also a characteristic of the Fauresmith industrical complex.

Some Acheulean handaxes were evidently shaped to obtain balance or symmetry (T Wynn in McNabb et al 2004:672). It is argued that symmetry or near-symmetry could reflect the handwork of more skilled artisans (McNabb et al 2004:668). Many of the handaxes from the Northern Cape certainly exhibit near-symmetry and examples from Kathu Pan made on banded jasper/ironstone are particularly fine.

MSA prepared cores and flaked pieces

The collection shows a high frequency of prepared cores characteristic of MSA technologies. The prepared core technique was used during the MSA to produce triangular flake blanks and blade blanks. Some of the flake and blade blanks from the Asmang locality do exhibit such faceted striking platforms that typify core preparation characteristic of Levallois-type cores. Levallois reduction technology is based on the preparation of a core by systematic shaping to produce a conical or convex shape with a continuous striking platform around most of the perimeter of the selected nodule. Multiple flakes can be systematically removed from the prepared platform, with the conical objective piece maintaining its shape so that minimal repreparation is required before subsequent removals (Andrefsky 2005:148-9). The detached flakes exhibit attributes such as a faceted platform that derives from the technology used in core preparation. The size of raw materials selected for a core influences the kind or reduction technology used (Andrefsky 2005:151-5). Levallois core reduction requires relatively large objective pieces, and the technique is not suitable for the generally small nodules of cryptocrystalline materials, which were the preferred rock types during the LSA.

It is not in all the examples possible to assign firm associations of the lithics with specific Stone Age periods. The relative high frequency of long flake-blades may, however, be significant. These tool types may either be ascribed to the Fauresmith Industrial Complex, which is transitory between the ESA and MSA, or forms part of a fully developed MSA (Mitchell 2002).

The collection is dominated by local cryptocrystalline silica rock types, which are fine-grained good knapping materials. Jaspers are particularly abundant and used for the bulk of the lithics. Local rock types were generally used at most Stone Age localities with small numbers of tools occasionally made on rocks imported to the region or manufactured at other localities and then brought back (Beaumont 2004).

Discussion and recommendations

In the Northern Cape ESA assemblages, including the Fauresmith, tend to occur as lag deposits on the margins of seasonal rivers, semi-permanent water holes or pans. Such assemblages commonly represent the accumulated remains of numerous reoccupations over possibly many thousands of years. The particular locality from where the handaxes in the collection originate reflects the correlation of Acheulean sites with sources of water and an environment that could provide animal and plant foods (Deacon 1988:643-647; Mason 1988:626-30; McNabb et al 2004:656).

In this region stone tools often occur within calcrete zones underlying the modern surface of unstratified red aeolian sands (Deacon 1988:643-647; Mason 1988:626-30). Previous research in the Hotazel area confirmed localised occurrences of low-density Stone Age scatters along the exposed calcrete areas in dry riverbeds (PGS Heritage Unit:2009).

During the Phase 1 Heritage assessment under review only one archaeological sensitive area was identified and which seemed to be restricted to a zone within the bed of the Ga-Mogara River. A representative collection of mostly ESA and MSA artefacts have been documented at this locality. The large cutting tools evidently form part of an Acheulean assemblage. However, the collection is not large enough for the MSA tools to be assigned to particularly phases within the MSA. The range of tool types, the diversity of raw materials used as well as the presence of formal tools types reflect various instances of site utilisation over a very long period of time. As the lithics were uncovered during quarrying it is probably that sub-surface assemblages may be present. The calcretes should accordingly be marked as archaeological-sensitive areas.

It has been pointed out that the collection contains tool types that may originate from the Fauresmith industry. However, the small size of the collection and the fact that it clearly exhibits a mix of tools from various periods preclude positive identification. The Fauresmith is represented by only a limited number of excavated sites. A lack of excavated and well-documented open air sites from the interior with regional representative stratigraphic sequences inhibits the identification of regional patterns within the various phases of the Stone Age. Reliable dates for the Fauresmith are also lacking and issues like typology need to be investigated (Mitchell 2002:229-230). A watching brief is therefore recommended for the locality under review. Should development proceeds within this general area any subsequent finds should be assessed by a Stone Age specialist.

Annexure B

ARCHAEOLOGY, GRAVES AND THE LAW

- In terms of Section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:

(a) destroy, damage, alter, exhume or remove from its original position of otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

(c) bring onto or use at a burial ground or grave referred to in paragraph

(a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

- Human remains that are less than 60 years old are subject to provisions of the Human Tissue Act (Act 65 of 1983) and to local regulations.
- Exhumation of graves must conform to the standards set out in the Ordinance on Excavations (Ordinance no. 12 of 1980) (replacing the old Transvaal Ordinance no. 7 of 1925). Permission must also be gained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and local police. Furthermore, permission must also be gained from the various landowners (i.e. where the graves are located and where they are to be relocated) before exhumation can take place.
- A registered undertaker can only handle human remains or an institution declared under the Human Tissues Act (Act 65 of 1983 as amended).
- Unidentified/unknown graves are also handled as older than 60 until proven otherwise

THE PROCESS/STEPS THAT ARE TAKEN

SITE VISIT: WHAT IS DONE DURING THIS SITE VISIT?

Physical documentation of graves prior to exhumation: Photographic, GPS, Site Maps, Final counting etc…

Determining context of graves: If any, are they associated with other sites such as farmhouses/structures etc…

SITE SIGNS AND ADVERTISEMENTS

Notices (in compliance with the National Heritage Resources Act) must be placed on the site/s, indicating the intent of relocation. This must be in at least 3 languages and has to be up for a minimum of 60 days.

As part of the preliminary social consultation, newspaper ads as well as radio announcements has to be made as well

This is in order that family members/descendants, if any, can reply/come forward to indicate if any of the graves belong to them

SOCIAL CONSULTATION

If any individuals responded during initial consultation/public participation, then full social consultation undertaken. This will include speaking to individuals regarding graves, their family wishes, getting consent for relocation/reburial etc…

It could also include an Open Day/Traditional Ceremony (or more than one if necessary)

PERMIT APPLICATIONS

Undertakers permits applied for and obtained during social consultation

Only after all necessary documents, family consent obtained, landowner letter, can SAHRA Permit be applied for and obtained. A few weeks should be budgeted for this.

EXHUMATION & RELOCATION

When permits obtained physical exhumation, investigation and reburial commences

THE ARCHAEOLOGICAL INVESTIGATION OF BURIALS: DOCUMENTATION FORM

This form contains the following information for each burial:

Feature/Burial No **Site Name/No** **GPS Reading** **Farm Name/No**

Province **Location of new cemetery**

It also includes information on the

Burial Type

Burial Dimensions

Grave Type

Grave Dimensions

Associated sites/features

Specimens or grave goods found

The state of preservation and percentage completeness of the human skeletal material

Sex and Age of the individual

Further Remarks

Information on the headstone and grave dressing (if any)

Photographs of each grave, headstone (if any), the skeletal remains, grave goods etc… are also taken and used in the final documentation

BIODIVERSITY ACTION PLAN FOR THE ASSMANG BLACK ROCK MANGANESE ORE MINE

PREPARED FOR

Environmental Science Associates

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Glossary of Terms & Acronyms

Alien vegetation – Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally.

Biome – A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.

Bush encroachment – A state where undesirable woody elements gain dominance within grassland, leading to depletion of the grass component. Typically due to disturbances and transformations as a consequence of veld mismanagement (overgrazing, incorrect burning, etc.).

Decreaser grass – Grass abundant in veld in good condition, which decreases when veld is under- or over-utilized.

°C – Degrees Celsius.

Endangered – Organisms in danger of extinction if causal factors continue to operate.

Endemic species – Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.

Exotic vegetation – Vegetation species that originate from outside of the borders of the biome. Usually international in origin.

Ex situ conservation – Where a plant (or community) cannot be allowed to remain in its original habitat and is removed and cultivated to allow for its ongoing survival.

Extrinsic – Factors that have their origin outside of the system.

GDACE – Gauteng Department of Agriculture, Conservation and Environment

ha – Hectares.

Indigenous vegetation – Vegetation occurring naturally within a defined area.

Increaser 1 grass – Grass species that increase in density when veld is under-utilized.

Increaser 2 grass – Grass species that increase in density in over-utilized, trampled or disturbed veld.

Increaser 3 grass – Grass species that increase in density in over and under-utilized veld.

In situ conservation – Where a plant (or community) is allowed to remain in its natural habitat with an allocated buffer zone to allow for its ongoing survival.

Karoid vegetation – A shrub-type vegetation that dominates in grasslands that have seen historical disturbances. Mainly due to over-grazing and mismanaged burning regimes. The shrubby vegetation eventually becomes dominant and out-competes the grassy layer.

m – Metres.

mm – Millimetres.

MAMSL – Metres above mean sea level.

MAP – Mean annual precipitation.

MAPE – Mean annual potential for evaporation.

MASMS – Mean annual soil moisture stress.

MAT – Mean annual temperature.

Orange Listed – Species that are not Red Data Listed, but are under threat and at risk of becoming RDL in the near future. Usually allocated to species with conservation status of *Near Threatened (NT), Least Concern (LC), Rare* and *Data Deficient (DD)*.

PES – Present Ecological State.

POC – Probability of occurrence.

PRECIS – Pretoria Computer Information Systems.

Pioneer species – A plant species that is stimulated to grow after a disturbance has taken place. This is the first step in natural veld succession after a disturbance has taken place.

QDS – Quarter degree square (1:50,000 topographical mapping references).

Rare – Organisms with small populations at present.

RDL (Red Data listed) species – Organisms that fall into the *Extinct in the Wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU)* categories of ecological status.

RDSIS – Red Data Sensitivity Index Score.

SANBI – South African National Biodiversity Institute.

Veld retrogression – The ongoing and worsening ecological integrity state of a veld

1 INTRODUCTION

Biodiversity may appear to be a straightforward concept that can quickly and painlessly be measured. This is understandable since most people have an intuitive grasp of what is meant by diversity and have little difficulty in accepting that tropical rainforests are more diverse than Highveld grasslands. However, this is illusional because as one observes biodiversity more closely, the less clearly defined it appears to be and viewing biodiversity from different angles can lead to different perceptions of biodiversity status. This is primarily because diversity consists of two components, variety, and secondly relative abundance of species. This applies at the landscape as well as individual habitat level.

In June 1992, 159 governments at the Earth Summit, which took place in Rio de Janeiro, signed the Convention on Biological Diversity. It entered into force on 29 December 1993. It called for the creation and enforcement of national strategies and action plans to conserve, protect, and enhance biological diversity. Since then, certain regions have prepared regional Biodiversity Action Plans (BAPs), into which local level BAPs need to feed.

Businesses globally have responded to the biodiversity challenge by trying to understand and manage their impacts on biodiversity. This has progressed further and businesses are now expected to not only manage their impacts on biodiversity but to take responsibility for the management of biodiversity within their properties.

The SHE Policy of many large industrial corporations commit to “active stewardship of biodiversity in all phases of its activities”. Commitment is also made to the wise use of environmental resources, and to prevent or minimise adverse environmental impacts arising from the company’s operations. These companies also generally recognise that biodiversity conservation means more than species protection. The company commitment therefore means that it must minimise the impacts that its activities may have on the maintenance of ecosystem integrity and functioning. A critical part of this management is the development of BAPs for the various projects.

It is the primary objective of this study to meet this management requirement. It is our understanding that the study is to provide strategic guidelines that can be incorporated in management and rehabilitation plans and activities that will result in ensuring that the biodiversity of the area (with special mention of sensitive environments and faunal/floral assemblages i.e. hills and stream valleys). The document will comply with corporate responsibility and image requirements as well as legislative requirements.

2 TERMS OF REFERENCE

The biodiversity study and assessment of the surface rights covered by the EMPR surrounding the various surface infrastructures associated to the Black Rock Mine. The study will include the following:

1. Literature study of both the regional and localised area which will include relevant legislation, geology, soil types, species likely to be encountered and possible red data species found in the area. Use will also be made of existing documentation; in this regard special mention is made of the EMPR documentation and supporting studies pertaining to the facility. Assmang Limited completed the EMPR for the four mines within the Black Rock surface rights area namely Black Rock, Gloria, Nchwaning II and Nchwaning III and these EMPR documents were amended in 2002.
2. A site visit was undertaken for the consultants to obtain an understanding of the site and to observe the various habitat types present at the site based on the brief scan of the EMPR documentation.
3. Based on the findings a set of biodiversity objectives will be developed to protect the biodiversity of the area. The findings to date along with the draft objectives will be presented to mine management at a meeting where the objectives can be refined with input from the mine.
4. Based on the set objectives a site-specific risk assessment will be undertaken where risks in terms of the defined objectives will be identified and classified according to a risk assessment system. Once the risks have been identified, classified mitigatory measures to minimise or prevent the risks will be developed.
5. Based on the risks, impacts and identified mitigatory solutions a Biodiversity Action Plan will be developed. The plan will summarise the findings of the entire study highlighting the biological characteristics of the area, risks, objectives and mitigation. A register of action plan items will be developed which will have responsible parties allocated to them as well as target dates for completion of each action plan item. The plan will also define the method of monitoring of compliance of the action plan and actual biodiversity integrity.

3 LEGAL FRAMEWORK

A legal overview was undertaken in order to identify legislation and policies that have a direct bearing on the biodiversity management of the Assmang Manganese ore Black Rock Mine. The sections below present each legislative document and the aspects which are pertinent to biodiversity management are presented.

- ***Environment Conservation Act (1989) and related EIA regulations;***

2. Determination of policy

1) Subject to the provisions of subsection (2) the Minister may by notice in the *Gazette* determine the general policy, including policy with regard to the implementation and application of a convention, treaty or agreement relating to the environment which has been entered into or ratified, or to be entered into or ratified, by the Government of the Republic, to be applied with a view to--

a) the protection of ecological processes, natural systems and the natural beauty as well as the preservation of biotic diversity in the natural environment;

Part III: Protection of Natural Environment

16. Protected natural environment

1) A competent authority may by notice in the *Official Gazette* concerned declare any area defined by him, to be a protected natural environment and may allocate a name to such area: Provided that such protected natural environment may only be declared--

a) if in the opinion of the competent authority there are adequate grounds to presume that the declaration will substantially promote the preservation of specific ecological processes, natural systems, natural beauty or species of indigenous wildlife or the preservation of biotic diversity in general;

In considering the biodiversity in the vicinity of the development area, cognisance must therefore be given of the surrounding land uses as well as any nearby and in the case of riverine features downstream land uses and conservation areas

- ***National Environmental Management Act (1998); (NEMA)***

The guiding principles of NEMA refer specifically to biodiversity management in the following Clause:

(4) (a) *Sustainable* development requires the consideration of all relevant factors including the following:

(i) That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied:

- ***Mineral and Petroleum Resources Development Act (2002)***

It is recognised that minerals and petroleum are non-renewable natural resources and should be utilised in a sustainable manner that causes the least threat to the biodiversity of the surrounding landscape.

In order to comply with the requirements of NEMA and the MPRDA it is therefore necessary that as part of an environmental impact assessment sufficient information is gathered to understand the structure, function and importance of various aspects of biodiversity. Once these aspects are fully understood, they must be adequately considered during the environmental impact assessment undertaken.

The Environmental Management Plan/Programme for any facility or activity must ensure that plans and procedures are put in place to prevent environmental degradation where possible, and where impacts will definitely occur, that plans are implemented to minimise the effects of such activities. The clause also means that any impacts which may occur need to be remedied and as such remediation of specific events and a life cycle management approach needs to be adopted wherein the biodiversity of an area needs to be managed beyond the decommissioning phase of any development.

- ***National Environmental Management: Biodiversity Act (2004)***

The objectives of this act are (within the framework of the National Environmental Management Act) to provide for:

- *the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;*
- *the use of indigenous biological resources in a sustainable manner; and*
- *the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources;*
- *to give effect to‘ ratified international agreements relating to biodiversity which are binding to the Republic;*
- *to provide for co-operative governance in biodiversity management and conservation; and*
- *to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.*

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas are not negatively impacted upon, by any activity being *undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources*

- ***The Protected Areas Act (Act 57 of 2003) (In conjunction with the National Environmental Management: Biodiversity Act of 2004)***

To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.

This act as with the forestry act alludes to the fact that the conservation status of all vegetation types needs to be considered when any development is taking place to ensure that the adequate conservation of all vegetation types is ensured.

- ***Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983)***

Amendments to regulations under the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) ensures that landowners are legally responsible for the control of invasive alien plants on their properties. The CARA legislation divides alien plants into weeds and invader plants, with *weeds* regarded as alien plants with no known useful economic purpose, while *invader plants* may serve useful purposes as ornamentals, as sources of timber and may provide many other benefits, despite their aggressive nature. In the legislation, 198 alien invader species were listed as declared weeds and invaders, and divided into three categories.

- ***Category 1:*** Prohibited weeds that must be controlled in all situations[1];
- ***Category 2:*** Plants with commercial value that may be planted in demarcated areas subject to a permit providing steps are taken to control spread; and[2]

Category 3: Ornamental plants that may no longer be planted or traded, but may remain in place provided a permit is obtained and steps taken to control their spread.[3]

- ***National Water Act (1998);***

The National Water Act defines not only that actual water but also the entire aquatic ecosystem as the ecosystem requiring protection. The purpose of this Act is to ensure that the national water

[1] Regulation 15A regarding the "combating of category 1 plants" in the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983).

[2] Regulation 15B regarding the "combating of category 2 plants" in the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983).

[3] Regulation 15B regarding the "combating of category 3 plants" in the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983).

resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors:

- *meeting the basic human needs of present and future generations:*
- *promoting equitable access to water;*
- *redressing the results of past racial and gender discrimination;*
- *promoting the efficient, sustainable and beneficial use of water in the public interest;*
- *facilitating social and economic development;*
- *providing for growing demand for water use;*
- *protecting aquatic and associated ecosystems and their biological diversity;*
- *reducing and preventing pollution and degradation of water resources;*
- *meeting international obligations;*
- *promoting dam safety;*
- *managing floods and droughts;*

The Reserve, which consists of two parts - the basic human needs reserve and the ecological reserve. The basic human needs reserve Provides for the essential needs of individuals served by the water resource in question and includes water for drinking, for food preparation and for personal hygiene. The ecological reserve relates to the water required to protect the aquatic ecosystems of the water resource. The Reserve refers to both the quantity and quality of the water in the resource, and will vary depending on the class of the resource.

As with the biodiversity act, the NWA alludes to the fact that water resource management must take place to ensure that the biodiversity of surrounding areas are not negatively impacted upon by any activity being undertaken, and in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources. The act further indicates that water resources need to be managed in such a way as to ensure that water resources are managed in such a way that their use is sustainable.

- ***National Forests Act (1998);***

Principles to guide decisions affecting forestry resources applicable to land development management are contained in the following principle:

Principle 3

3) The principles are that—

(a) natural forests must not be destroyed save in exceptional circumstances where, in the opinion of the Minister, a proposed new land use is preferable in terms of its economic, social or environmental benefits;

(b) a minimum area of each woodland type should be conserved and forests must be developed and managed to -

(i) conserve biological diversity, ecosystems and habitats;

(ii) sustain the potential yield of their economic, social and environmental benefits.

This section of the act alludes to the fact that the conservation status of all vegetation types needs to be considered when any development is taking place to ensure that the adequate conservation of all vegetation types is ensured.

<u>Principle 6</u>

(6) Criteria and indicators may include but are not limited to, those for determining—

(a) the level of maintenance and development of—

(i) forest resources:

(ii) biological diversity in forests:

(iii) the health and vitality of forests:

(iv) the productive functions of forests:

(v) the protective and environmental functions of forests; and

(vi) the social functions of forests:

- ***National Heritage Resources Act (1999);***

<u>Chapter 1</u>

<u>System for management of national heritage resources</u>

Part 1: General Principles

National estate

(3)Without limiting the generality of subsections (1) and (2), a place or object is to be considered part of the national estate if it has cultural significance or other special value because of—

(a) its importance in the community, or pattern of South Africa's history;

(b) its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;

(c) its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;

(d) its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;

- ***Convention on Biological Diversity (1995)***

A multilateral, multi-national binding agreement where countries, including South Africa, undertake to identify and conserve areas of high biodiversity and ecological importance, in areas of their own jurisdiction. The convention also includes measures relating to sustainable development and protection of natural heritage.

- ***World Summit for Sustainable Development (2002)***

Hosted by South Africa in 2002 and led by the United Nations, where all nations present pledged their commitment to sustainable development and conservation of biodiversity in their respective states.

4 APPROACH & METHODOLOGY

4.1 Desktop study

Prior to the field assessment being completed, a desktop study was undertaken to gather background information regarding the site and its surrounding areas. This involved:

- Consulting maps, aerial photographs and digital satellite images in order to determine broad habitats and sensitive sites;
- A literature review concerning habitats, vegetation types, faunal and floral species distributions;
- Contacting all the relevant authorities regarding red data listed floral species and
- Identifying the status of the land as well as conservation requirements and nearby conservation areas.
- Discussions with the Black Rock Mine and closure consultants regarding post closure land use, focusing on issues related to:
  - Intended and viable post closure land use plans.
  - Rehabilitation methods and timeframes.

4.2 Floral Diversity

4.2.1 Vegetation Index Score

The Vegetation Index Score (VIS) was designed to determine the ecological state of each habitat unit defined within an assessment site. This enables an accurate and consistent description of the present ecological state (PES) concerning the subject property in question. The information gathered during these assessments also significantly contributes to sensitivity mapping, leading to a more truthful representation of ecological value and sensitive habitats.

Each defined management unit is assessed using separate data sheets (see Appendix A) and all the information gathered then contributes to the final VIS score. The VIS is derived using the following formulas:

VIS = [(EVC)+((SIxPVC)+(RIS))]

Where:

1. ***EVC** is extent of vegetation cover;*
2. ***SI** is structural intactness;*
3. ***PVC** is percentage cover of indigenous species and*
4. ***RIS** is recruitment of indigenous species.*

Each of these contributing factors is individually calculated as discussed below. All scores and tables indicated in blue are used in the final score calculation for each contributing factor.

VIS = [(EVC)+((SIxPVC)+(RIS))]

Where:

1. **EVC** is extent of vegetation cover;
2. **SI** is structural intactness;
3. **PVC** is percentage cover of indigenous species and
4. **RIS** is recruitment of indigenous species.

Each of these contributing factors is individually calculated as discussed below. All scores and tables indicated in blue are used in the final score calculation for each contributing factor.

1. EVC=[[(EVC1+EVC2)/2]

EVC 1 - Percentage natural vegetation cover:

Vegetation cover % Site score	0%	1-5%	6-25%	26-50%	51-75%	76-100%
EVC 1 score	0	1	2	3	4	5

EVC2 - Total site disturbance score:

Disturbance score Site score	0	Very Low	Low	Moderately	High	Very High
EVC 2 score	5	4	3	2	1	0

2. SI=(SI1+SI2+SI3+SI4)/4)

	Trees (SI1)		Shrubs (SI2)		Forbs (SI3)		Grasses (SI4)	
Score:	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State
Continuous								
Clumped								
Scattered								
Sparse								

Present State (P/S) = Currently applicable for each habitat unit

Perceived Reference State (PRS) = If in pristine condition

Each SI score is determined with reference to the following scoring table of vegetation distribution for present state versus perceived reference state.

Perceived Reference state (PRS)	Present state (P/S) Continuous	Clumped	Scattered	Sparse
Continuous	3	2	1	0
Clumped	2	3	2	1
Scattered	1	2	3	2
Sparse	0	1	2	3

3. PVC=[(EVC)-((exotic x 0.7) + (bare ground x 0.3))

Percentage vegetation cover (exotic):

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
PVC Score	0	1	2	3	4	5

Percentage vegetation cover (bare ground):

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
PVC Score	0	1	2	3	4	5

4. RIS

Extent of indigenous species recruitment	0	Very Low	Low	Moderate	High	Very High
RIS	0	1	2	3	4	5

The final VIS scores for each habitat unit are then categorised as follows:

Vegetation Index Score	Assessment Class	Description
25	A	Unmodified, natural
20 to 24	B	Largely natural with few modifications.
15 to 20	C	Moderately modified
10 to 15	D	Largely modified
5 to 10	E	The loss of natural habitat extensive
<5	F	Modified completely

4.2.2 Vegetation Community Analysis

Vegetation surveys were undertaken by first identifying different management units and then analysing the floral species composition. Different transect lines were chosen within areas that were perceived to best represent the various plant communities. A walking stick was used that was placed every 1m and the plant species of biophysical feature falling closest to the point of the stick was identified. These points were done along a 100m transect line, making for 100 data points along a single transect. The data was then analysed and the percentage contribution of the various floral species for each transect line was calculated. These species lists were then also compared with the vegetation expected to be found in the various vegetation types within the study area, which provided an accurate indication of the ecological integrity and conservational value of each management unit. These results also provide data to which future monitoring data can be compared to determine the success of any rehabilitation activities or indicate changes occurring due to increased disturbance.

4.2.3 Red and Orange Data Listed Flora

Prior to the field visit, a record of Red Data List plant species and their habitat requirements was acquired from SANBI for the quarter degree grids *2722BB*. Throughout the floral assessment special attention was paid to identification of any of these RDL species as well as identification of suitable habitat that could potentially sustain these species.

The probability of occurrence (POC) for each floral species of concern (*2722BB*) was determined using the following calculation wherein the habitat requirements and habitat disturbance were considered. The accuracy of the calculation is based on the available knowledge about the species in question, with many of the species lacking in depth habitat research. Therefore it is important that the literature available is also considered during the calculation.

Each factor contributes an equal value to the calculation.

Literature availability						
	No Literature available					Literature available
Site score						
Score	0	1	2	3	4	5
Habitat availability						
	No Habitat available					Habitat available
Site score						
Score	0	1	2	3	4	5
Habitat disturbance						
	0	Very Low	Low	Moderately	High	Very High
Site score						
Score	0	1	2	3	4	5

[Literature availability + Habitat availability + Habitat disturbance] / 15 =POC%

4.2.4 Medicinal Floral Species

During the floral assessment special attention was paid with identification of any medicinal floral species or suitable habitat that could sustain any medicinal floral species of concern. Various medicinal plant species are under collection pressure from the medicinal plant trade. Therefore it is important to determine the presence of any medicinal plant species as well as location in which found, for future conservation and management.

4.2.5 Invasive Floral Community

During the floral assessment the dominant invasive floral community was identified. Alien vegetation invasion causes degradation of the ecological integrity of an area, causing (Bromilow, 2001):

- A decline in species diversity;
- Local extinction of indigenous species;
- Ecological imbalance;
- Decreased productivity of grazing pastures and
- Increased agricultural input costs.

It is therefore important that all alien and weed species are identified and appropriately managed within the study area.

4.3 Faunal Diversity

During site survey all faunal aspects as well as possible habitat types were noted. Small mammals are unlikely to be directly observed in the field because of their nocturnal/crepuscular and cryptic nature. A simple and effective solution to this problem is to use Sherman traps. A Sherman trap is a small aluminium box with a spring-loaded door. Once the animal is inside the trap, it steps on a small plate that causes the door to snap shut thereby capturing the individual. Trapping took place within relatively undisturbed small mammal habitat identified throughout the study area.

Larger faunal species were recorded during the subject property assessment with the use of visual identification, spoor, call and dung and positively identified. It is important to note that due to the nature and habits of fauna it is unlikely that all species will have been recorded during the site assessment.

4.3.1 Red data Fauna

Habitat conditions at the study site were considered and the Probability of Occurrence (POC) for the specific species was determined. Using the POC a red data sensitivity index score (RDSIS) was determined for the property and included all fauna taxa (excluding flora), as listed on the national red data lists in the categories *critically endangered*, e*ndangered* and v*ulnerable*. Species with distribution and habitat requirements not consistent with the immediate area or site were not considered. Methodology to determine the RDSIS of the property was as follows:

- Probability of Occurrence (POC). Known distribution range (D), habitat suitability of the site (H) and availability of food sources (F) on site were determined for each of the species. Each of these variables is expressed as a percentage (where 100% is a perfect score). The average of these scores provided a probability of occurrence (POC) score for each species. The POC value was categorised as follows:
  - **0-20% = Low;**
  - **21-40% = Low to Medium;**
  - **41-60% = Medium;**
  - **60-80% = Medium to High; and**
  - **81-100% = High**

POC = D+H+F/3

➢ Total Species Score (TSS). Species with POC of more than 60% (High-medium) were considered when applying the RDSIS. A weighting factor was assigned to the different IUCN categories providing species with a higher conservation status, a higher score. This weighting factor was then multiplied with the POC to calculate the total species score (TSS) for each species. The weighting as assigned to the various categories is as follows:

- **Vulnerable = 1.2;**
- **Endangered = 1.7; and**
- **Critically Endangered = 2.0.**

TSS = (IUCN weighting*POC) where POC > 60%

➢ Average Total Species (Ave TSS) and Threatened Taxa Score (Ave TT). The average of all TSS potentially occurring on the site is calculated. The average of the Threatened taxa (TT) - *Vulnerable*, *Endangered* and *Critically Endangered* and the TSS scores are also calculated. The average of these two scores (Ave TSS and Ave TT) was then calculated in order to add more weight to threatened taxa with POC higher than 60%.

Ave = Ave TSS [TSS/No of Spp] + Ave TT [TT TSS/No of Spp]/2

➢ Red Data Sensitivity Index Score (RDSIS). The average score obtained above and the sum of the percentage of species with a POC of 60% or higher of the total number of Red Data Listed species listed for the area was then calculated. The average of these two scores, expressed as a percentage, gives the RDSIS for the area investigated.

RDSIS = Ave + [Spp with POC>60%/Total no Of Spp*100]/2

Table 1: RDSIS value interpretation with regards to RDL importance on the subject property.

RDSIS Score	RDL mammal importance
0-20%	Low
21-40%	Low-Medium
41-60%	Medium
60-80%	High-Medium
81-100%	High

4.4 Wetland Assessment Methodology

4.4.1 South African Wetland Assessment Classification System

All wetland and riparian features encountered within the study area were assessed using *the South African Wetland Classification System* as ascribed within the *Resource Directed Measures for Protection of Water Resources* (1999). This was done in order to achieve the Recommended Ecological Category (REC) of the wetland features. The methodology followed is illustrated in the figure below, followed by a detailed discussion of each section.

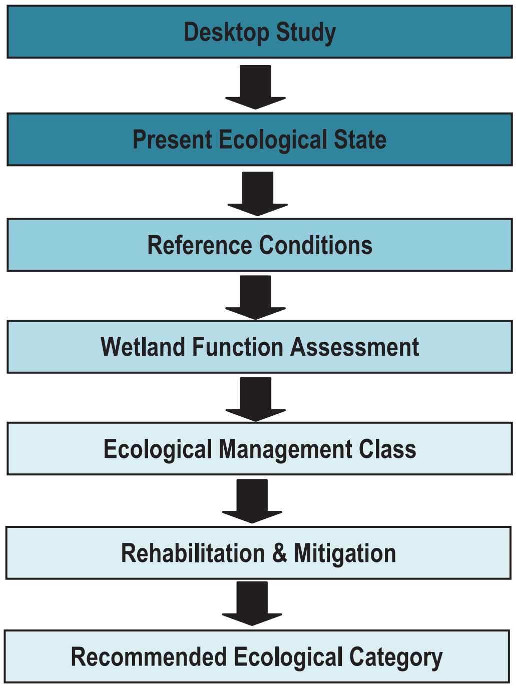

Figure 1: Wetland determination flow chart.

4.4.2 Ecoregion

When assessing the ecology of any area (aquatic or terrestrial), it is important to know which ecoregion the study area is located within. This knowledge allows for improved interpretation of data, since reference information and representative species lists are often available on this level of assessment to guide the assessment.

4.4.3 Ecostatus

Studies undertaken by the Institute for Water Quality Studies assessed all quaternary catchments as part of the Resource Directed Measures for Protection of Water Resources. In these assessments, the Ecological Importance and Sensitivity (EIS), Present Ecological Management Class (PEMC) and Desired Ecological Management Class (DEMC) were defined, and serve as a useful guideline in determining the importance and sensitivity of aquatic ecosystems prior to assessment, or as part of a desktop assessment.

Water resources are generally classified according to the degree of modification or level of impairment. The classes used by the South African River Health Program (RHP) are presented in the table below and will be used as the basis of classification of the systems in this field, and desktop study.

Table 2: Classification of river health assessment classes in line with the RHP

Class	Description
A	Unmodified, natural.
B	Largely natural, with few modifications.
C	Moderately modified.
D	Largely modified.
E	Extensively modified.
F	Critically modified.

4.4.4 Present Ecological State

A site visit was undertaken in order to identify all natural characteristics of the wetland features within the study area, followed by characterisation of all wetland systems using the flow chart with definitions as stipulated below.

Water surface – This is found in all systems and includes all water surfaces with a vegetative cover of less than 30%.
Non-vegetated – Includes surfaces with less than 30% surface area cover of vegetation other than pioneer species. Common examples include rocky shores along Marine coastlines, Marine and Estuarine mud, and sand flats, exposed shores on the margins of lakes and dams, and riverine sand bars.
Reef – Includes ridge-like or mound-like structures formed by the colonization and growth of sedentary invertebrates.
Aquatic Bed – Includes habitats dominated by plants that growing principally on or below the water surface for most of the growing season in most years. These habitats are usually found in water less than 2meter deep. They represent a diverse group of plant communities that require surface water for optimal growth and reproduction.
Emergent – Characterised by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years, usually maintaining the same appearance form one year to another. Perennial species tend to dominant Emergent Habitats. Areas that are dominated by pioneer species, which become established during periods of low water, are not Emergent Wetlands and should be classified as Non-vegetated.
Scrub-Shrub – Includes areas dominated by woody vegetation less than 6 meter tall. It is characterised by true shrubs, young trees, and trees or shrubs that are small or stunted as a result of environmental conditions. Such communities may represent a successional stage leading to forested Wetland, or they may be relatively stable.
Forested – This class is characterised by woody vegetation that is taller than 6 meter. These habitats normally possess an overstorey of trees, an understorey of young trees or shrubs, and herbaceous layer.

MARINE

Consists of the open ocean overlying the continental shelf and its associated exposed coastline.

- ***Subtidal:*** substrate continuously submerged.
  - Water surface
  - Aquatic Bed
  - Reef
- ***Intertidal***: substrate is exposed and flooded by tides, including the splash zone
  - Water surface
  - Aquatic Bed
  - Reef
  - Non-vegetated

ESTUARINE

Consits of tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater.

- ***Subtidal:*** substrate continuously submerged.
  - Water surface
  - Aquatic Bed
  - Reef
- ***Intertidal***: substrate is exposed and flooded by tides, including the splash zone
  - Water surface
  - Aquatic Bed
  - Reef
  - Non-vegetated
  - Emergent
  - Scrub-shrub
  - Forested

LACUSTRINE SYSTEM

Includes permanently flooded lakes and dams. Waters may be tidal/non-tidal, but ocean-derived salinity is always less than 0,5g/l. Extensive areas of deep water, and there may be considerable wave action. Islands of Palustrine wetlands may lie within boundaries of the Lacustrine system.

- ***Limnetic:*** *all habitats lying at a depth of >2m below low water. Many Lacustrine systems have no subsystem.*
  - Water surface
  - Aquatic Bed
- ***Littoral****: all wetland habitats extending from the shoreward boundary of the system to a depth of 2m below low water, or to the maximum extent of non-persistant emergents, if these grow below depths of 2m.*
  - Water surface
  - Aquatic Bed
  - Non-vegetated
  - Emergent

PALUSTRINE SYSTEM

Groups together vegetated wetlands traditionally calles marshes, swamps, bogs, fens and vleis. May be situated shorward of river channels, lakes or estuaries; on river floodplains; in isolated catchments; or on slopes. They may also occur as islands in lakes or rivers.

- ***Flat:*** *wetland habitat occurring on areas of comparatively level land (slope less than 1%) with little or no relief, but not directly associated with either a valley bottom or floodplain feature.*
- ***Slope****: wetland habitat occurring on areas with gradient greater than 1%, but not directly associated with either a valley bottom or floodplain feature.*
- ***Valley bottom:*** *wetland habitats occupying the bottom of the topographical sequence. They are not necessarily associated with a river channel.*
- ***Floodplain:*** *wetland habitats falling within areas which area adjacent to a well-defined river channel; built of sediments during the present regimen of the stream; and covered with water when the river overflows its banks during a 1 in 10 year magnitude flood event.*
  - Water surface
  - Non vegetated
  - Aquatic Bed
  - Emergent
  - Scrub-shrub
  - Forested

Figure 2: Wetland system characterisation.

RIVERINE

Includes all wetlands contained within a channel. A channel is an open conduit, either natural or artificial, which periodically or continuously contains flowing water.

Tidal

- *Gradient is low and water velocity fluctuates under tidal influence.*
- *Steambed is mainly mud.*
- *Floodplain is typically well-developed.*

Classes:
- Water surface
- Aquatic Bed
- Non vegetated
- Emergent

Lower Perennial

- *Gradient is lower than Upper perennial, water velocity is slow.*
- *No tidal influence and some water flows throughout the year.*
- *Substrate consists mainly of sand and mud.*
- *Oxygen dificits may sometimes occur.*
- *Fauna typically composed of species that reach their maximum abundance in still water. True planktonic organisms area common.*
- *Floodplain is well-developed.*

Classes:
- Water surface
- Aquatic Bed
- Non-vegetated
- Emergent

Upper Perennial

- *Gradient is high and water velocity fast.*
- *No tidal influence and some water flows throughout the year.*
- *Substrate consists of rock, cobbles or gravel with occasional patches of sand.*
- *Natural dissolved oxygen concentration is normally near saturation*
- *Fauna is characteristic of running water, and few/no planktonic forms.*
- *Very little floodplain development.*

Classes:
- Water surface
- Aquatic Bed
- Non-vegetated Emergent

Upper Intermittent

- *Gradient is similar to Upper perennial*
- *Channel containes non-tidal flowing water for only a part of the year, isolated pools may persist.*
- *Substrate consist of rock, cobbles or gravel with patches of sand.*

Classes:
- Non vegetated

Lower Intermittent

- *Gradient similar to Lower perennial.*
- *Channel contains non-tidal flowing water for only part of the year, although pools may persist.*
- *Substrate consist mainly of sand and mud.*

Classes:
- Non vegetated

ENDORHEIC SYSTEM

Wetlands that would otherwise be classified as Palustrine or Lacustrine, but which posess all the following characteristics; circultar to oval shape, sometimes kidney-shape or lobed; flat basin floor; less than 3m deep when fully inundated; closed drainage.

Classes:
- Water surface
- Non vegetated
- Aquatic Bed
- Emergent
- Scrub-shrub

Figure 3: Wetland system characterisation[4] (continued).

Department of Water Affairs and Forestry, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999* [Appendix W1][4]

After wetland systems have been classified according to the characteristics stipulated above it is important to determine any modifying aspects that may have altered the natural ecological state of the wetland system. *Resource Directed Measures (*RDM) (Dini, J; Cowan, G. & Goodman, P. First Draft: DWAF, *Version 1.0, 1999*) identifies three groups of modifiers: Water Regime Modifiers, Water Chemistry Modifiers, and Artificial Modifiers. A desktop study as well as the field assessment was used in order to determine any of these modifiers present at the subject property.

All the information gathered above as well as hydrology-, hydraulic/geomorphic-, biological criteria and water quality were then used to assign a Present Ecological Status (PES) for the wetland features. The table below lists the attributes as well as criteria assessed during the PES assessment.

Table 3: Criteria and attributes assessed during the determination of the PES.

Criteria and attributes	
Hydrologic	**Hydraulic/Geomorphic**
Flow modification	Canalisation
Permanent Inundation	Topographic Alteration
Water Quality	**Biota**
Water Quality Modification	Terrestrial Encroachment
Sediment load modification	Indigenous Vegetation Removal
	Invasive plant encroachment
	Alien fauna
	Overutilisation of biota

Each of the attributes where given a score according to ecological state observed during the site visit, as well as a confidence score to indicate areas of uncertainty (table below).

Table 4: Scoring guidelines.

Scoring guidelines		Relative confidence score	
Natural, unmodified	5	Very high	4
Largely natural	4	High	3
Moderately modified	3	Moderate	2
Largely modified	2	Low	1
Seriously modified	1		
Critically modified	0		

A mean score for all attributes were then calculated and the final score was then used in the Present Ecological Status category determination as indicated in the table below.

Table 5: Present Ecological Status Category descriptions[5]

Score	Class	Description
>4	A	Unmodified, natural
>3 and <=4	B	Largely natural with few modifications
>2 and <=3	C	Moderately modified
2	D	Largely modified
>0 and <2	E	Seriously modified
0	F	Critically modified

4.4.5 Reference Conditions

"Reference conditions refer to the natural un-impacted condition of the wetland feature prior to changes due to human settlement, utilisation of the wetland feature and its resources."[6] To determine, accurate reference conditions the historical geomorphology (terrain unit, landform, substrate type, substrate erodibility, and sediment dynamics), hydrology (water source, saturation zones, extent, period and depth of inundation, flow volumes) and biological attributes (vegetation communities and zonation, faunal communities, occurrence of threatened species) were determined. The reference conditions were then used as a "bench-mark" to determine an appropriate EMC class.

4.4.6 Wetland function assessment

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class".[7] The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et* al (2005). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- · Flood attenuation
- · Stream flow regulation
- · Sediment trapping
- · Phosphate trapping
- · Nitrate removal
- · Toxicant removal

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[5] Department of Water Affairs and Forestry, South Afica *Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999* [Table G2].

[6] Department of Water Affairs and Forestry, South Afica *Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999* [Appendix W3].

[7] Department of Water Affairs and Forestry, South Afica *Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999*

- · Erosion control
- · Carbon storage
- · Maintenance of biodiversity
- · Water supply for human use
- · Natural resources
- · Cultivated foods
- · Cultural significance
- · Tourism and recreation
- · Education and research

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland.

Table 6: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.5-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

4.4.7 Ecological Management Class

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability, but carries a higher risk of ecosystem failure." [8]

The Ecological Management Class (EMC) was determined based on the results obtained from the PES, reference conditions and Ecological Importance and Sensitivity of the resource (sections above). Followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired EMC.

A wetland may receive the same class for the PES, as the EMC if the wetland is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate EMC should be

[8] Department of Water Affairs and Forestry, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources 1999*

assigned in order to prevent any further degradation as well as to enhance the PES of the wetland feature.

Table 7: Description of EMC classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

4.4.8 Wetland delineation

For the purposes of this investigation, a wetland habitat is defined in the National Water Act (1998) as including the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

The wetland zone delineation took place according to the method presented in the final draft of “A practical field procedure for identification and delineation of wetlands and riparian areas” published by the department of Water Affairs and Forestry in February 2005. The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils and
- The presence of alluvial soils in stream systems.

By observing the evidence of these features, in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF 2005).

Riparian and wetland zones can be divided into three zones (DWAF 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant part of the rainy season and the temporary zone surrounds the seasonal zone and is only saturated for a short period of the year, but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation. The objective of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

4.5 Biodiversity Status Determination

A quantitative scoring system was developed by which the several factors influencing the biodiversity status of a specific system or subsystem were combined in order to produce an overall score. The biodiversity status of a system was divided into two subsections, namely Ecological Sensitivity and Importance (ESI) and Human Use Value (HUV). ESI incorporates factors such as Ecological Integrity (EI), Levels of Functionality (FL) and Conservation Value (CV) of the specific system. HUV incorporates Service Value (SV), Anthropogenic Value (AV) and Recreational Value (RV). These two subsections (ESI and HUV) are then combined to produce an overall Biodiversity Status (BS) score, by which a specific system can be managed. This process is further described below.

4.5.1 Ecological Sensitivity and Importance (ESI)

The ecological importance (ESI) of a specific management unit is influenced by several factors, namely:

- Ecological integrity (EI) of the system (levels of transformation) which can be classified as:
  - Very high (12)
  - High (9)
  - Medium (6)
  - Low (3)
- Levels of functionality (FL) of the system which can be classified as:
  - Very high (12)
  - High (9)
  - Medium (6)
  - Low (3)
- Conservation value (CV) of the system (does the system warrant conservation in terms of size, function, integrity) which can be classified as:
  - Very high (12)
  - High (9)
  - Medium (6)
  - Low (3)

When the average of the above parameters is calculated, it will produce an overall value for the Ecological Sensitivity and Importance (ESI) of a system, as described below:

- (EI)+(FL)+(CV)/3=(ESI)

Based on the above, the average score obtained is interpreted as follows:

- Very high ESI; no transformation, area must be preserved (10-12)
- High ESI; moderate transformation, area must be preserved and enhanced (7-9)
- Medium ESI;high transformation, area must be enhanced (4-6)
- Low ESI; complete transformation, human use must be optimised (3)

4.5.2 Human Use Value (HUV)

The human use value (HUV) of a specific management unit is influenced by several factors, namely:

- Service Value (SV) of the system (flood attenuation, water supply, erosion control, sediment trapping),which can be classified as:
  - Very high (12)
  - High (9)
  - Medium (6)
  - Low (3)
- Anthropogenic value (AV) of the system (cultural and historic value, collection of plants for food and medicine, educational value) which can be classified as:
  - Very high (12)
  - High (9)
  - Medium (6)
  - Low (3)
- Recreational value (RV) of the system (aesthetic appeal, hunting, fishing, hiking) which can be classified as:
  - Very high (12)
  - High (9)
  - Medium (6)
  - Low (3)

When the average of the above parameters is calculated, it will produce an overall value for the Human Use Value (HUV) of a system, as described below:

- (SV)+(AV)+(RV)/3=(HUV)

Based on the above, the average score obtained is interpreted as follows:

- Very high HUV; optimise human use with emphasis on preservation of ecosystems and sustainable use of natural resources (10-12)
- High HUV; human use important, but emphasis must be placed on conservation and enhancement of ecosystems (7-9)
- Medium HUV;human use moderately important, emphasis leaning towards conservation and limiting of interference by humans (4-6)
- Low HUV; no use for humans, system must be preserved with minimal interference by humans (3)

4.5.3 Biodiversity Status (BS)

Biodiversity Status is derived from a combination of the ESI and HUV of a specific system. The combination is further explained in the matrix below:

Table 8: Biodiversity Status (BS) Combination Matrix

	HUV			
ESI	**Very high HUV**	**High HUV**	**Moderate HUV**	**Low HUV**
Very high ESI	Very high	Very high	Very high	High
High ESI	Very high	High	High	Moderate
Moderate ESI	High	Moderate	Moderate	Low
Low ESI	Moderate	Moderate	Low	Low

Once the Biodiversity Status has been calculated for a specific system, objectives are set, by which the system can be managed to improve its BS. These objectives are further explained in the table below:

Table 9: Biodiversity Status and Specific Objectives

Very high BS	Preserve and enhance the biodiversity of the system, maintain genetic and ecosystem diversity.
High BS	Preserve and enhance biodiversity of the system in conjunction with human use value
Moderate BS	Preserve and enhance biodiversity and optimise human use value
Low BS	Optimise human use value while improving biodiversity levels of the specific system.

4.6 Ecological Impact Assessment Methodology

In order for the EAP to allow for sufficient consideration of all environmental impacts, environmental impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[9]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or well being, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** Receptors can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.

[9] The definition has been aligned with that used in the ISO 14001 Standard.

- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the below. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and is used to determine whether mitigation is necessary[10].

The assessment of significance is undertaken twice. Initial significance is based only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

[10] Some risks/impacts that have low significance will however still require mitigation

Table 10: Criteria for assessing significance of impacts

CONSEQUENCE DESCRIPTORS

Severity of impact	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5
Spatial scope of impact	**RATING**
Activity specific	1
Mine specific (within the mine boundary)	2
Local area (within 5 km of the mine boundary)	3
Regional	4
National	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5

LIKELIHOOD DESCRIPTORS

Frequency of activity/ duration of aspect	RATING
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5
Frequency of impact	**RATING**
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

Table 11: Significance rating matrix

	CONSEQUENCE (Severity + Spatial Scope + Duration)														
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 12: Positive/Negative Mitigation Ratings

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Improve current management	Maintain current management
High	101-125	Improve current management	Maintain current management
Medium-high	76-100	Improve current management	Maintain current management
Medium-low	51-75	Maintain current management	Improve current management
Low	26-50	Maintain current management	Improve current management
Very low	1-25	Maintain current management	Improve current management

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction;
  - Operation; and

- Post-closure.

- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur post-closure.

4.7 Mitigation measure development

The following points present the key concepts considered in the development of mitigation measures for the proposed development:

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts[11] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimization, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation*.

5 CONSTRAINTS AND LIMITATIONS OF BIODIVERSITY IMPACT ASSESSMENT

In compiling this BAP several limitations on biodiversity management were applicable due to the site-specific circumstances, relevant to the Assmang Manganese ore Black Rock Mine. The points below summarise these limitations and assumptions:

- ***Sampling and level of assessment:*** Sampling, by nature, implies that not all plants in the study area will be recorded, due to plant phenology as affected by seasonality, microhabitat requirements and management practices. Similarly, the presence and sighting of faunal taxa is linked to a number of factors such as weather, time of day, food availability, localised movement patterns and activity in the area. Therefore, to supplement field assessments, extensive use is made of literature and existing data bases (SANBI, National and Provincial – databases). The on-site ecological observations, however, form the basis for recommendations and any designation of sensitive areas.

[11] Mitigation measures should address both positive and negative impacts

- ***Temporal variability:*** The data presented in this report is based on one site visit conducted over a period of three days, undertaken in March 2011. The effects of natural seasonal and long-term variation in the ecological conditions and floral communities are therefore unknown.
- ***Ecological assessment timing:*** Aquatic and terrestrial ecosystems are dynamic and complex; it is likely that aspects, some of which may be important, could have been overlooked. A more reliable assessment of the biota would require regular sampling, possibly on a monthly basis throughout the growing season of vegetation in the area (spring to early autumn)
- **Past agricultural and mining activities:**
  The area has been subject to past disturbance by mining activities as well as impacts from anthropogenic activities in the area. Specific impacts from anthropogenic activities include overgrazing leading to impacts such as soil erosion and invasion by alien and invasive species. These long-term impacts on the area lead to reduced capability of the area and will have bearing on the type of biodiversity management activities that take place as well as the degree to which biodiversity action plans are implemented.
- **Existing infrastructure:**
  Large areas within the study area are presently utilised and contain the facilities utilised in the mining activities. Features included within the four mines included in the Black Rock surface rights area namely Black Rock, Gloria, Nchwaning II and Nchwaning III are:

Waste rock dumps	Tailings dam complex	Processing plant areas
Workshops	Toadways	Administration buildings
Shaft complexes	Hostel complex	Opencast Mining Operations
Black Rock village	Rail road line	Two water reservoirs

These features have led to a loss (sometimes completely) of biodiversity and most of the facilities are still in the operational phase of their life cycle. As such the presence and ongoing use of these facilities limit any mitigatory actions that can be implemented to improve biodiversity in these areas.

6 SITE DESCRIPTIONS AND ASSESSMENTS

The purpose of this section is to set the local and regional context of the study area in terms of biodiversity. Therefore, local climate, faunal and floral characteristics, aquatic resources and any other significant features, which may influence biodiversity, are discussed in order to emphasise biodiversity resources.

Site visits were undertaken during March 2011 to determine the ecological status of the study area and the surrounding area. After an initial reconnaissance drive around, more thorough investigations of the site were undertaken in order to determine threats posed to the biodiversity resources present on the study area.

Four mining entities form part of the Black Rock surface rights area namely Black Rock, Gloria, Nchwaning II and Nchwaning III. Black Rock, Gloria, and Nchwaning II and III Mines are situated in the Northern Cape Province approximately 80km north-west of the town of Kuruman. Black Rock, Nchwaning II and III are situated 16km north-west of Hotazel and Gloria Mine is situated 12km north-west of Hotazel. As depicted in the figure below the Black Rock Mine is bordered by the Belgravia Game Farm to the west which also falls under management of the mine. The Gloria and Nchwaning III mines are located east of the Black Rock Mine and Nchwaning II is located within the Black Rock Mine footprint area. All the above mentioned mining facilities are presently still in use, with the exception of the Black Rock koppie operations which ceased in 1992. Two decommissioned mine sites are located to the south of the Black Rock surface rights area, located on the farms Perth 276 and Devon 277. The mining footprint within the farm Perth 276 constitutes approximately 160ha of the total farm surface area and Devon 277 approximately 105ha.

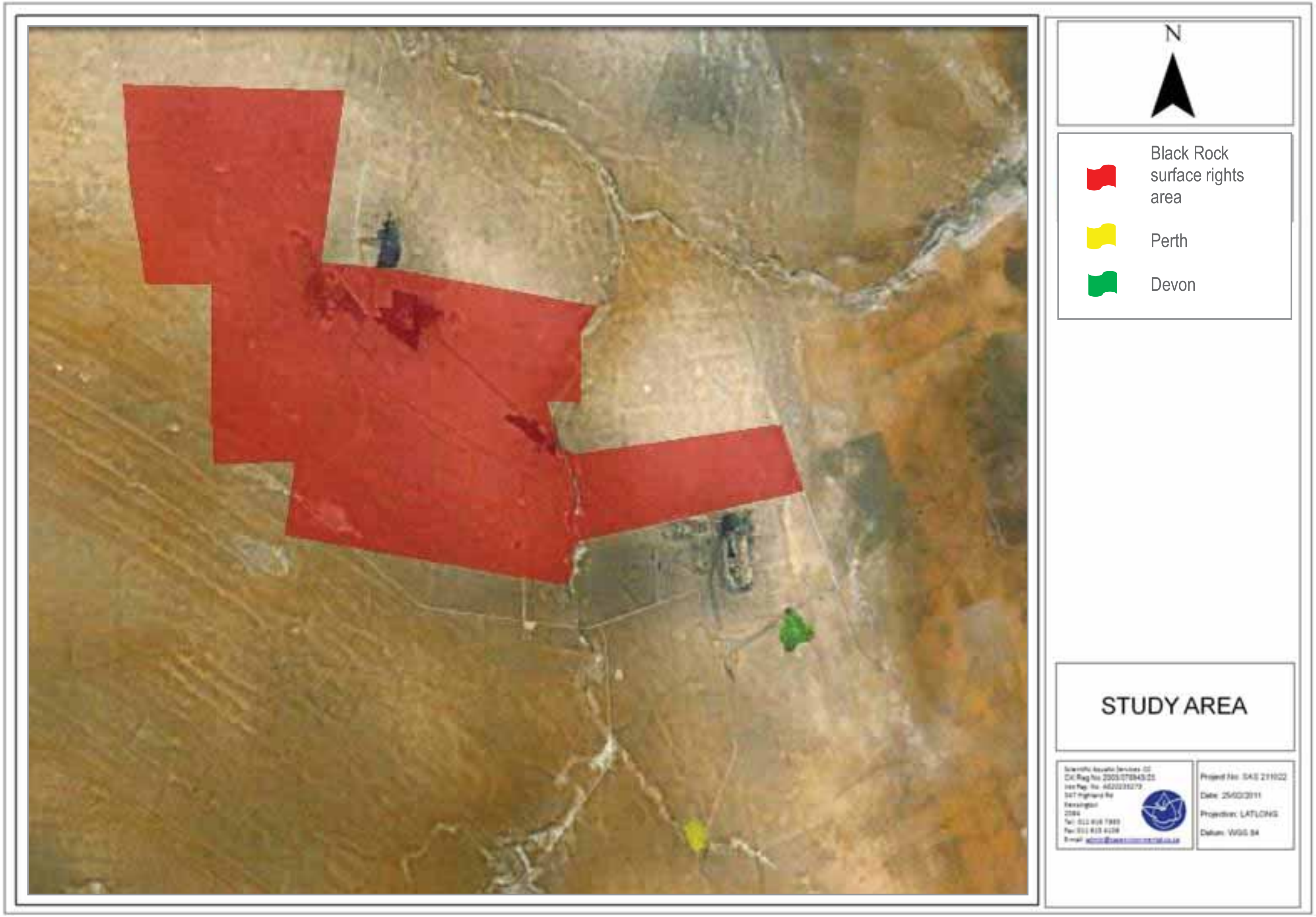

Figure 4: Aerial photograph depicting locality of the subject property within the larger area

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6.1 General background

The National Biodiversity Act, 2004, has the strategic objectives of managing and conserving biological diversity, sustainable utilisation within South Africa and complying with binding international agreements. Assmang Manganese ore has, in order to comply with the Biodiversity Act, related legislation and social/environmental responsibilities, embarked on a policy of developing and implementing scientifically sound technologies and procedures for the effective management and conservation of biodiversity, and for the rehabilitation of disturbed land to planned post-closure use. The crux of these policies being that biodiversity considerations must be addressed when determining how land is to be used after closure and the rehabilitation or restoration of ecosystems as appropriate. This consideration of biodiversity aspects is applicable prior to, during the life cycle of the project, and post closure of the operation.

This assessment of the operation therefore serves the purpose of determining the Present Ecological State of the biodiversity of the operational footprint. The report determines significant zones/areas in terms of biodiversity conservation value, detailing the current biodiversity and land use status, and will finally propose biodiversity action plans (BAP's) for sustainable conservation of noteworthy biodiversity areas, including providing planning for environmentally responsible closure of the operation. The process of determining appropriate BAP's is seen as being participatory between consultant, client, local government departments, and stakeholders and should additionally be reviewed periodically to ensure relevance and progress.

6.2 Surrounding properties/land uses

Historically the subject property was utilised primarily for livestock grazing. Some portions within the surface rights area are presently rented to farmers which currently still use the open veld for grazing of cattle. The four of the mining areas namely Black Rock, Gloria, Nchwaning II and Nchwaning III are still largely in operation with some areas presently in their closure phases, such as the areas associated with the farms Perth 276 and Devon 277. The portion of the Balgravia farm presently managed as a game farm was historically also utilized for grazing however from the time of the establishment of the game farm this area has seen little anthropogenic activity and has largely returned to a more natural ecological state. Land in the immediate vicinity of the Black Rock Mine not used for mining purposes is used for extensive livestock farming.

6.3 General importance of subject property

Land cover indicated for the study area and surroundings is thicket and bushveld, with an unspecified land use. No sensitive features or protected areas are indicated within the study area or in close vicinity to the study area.

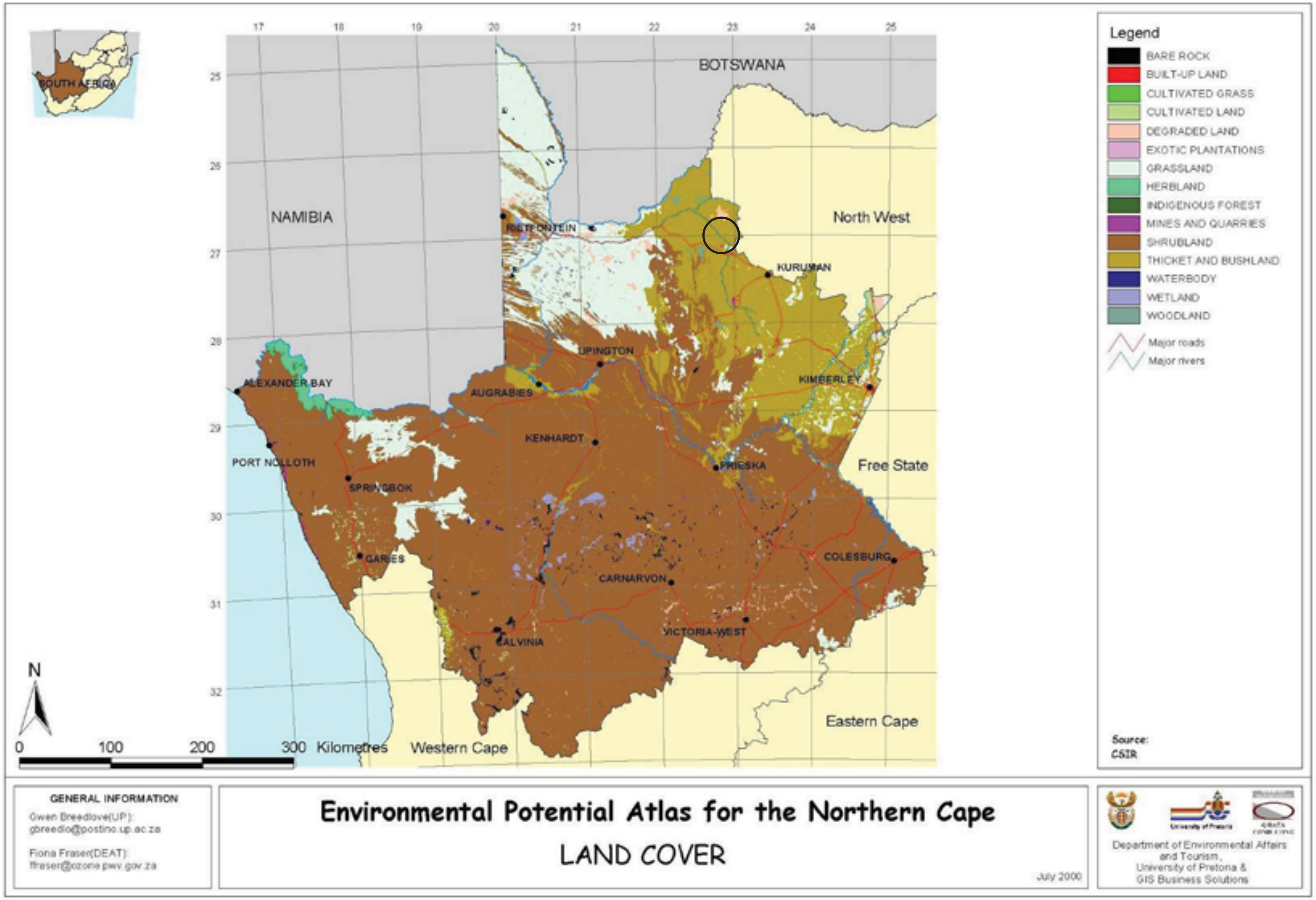

Figure 5: Land cover for the study area and surroundings (www.environment.gov.za). Study area is indicated with a black circle.

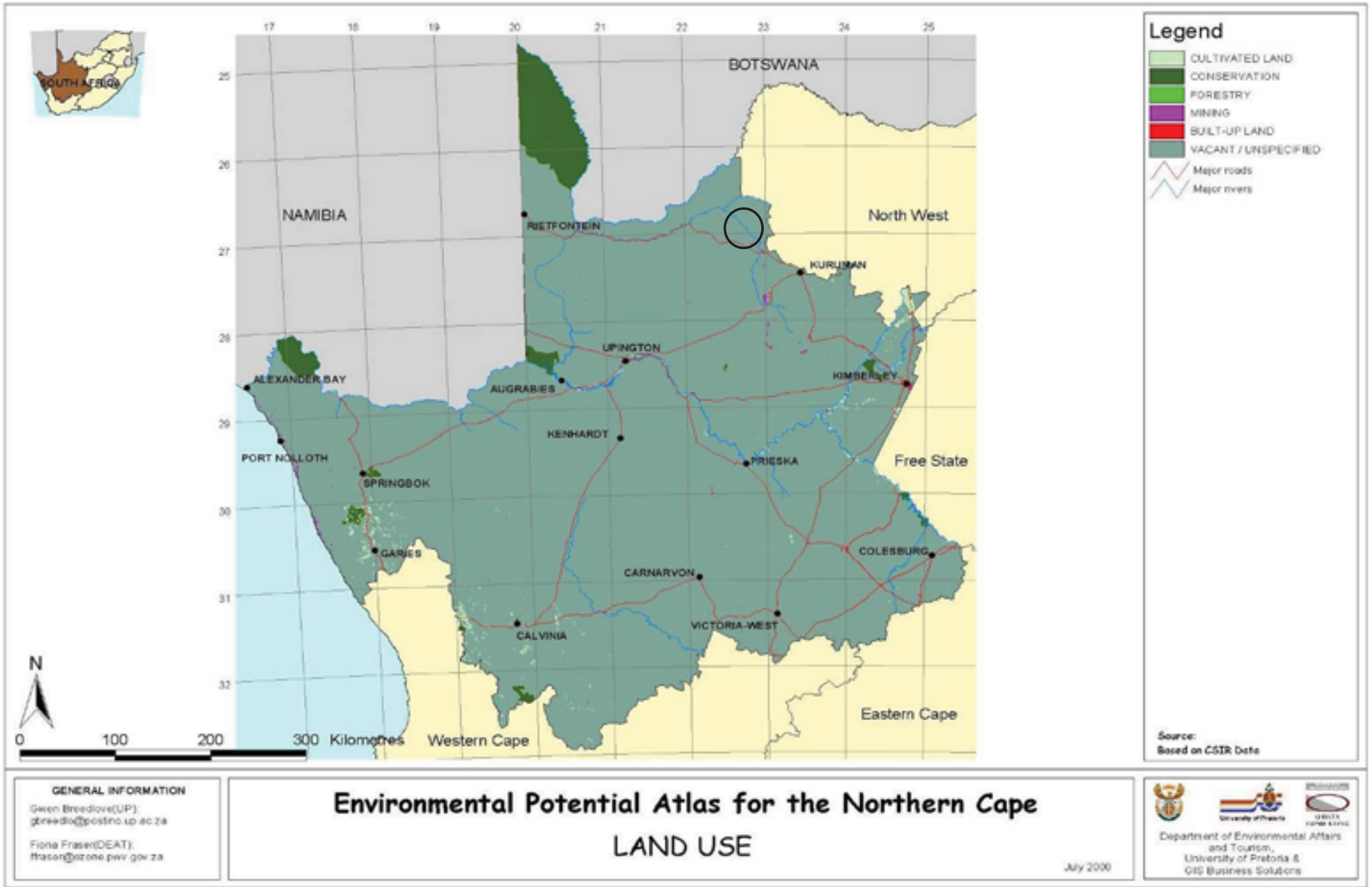

Figure 6: Land use for the study area and surroundings (www.environment.gov.za). Study area is indicated with a black circle.

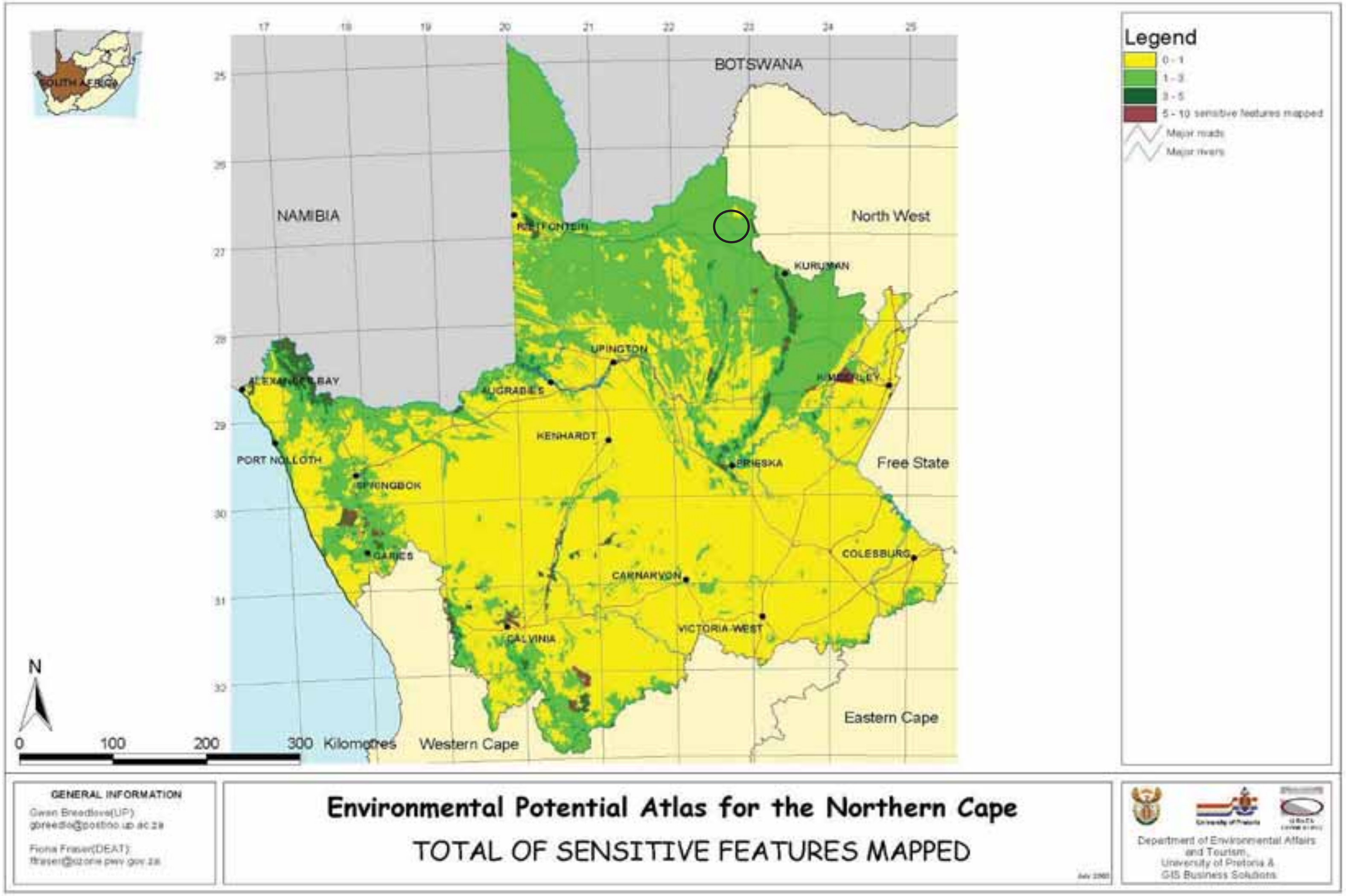

Figure 7: Sensitive features mapped for the study area and surroundings (www.environment.gov.za). Study area is indicated with a black circle.

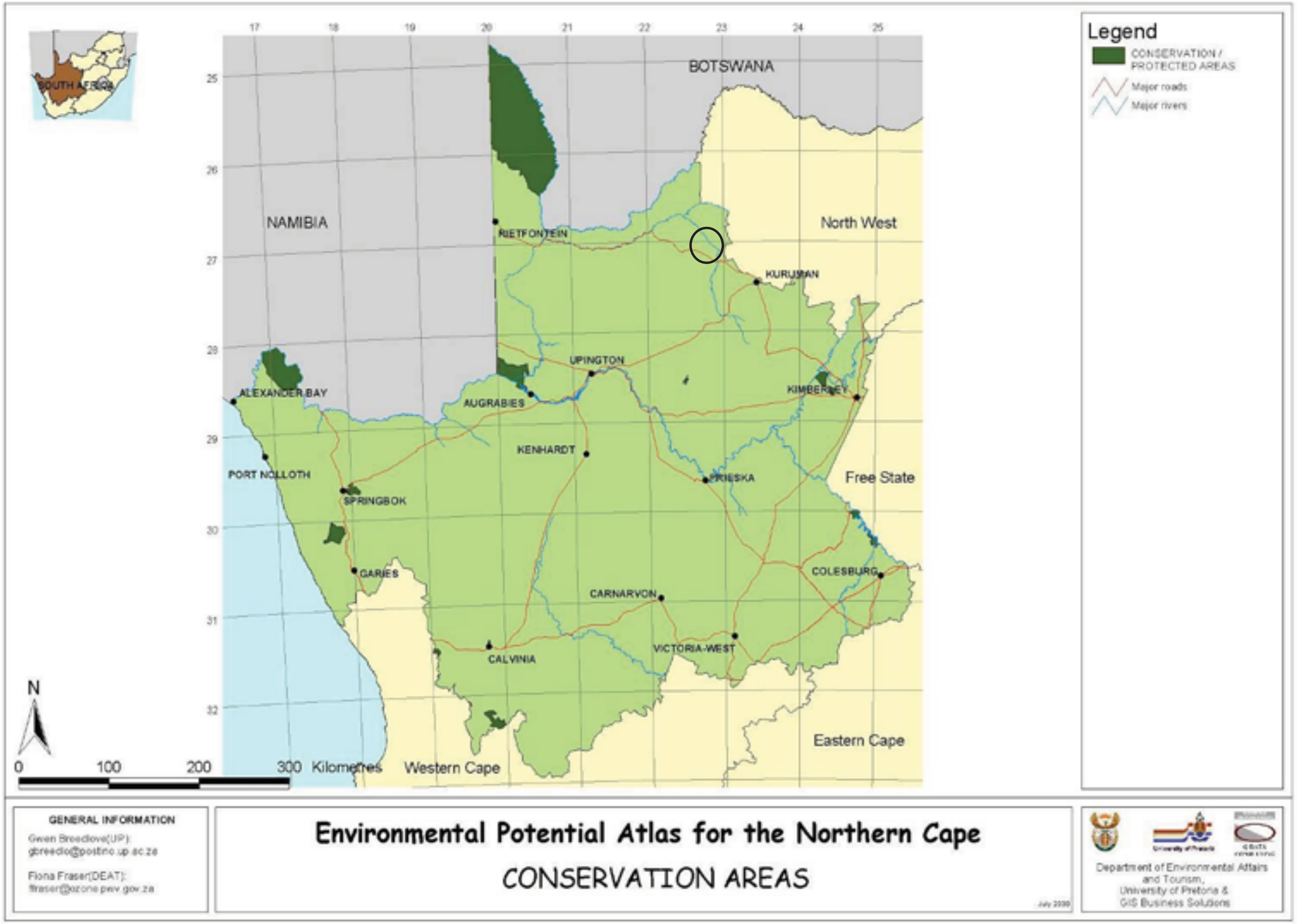

Figure 8: Conservation areas the study area and surroundings (www.environment.gov.za). Study area is indicated with a black circle

7 REGIONAL FLORAL LIFE CONTEXT

The purpose of this section is to describe the floral characteristics of the study area in terms of the regional floral context with emphasis on diversity of species, floral habitat and communities that define the rich floral diversity present.

7.1 Biome and bioregion

Biomes are broad ecological units that represent major life zones extending over large natural areas (Rutherford 1997). This assessment site falls within the *Savanna biome* (Figure 9) (Rutherford & Westfall, 1994). Biomes are further divided into bioregions, which are spatial terrestrial units possessing similar biotic and physical features, and processes at a regional scale. The majority of the assessment site is situated within the *Eastern Kalahari Bushveld Bioregion* however some smaller portions are located within the *Kalahari Duneveld Bioregion* (Figure 11) (Musina & Rutherford, 2006).

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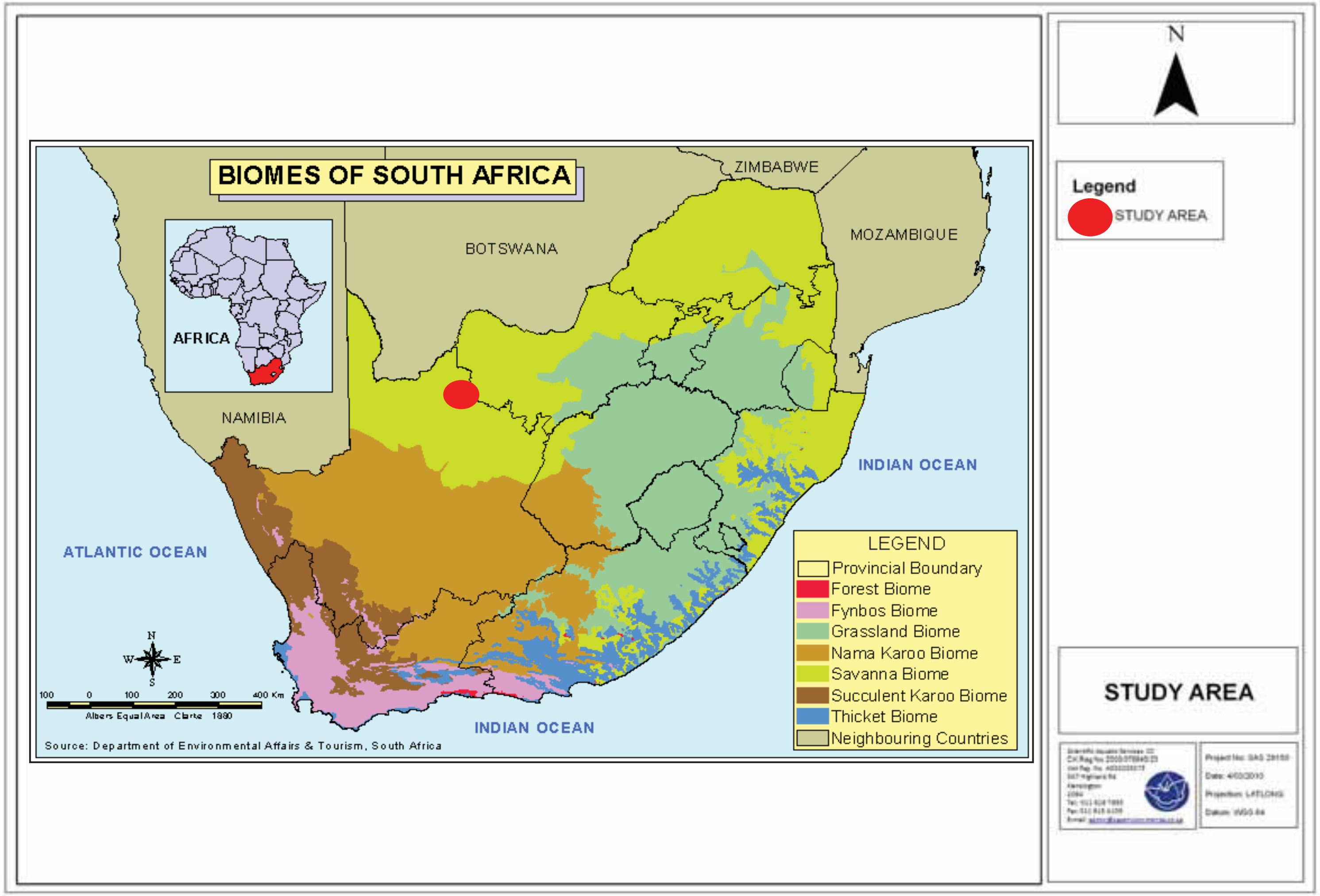


Figure 9: Biomes of South Africa

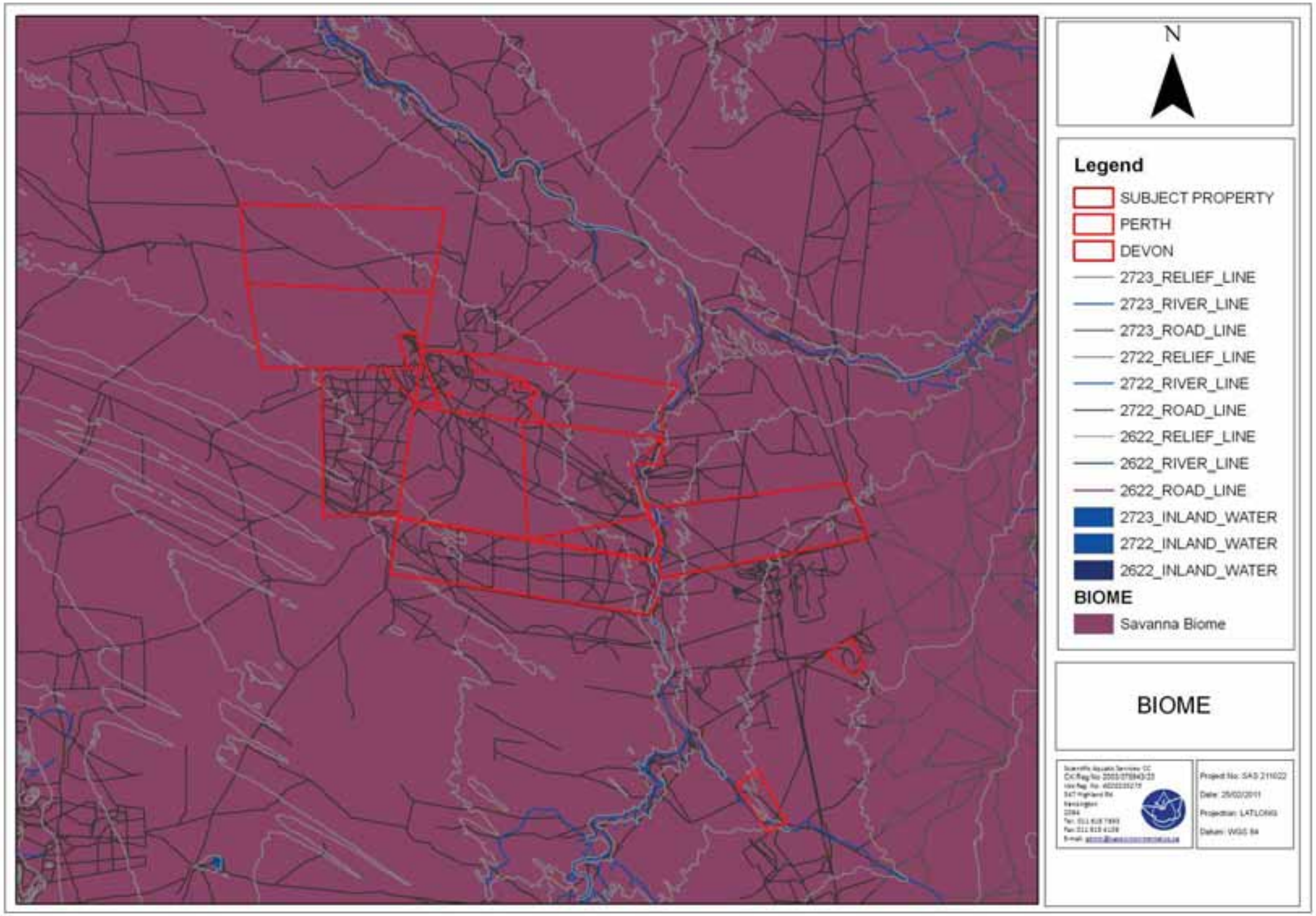


Figure 10: Biomes associated with the study area *(Mucina & Rutherford, 2006)*.

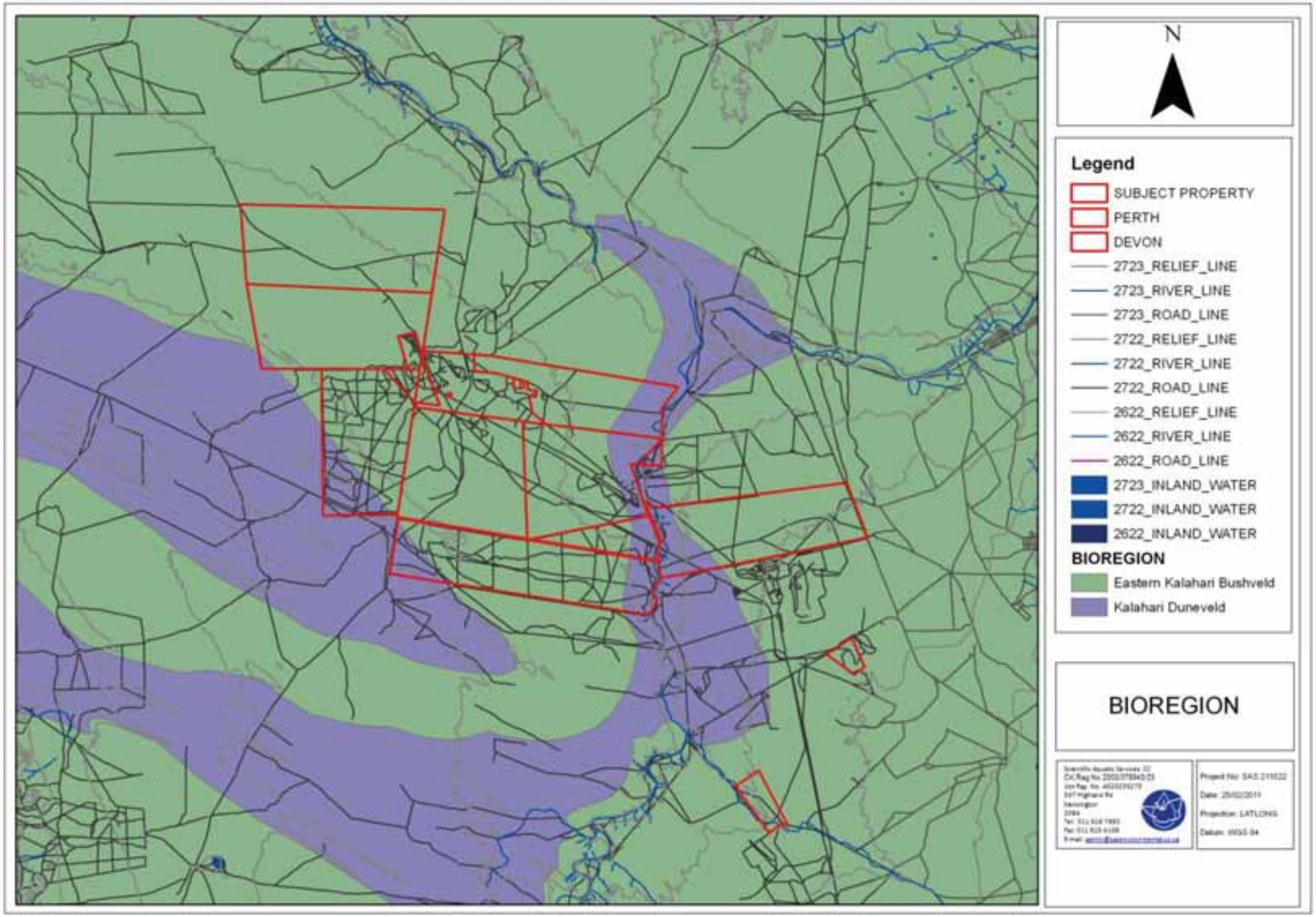


Figure 11: Bioregions associated with the study area *(Mucina & Rutherford, 2006)*.

7.2 Vegetation type

While biomes and bioregions are valuable as they describe broad ecological patterns, they provide limited information on the actual species that are expected to be found in an area. Knowing which vegetation type an area belongs to provides an indication of the floral composition that would be found if the assessment site was in a pristine condition, which can then be compared to the observed floral list and so give an accurate and timely description of the ecological integrity of the assessment site. When the boundary of the assessment site is superimposed on the vegetation types of the surrounding area, it is evident that the subject property falls within the *Kalahari Thornveld and Shrub Bushveld* veld type; Figure 12 (Acock's, 1990) and *Kathu Bushveld* vegetation type and partly in the *Gordonia Duneveld* vegetation type; Figure 13 (Musina & Rutherford, 2006).

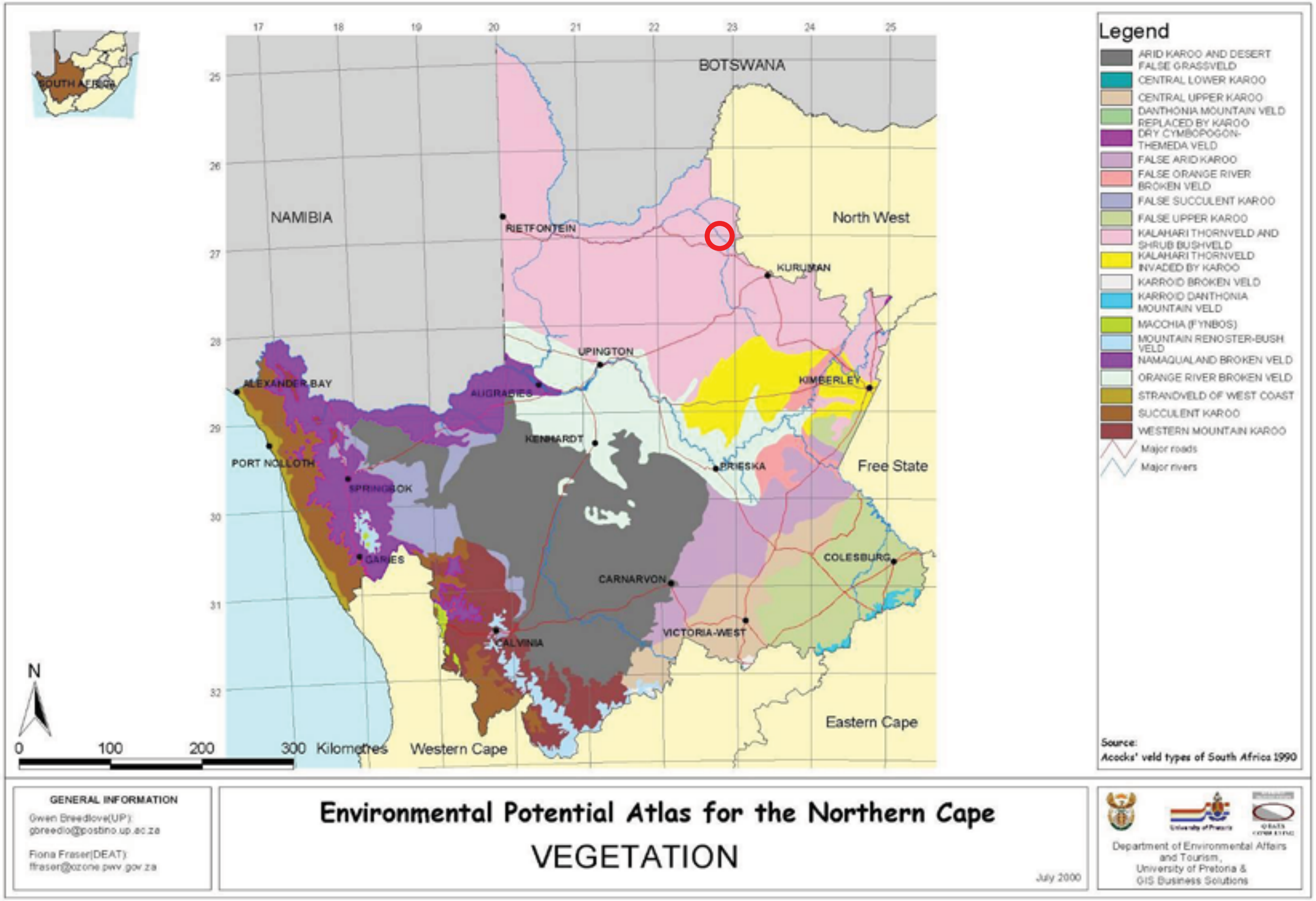


Figure 12: Veld types of the Northern Cape (www.environment.gov.za) subject property is depicted in red.

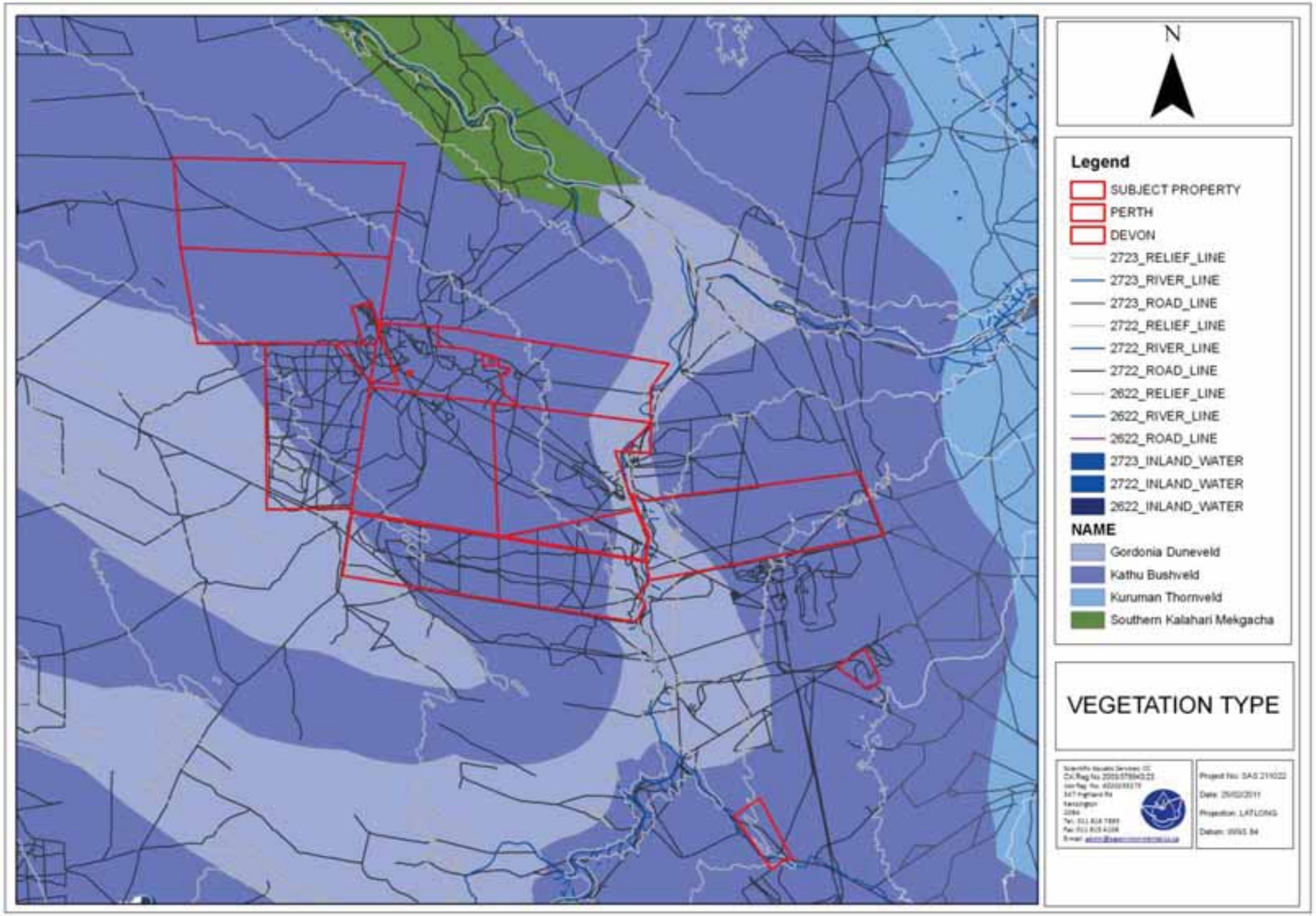


Figure 13: The boundary of the assessment site and the vegetation types of the surroundings areas.

7.3 Distribution

7.3.1 Kathu Bushveld

Northern Cape Province: Plains from Kathu and Dibeng in the south, through Hotazel, vicinity of Frylinckspan to the Botswana border roughly between Van Zylsrus and McCarthysrus. Altitude 960-1300m (Musina & Rutherford, 2006).

7.3.2 Gordonia Duneveld

Northern Cape Province: Broad north-south band on flats west of the Korannaberg and Langeberg Mountains (and of their western pediment) and east of the main Kalahari duneveld area (for example at Pearson's Hunt). From van Zylsrus in the north to the south-west of Witsand in the south. Also as a number of isolated patches embedded in the duneveld area between the Auob and Nossob Rivers in the Kgalagadi Transfrontier Park as well as the valley containing Groot and Klein Mier south of the park. Altitude 900-1250m (Mucina & Rutherford, 2006).

7.4 Geology and soils

7.4.1 Kathu Bushveld

Aeolian red sand and surface calcrete, deep (>1.2m) sandy soils of Hutton and Clovelly soil forms. Land types mainly Ah and Ae, with some Ag (Mucina & Rutherford, 2006).

7.4.2 Gordonia Duneveld

Aeolian sand, underlay by calcrete of the kalahari group, deep, loose, sandy soils of the namib soil form on the flat plains. Land types mainly Ah, and Af with little Ae (Mucina & Rutherford, 2006).

7.5 Climate

7.5.1 Kathu Bushveld

Summer and autumn rainfall with very dry winters. MAP about 220-380mm. Frost frequently in winter. Mean monthly maximum and minimum temperatures for Sishen 37.0°C and -2.2°C for December and July, respectively (Mucina & Rutherford, 2006).

7.5.2 Gordonia Duneveld

Summer and autumn rainfall with very dry winters. MAP about 180-280mm. Frost frequent in winter (Mucina & Rutherford, 2006).

7.6 Conservation

7.6.1 Kathu Bushveld

Least concern with a target of 16%. None conserved in statutory conservation areas. More than 1% already transformed, including the manganese ore mining locality at Sishen, one of the biggest open-cast mines in the world. Erosion is very low (Mucina & Rutherford, 2006).

7.6.2 Gordonia Duneveld

Least threatened with a target of 16%. Some 14% statutorily conserved in the Kgalagadi Transfrontier Park. Very little transformed. Generally low erosion, but some areas with spectacular destabilisation of normally vegetated dues (through local overstocking) favoured by Photographers. Erosion is normally very low (Mucina & Rutherford, 2006).

8 HABITAT DESCRIPTIONS

8.1 Belgravia Game Farm

The Belgravia game farm is situated within the western portion of the Black Rock Mine surface rights area. The game farm is the only on-site area presently considered of increased sensitivity. Although the area associated with game farm was historically used for livestock grazing, which has led to vegetation transformation the area has been left open space for a significant number of years. Overtime with correct management and rehabilitation measures the present ecological state this area increased and currently provides habitat for various faunal and floral species.

Figure 14: Belgravia Game Farm entrance (left). Grass dominated habitat evident within the farm (right).

Issues to be addressed within this area include:

- Weed and invader species (*Acacia mellifera, Prosopis glandulosa* and *Verbesina encelioides)* mapping and removal;

- Mining footprint areas that may encroach upon the areas considered of higher ecological value should be monitored;
- Removal of protected and RDL floral species should be prohibited;
- Illegal trapping and poaching of faunal species needs to be prevented;
- Establishment and maintaining of an effective game management plan;
- Implementation of a fire management plan and the prevention of unplanned fires;
- Exclusion of these areas from mining activities and associated impacts;
- Ineffective rehabilitation in areas historically disturbed.

8.2 Transformed habitat unit

Included within this habitat unit is all mining and farming related infrastructure, roads, railways, administration and residential developments associated with the Black Rock surface rights area. The majority of the infrastructure is still in use with the exception of the Black Rock Mine that was operational for more than 60 years and ceased operations in 1992 as well as the Perth and Devon mines situated south of the surface rights area.

Historically these areas could have supported a diversity of bushveld floral species which provided foraging habitat for various faunal species. However, site clearing and construction of the infrastructure has led to transformation within the habitat unit (see figure below). Little natural vegetation is left within these areas and alien vegetation encroachment was evident during the assessment; as a result it is doubtful that this habitat unit in its Present Ecological State will provide suitable refuge for a great diversity of faunal species. However it should be noted that protected plant species were observed namely *Ammocaris coranica, Harpagophytum procumbens, Acacia erioloba, Boscia albitrunca and Acacia haematoxylon*. It is deemed important that all these species be left undisturbed and if necessary be rescued and relocated with specific reference to *Ammocaris coranica* and *Harpagophytum procumbens* or species to be cut and destroyed, propagated for future rehabilitation with specific reference to *Acacia erioloba, Boscia albitrunca* and *Acacia haematoxylon*.

Figure 15: Farming and mining related footprint areas encountered during the assessment.

Issues to be addressed within this area include:

- Weed and invader species (*Acacia mellifera, Prosopis glandulosa* and *Verbesina encelioides*) mapping and removal;
- Dust management to prevent impact on biodiversity within the area;
- Removal of protected and RDL floral species without proper planning and permits;
- Management of noise levels that may impact on biodiversity within the area;
- Monitoring of the mine footprint and edge effects along the Belgravia game farm and open veld areas;

8.3 Open veld habitat unit

The open veld habitat unit is largely associated with areas presently rented to farmers for livestock grazing. Some vegetation transformation was encountered within the habitat unit, but basic ecological processes were still evident. These areas can be considered in a moderate present ecological state.

Figure 16: Undisturbed open veld

Issues to be addressed within this area include:

- Weed and invader species (*Acacia mellifera, Prosopis glandulosa* and *Verbesina encelioides)* mapping and removal;

- Mining footprint areas that may encroach upon the areas considered of higher ecological value should be monitored;
- Removal of protected and RDL floral species without proper planning and permits;
- Illegal trapping and poaching of faunal species;
- Prevention of unplanned fires;
- Exclusion of these areas from mining activities and associated impacts.

8.4 Riparian habitat unit

The Black Rock surface rights area is situated within the Ga Magara River catchment. It is indicated by the EMPR that the Ga Magara River is known only to flow during very wet seasons; and the last record of flow in the river adjacent to the mine was 1988. Therefore, historically the Ga Magara River would have been considered a sensitive habitat with higher ecological importance and sensitivity, however various impacts over extended periods of time has resulted in habitat transformation from riparian to terrestrial. Furthermore, the encroachment of the mine footprint within the riparian area also increased the vegetation transformation. The EMPR document states that within wetter areas species such as *Boscia albitrunca, Grewia flava, Lycium hirsutum* and *Rhigozum trichototum* increases. At the time of the assessment of the Ga Magara River only *Grewia flava* was encountered in slightly higher abundances than the surrounding terrestrial habitat, little or none of the other species listed within the EMPR associated with wetter habitat were found.

Figure 17: Riparian habitat.

It should be noted that open cast quarries located within the decommissioned Perth and Devon mines presently holds water and creates habitat for various faunal wetland inhabitants. The area within Devon cannot be considered a natural wetland feature. However, Perth is situated in the floodline of a tributary of the Ga Magara River namely the Witleegte River. The location of the decommissioned mine close to the river may also have an effect on the amount of water present within the open pit. It is therefore considered important that rehabilitation plans for both these areas consider the preservation of wetland habitat and longitudinal connectivity with special mention of mining infrastructure within the river system.

Figure 18: Open cast areas within decommissioned mines within the study area providing habitat for faunal species with an affinity for wetland conditions.

Issues to be addressed within this area include:

- Weed and invader species (*Acacia mellifera, Prosopis glandulosa* and *Verbesina encelioides)* mapping and removal;
- Mining footprint areas that may encroach upon the areas considered of higher ecological value should be monitored;
- Removal of protected and RDL floral species without proper planning and permits should be prohibited;
- Illegal trapping and poaching of faunal species;
- Prevention of unplanned fires;
- Exclusion of these areas from mining activities and associated impacts;
- Compilation of a rehabilitation plan for the Ga Magara River disturbed by mining related activities.

9 MANAGEMENT UNITS

For this project and future management, it is best to divide the assessment site into the management units defined below. Management units were assigned according to current ecological condition, habitat types, as well as transformation of the study area. Regions of the study area with the same attributes are integrated within the same management units.

Table 13: Management units with definitions.

Management unit	Definition
Management unit 1	Belgravia Game Farm
Management unit 2	Open veld
Management unit 3	Operational footprint comprising of: • Waste rock dumps • Tailings dam complex • Processing plant areas • Workshops • Roadways • Administration buildings • Shaft complexes • Hostel complex • Opencast Mining Operations • Black Rock village • Rail road line • Two water reservoirs
Management unit 4	Riparian habitat

The management units where delineated using desktop methods and are presented in the figure below.

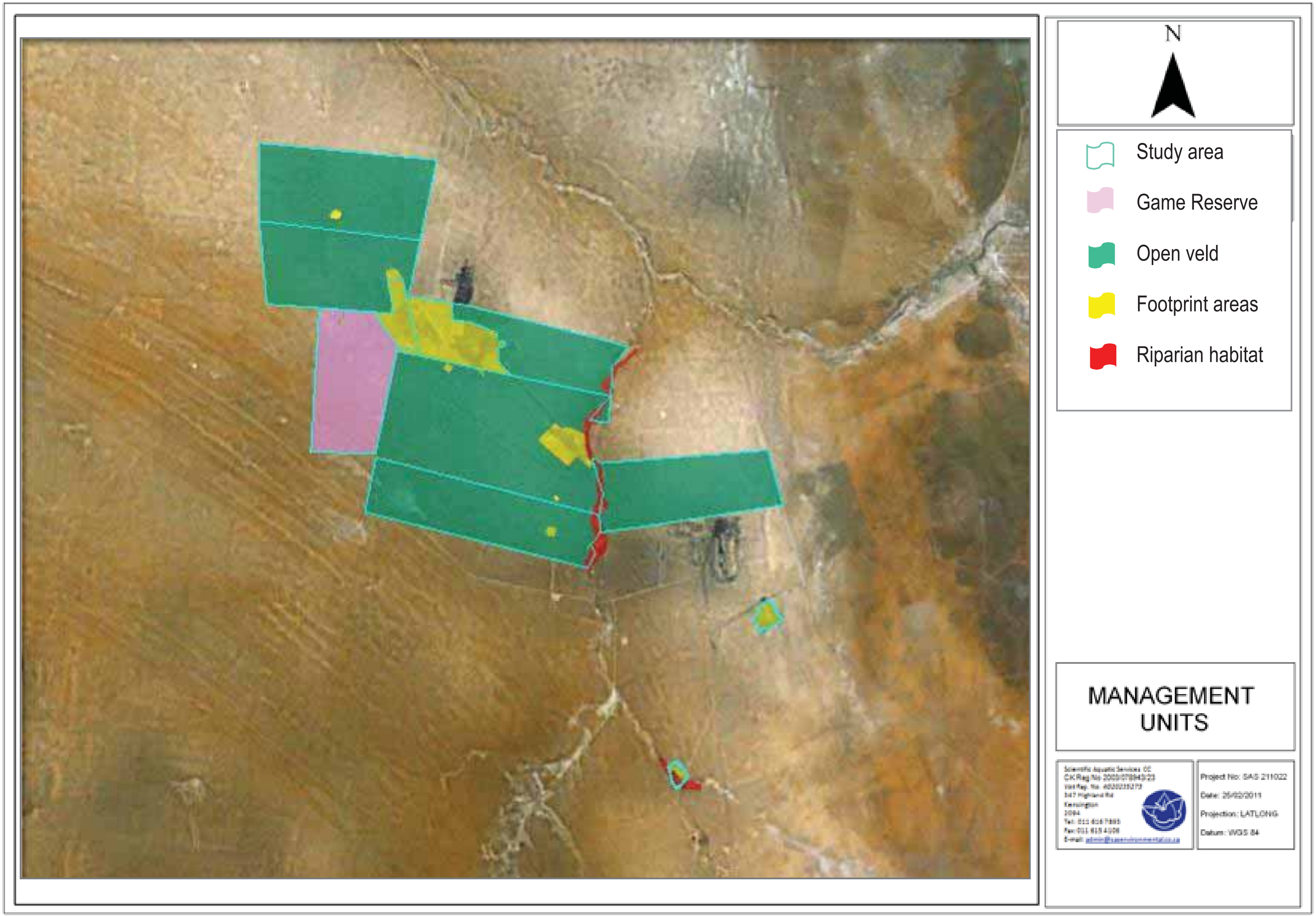


Figure 19: Aerial map depicting the locations of the various management units.

10 FLORAL DIVERSITY

During the assessment of the Black Rock surface rights area all floral species encountered were identified. Dominant species encountered during the BAP assessment (2011) are listed in Appendix A.

10.1 Floral Community Assessment

Floral communities can provide information regarding the ecological status of specific areas within a study area. If the species composition is quantitatively determined and characteristics of all components of the floral community are taken into consideration, it is possible to determine the Present Ecological State of the portion of land represented by the assessment point.

Any given grass species is specifically adapted to specific growth conditions. This sensitivity to specific conditions make grasses good indicators of veld conditions. The sections below summarise the dominant floral species identified within each transect with their associated habitats and optimal growth conditions with reference to the table and figure below.

Table 14: Grouping of grasses (Van Oudtshoorn, 2006).

Pioneer	Hardened, annual plants that can grow in very unfavourable conditions. In time improves growth conditions for perennial grasses.
Subclimax	Weak perennials denser than pioneer grasses. Protects soils leading to more moisture, which leads to a denser stand, which deposits more organic material on the surface. As growth conditions improve climax grasses are replaced by subclimax grasses.
Climax	Strong perennial plants adapted to optimal growth conditions.
Decreaser	Grasses abundant in good veld.
Increaser I	Grasses abundant in underutilized veld.
Increaser II	Grasses abundant in overgrazed veld.
Increaser III	Grasses commonly found in overgrazed veld.

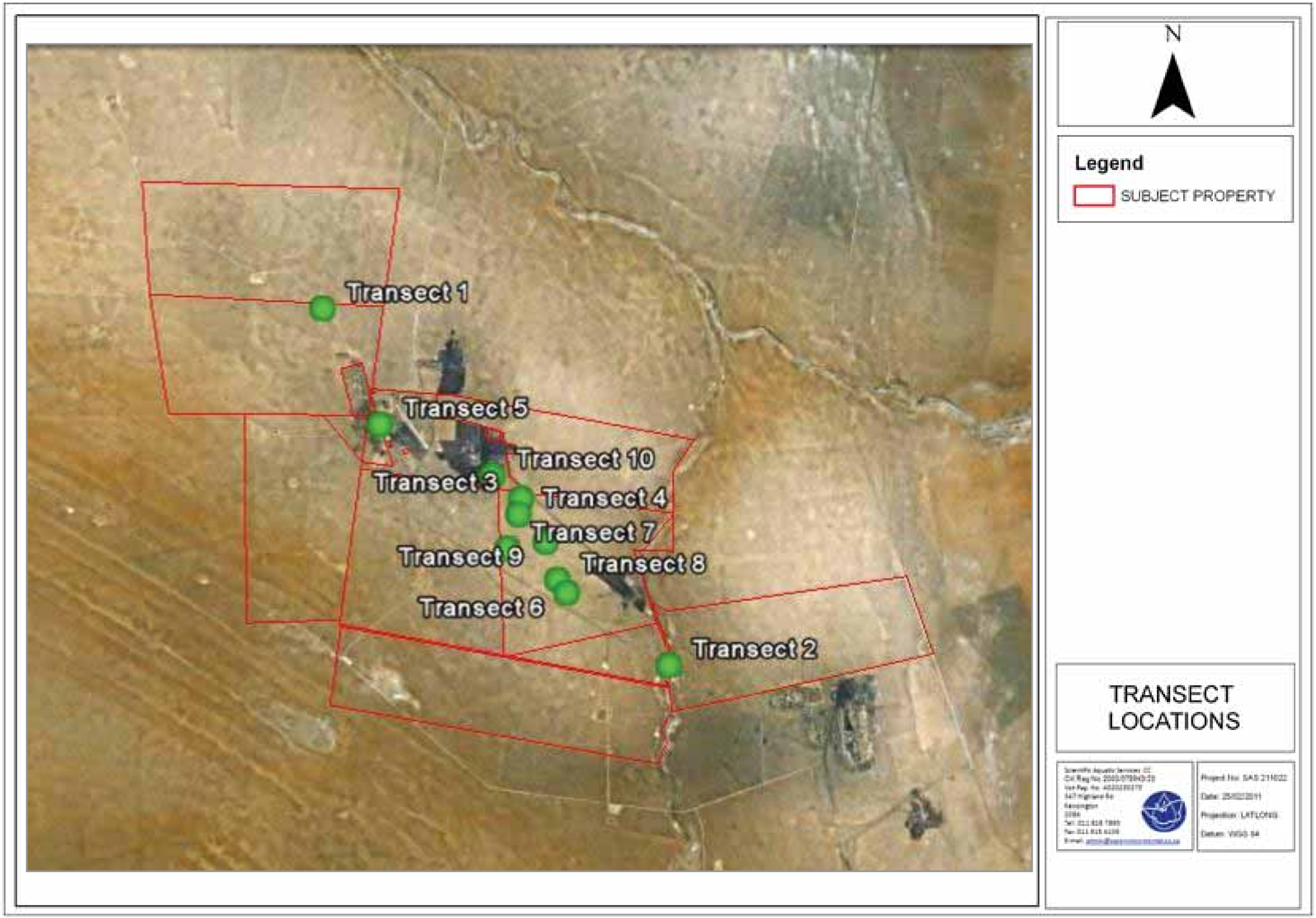
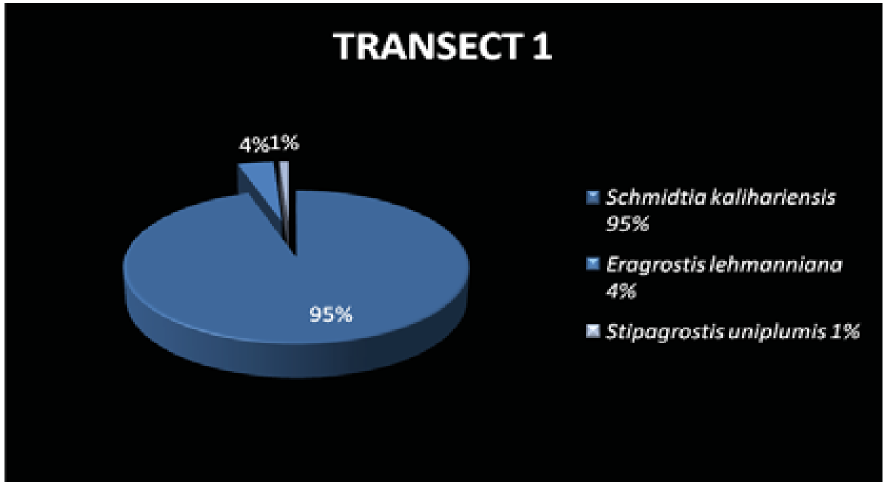


Figure 20: Arial map depicting locations of individual transects.



Transect 1 – North-western portion of subject property within an area currently used for cattle grazing.

- *Schmidtia kalihariensis* (Kalahari Sour Grass) [Pioneer grass; Increaser II]. Kalahari sour grass grows in disturbed sandy soil in arid to very arid parts.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Stipagrostis uniplumis* (Silky Bushman Grass) [Subclimax grass; Increaser II]. Silky bushmans grass grows in sandy soil in the arid parts of the region. It is often encountered in gravelly places, especially where disturbance has taken place.

Kathu Bushveld Indicators:
- *Schmidtia kalihariensis*
- *Eragrostis lehmanniana*
- *Stipagrostis uniplumis*

Conclusion: *S. kalihariensis* dominates this area with very little species diversity evident.

Figure 21: Transect 1.

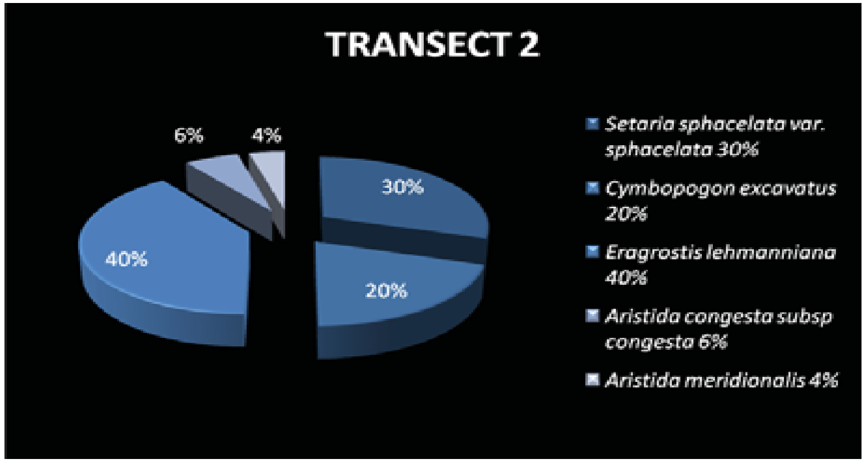


Figure 22: Transect 2.

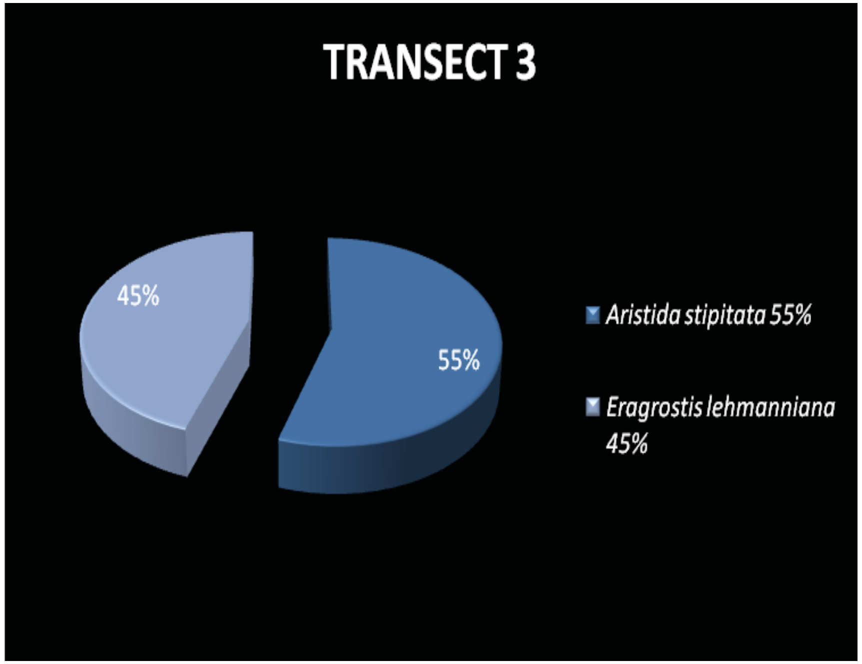
Transect 2 – Southern portion of study area in close vicinity to the Ga Magara River.

- *Setaria sphacelata* var. *sphacelata* (Common Bristle Grass) {Decreaser, Climax grass] Common bristle grass usually grows on stony slopes or sometimes next to streams in damp soil. It utilises a wide range of habitat types.
- *Cymbopogon excavates* (Broad-leaved Turpentine Grass) [Climax grass; Increaser I]. Broad-leaved turpentine grass grows in most soil types, but especially in sandy and gravelly soil in disturbed as well as undisturbed veld. It often also grows along roadsides.
- *Aristida congesta* subsp. *congesta* (Tassel Three Awn) [Pioneer grass; Increaser II]. Tassel three awn occurs in disturbed places such as road reserves, old cultivated lands and bare patches in overgrazed veld.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increaser II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida meridionalis* (Giant Three-awn) [Climax grass; Increaser III]. Giant three-awn commonly grows in Kalahari sandveld, as well as sandy soil in other parts of the region. It also often grows in gravelly soil, in damp places and along roadsides.

Kathu Bushveld Indicators:

- *Eragrostis lehmanniana*

Conclusion: The majority of grass species are indicative of historical disturbance, with only one species namely *Setaria sphacelata* var. *sphacelata* indicative of wet soil conditions. Transformation from previous riparian conditions to present terrestrial conditions is evident.



<u>Transect 3 – Centre portion of the study area located relatively close to existing mining infrastructure.</u>

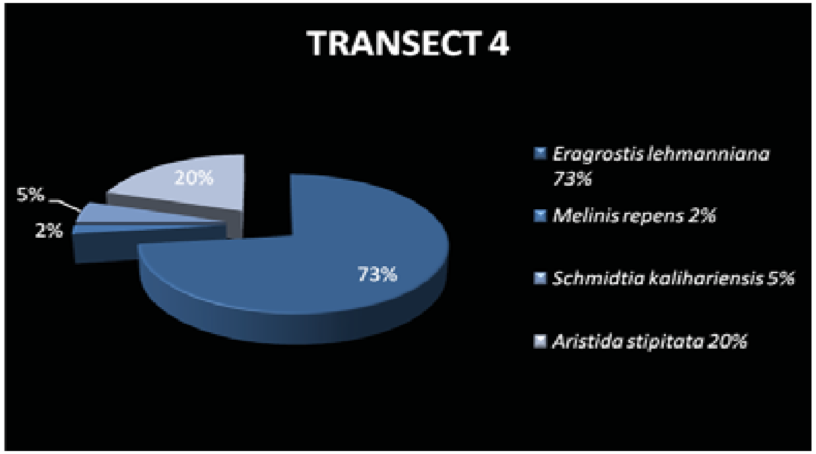
- *Aristida stipitata* (Long-awned grass) [Subclimax grass; Increaser II]. Long-awned grass grows mainly in deep sandy soil and loam soil, usually in disturbed places such as roadsides and overgrazed veld. It is often associated with silver cluster leaf (*Teminalia sericea*) veld. It also occurs on rocky outcrops.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.

<u>Kathu Bushveld Indicators:</u>

- *Eragrostis lehmanniana*

<u>Conclusion</u>: Very low species diversity, indicative of disturbance. Within this area the *Acacia mellifera* encroachment is considered significant.

Figure 23: Transect 3



<u>Transect 4 – Northern portion of the study area within open veld located relativley close to current mining related activities.</u>

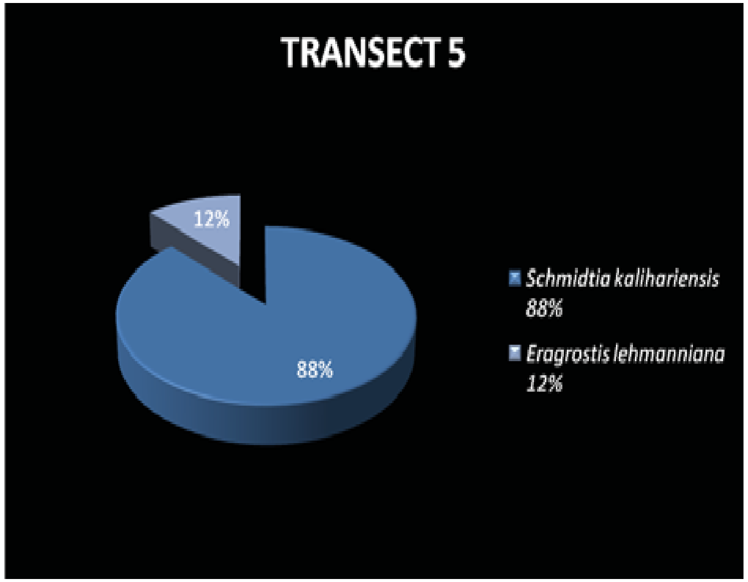
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Melinis repens* (Natal Red top) [Subclimax grass, Increaser II]. Natal red top grows in disturbed places such as roadsides and old cultivated lands (subsp. *repens*) or in sunny dry places (subsp. *grandiflora*), in all soil types, but especially in well drained soil.
- *Schmidtia kalihariensis* (Kalahari Sour Grass) [Pioneer grass; Increaser II]. Kalahari sour grass grows in disturbed sandy soil in arid to very arid parts.
- *Aristida stipitata* (Long-awned grass) [Subclimax grass; Increaser II]. Long-awned grass grows mainly in deep sandy soil and loam soil, usually in disturbed places such as roadsides and overgrazed veld. It is often associated with silver cluster leaf (*Teminalia sericea*) veld. It also occurs on rocky outcrops.

<u>Kathu Bushveld Indicators:</u>

- *Eragrostis lehmanniana*
- *Melinis repens*
- *Schmidtia kalihariensis*

<u>Conclusion</u> Dominance by *Eragrostis lehmanniana* in combination with *Melinis repens* is considered a result of disturbance.

Figure 24: Transect 4.



Transect 5 – Centre of Black Rock Mine.

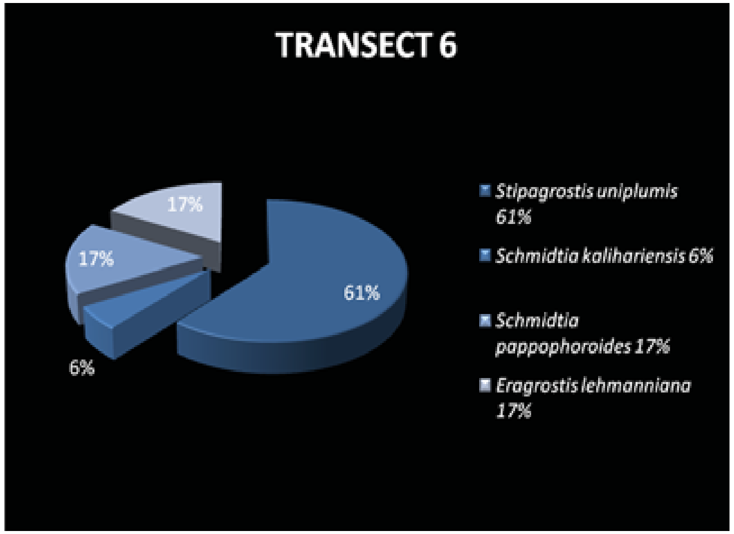
- *Schmidtia kalihariensis* (Kalahari Sour Grass) [Pioneer grass; Increaser II]. Kalahari sour grass grows in disturbed sandy soil in arid to very arid parts.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.

Kathu Bushveld Indicators:

- *Eragrostis lehmanniana*
- *Schmidtia kalihariensis*

- **Conclusion:** As with transect 1 done within an area were transformation was evident due to cattle grazing transect 5 is also dominated by *S. kalihariensis*. Dominance of this grass species is therefore indicative of disturbance.

Figure 25: Transect 5.



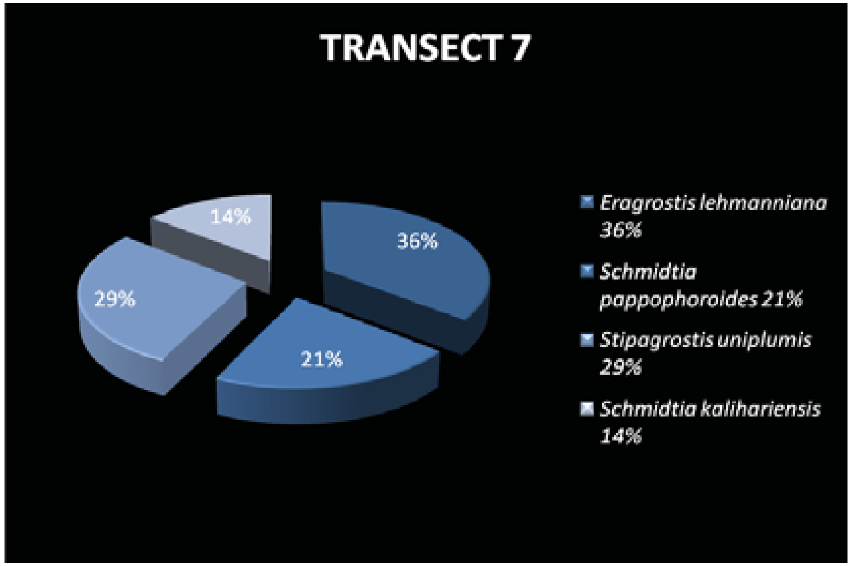
Transect 6 – Centre portion of study area within a open veld area located close to the existing R308.

- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Schmidtia pappophoroides* (Sand Quick) [Climax grass; Increaser II]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy loam and gravelly soil. It often grows in limeveld and sometimes in gravelly clay soil.
- *Stipagrostis uniplumis* (Silky Bushman Grass) [Subclimax grass; Increaser II]. Silky bushmans grass grows in sandy soil in the arid parts of the region. It is often encountered in gravelly places, especially where disturbance has taken place.
- *Schmidtia kalihariensis* (Kalahari Sour Grass) [Pioneer grass; Increaser II]. Kalahari sour grass grows in disturbed sandy soil in arid to very arid parts.

Kathu Bushveld Indicators:
- *Eragrostis lehmanniana*
- *Schmidtia kalihariensis*
- *Schmidtia pappophoroides*
- *Stipagrostis uniplumis*

Conclusion: All species identified are indicators of the Kathu Bushveld vegetation type. Of which *Stipagrostis uniplumis* contributes the highest score and it is deemed highly likely that its presence is due to habitat suitability in combination with some disturbance within the area that led to an increase of the species abundance.

Figure 26: Transect 6.



<u>Transect 7 – Centre portion of study area within open veld situated between two mining footprint areas.</u>

- *Stipagrostis uniplumis* (Silky Bushman Grass) [Subclimax grass; Increaser II]. Silky bushmans grass grows in sandy soil in the arid parts of the region. It is often encountered in gravelly places, especially where disturbance has taken place.
- *Schmidtia kalihariensis* (Kalahari Sour Grass) [Pioneer grass; Increaser II]. Kalahari sour grass grows in disturbed sandy soil in arid to very arid parts.
- *Schmidtia pappophoroides* (Sand Quick) [Climax grass; Increaser II]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy loam and gravelly soil. It often grows in limeveld and sometimes in gravelly clay soil.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.

<u>Kathu Bushveld Indicators:</u>
- *Eragrostis lehmanniana*
- *Schmidtia kalihariensis*
- *Stipagrostis uniplumis*
- *Schmidtia pappophoroides*

<u>Conclusion</u>: Relativley uniform dominance inidative of limited transformation within the area.

Figure 27: Transect 7.

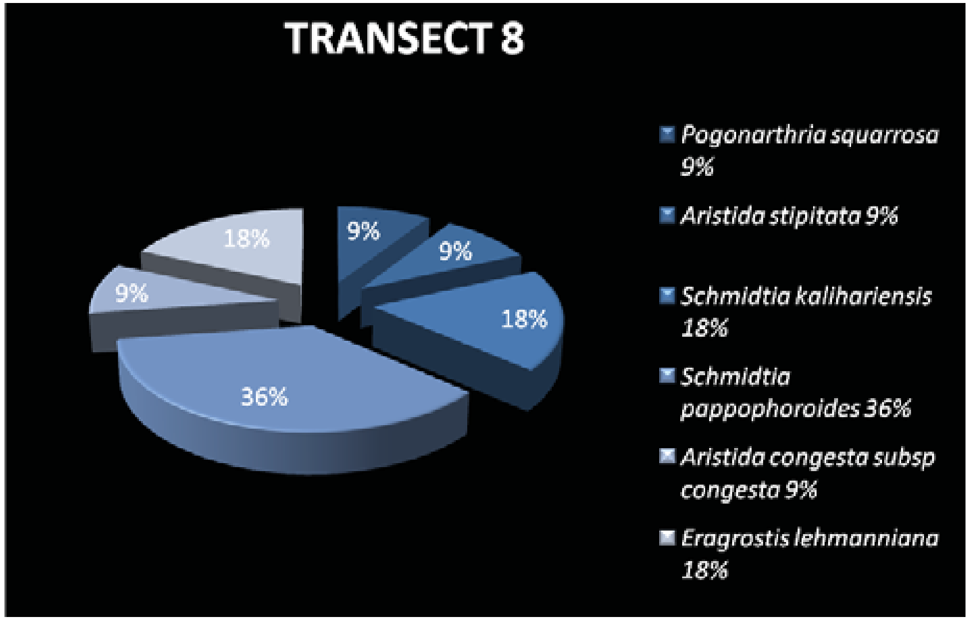


Figure 28: Transect 8.

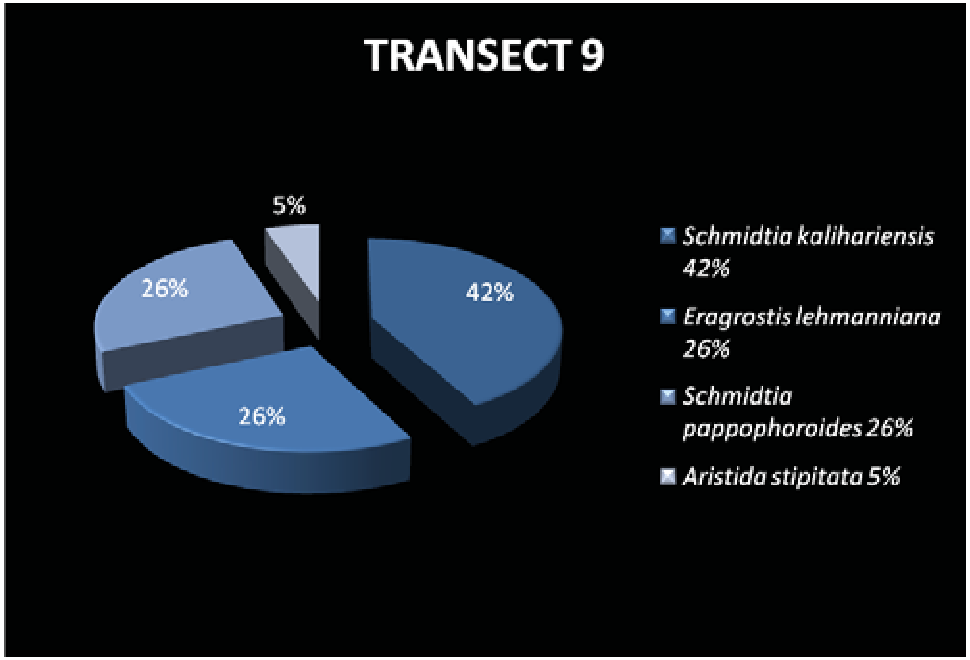
Transect 8– Centre portion of study area within open veld presently used for cattle grazing, however located a distance from any other anthorpogenic activity.

- *Pogonarthria squarrosa* (Herringbone grass) [Subclimax grass; Increaser II] Herringbone grass grows in disturbed places such as roadsides but is also sparsely distributed in undisturbed veld. It grows mostly in sandy soil, but also in other well drained soils.
- *Aristida stipitata* (Long-awned grass) [Subclimax grass; Increaser II]. Long-awned grass grows mainly in deep sandy soil and loam soil, usually in disturbed places such as roadsides and overgrazed veld. It is often associated with silver cluster leaf (*Teminalia sericea*) veld. It also occurs on rocky outcrops.
- *Schmidtia kalihariensis* (Kalahari Sour Grass) [Pioneer grass; Increaser II]. Kalahari sour grass grows in disturbed sandy soil in arid to very arid parts.
- *Schmidtia pappophoroides* (Sand Quick) [Climax grass; Increaser II]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy loam and gravelly soil. It often grows in limeveld and sometimes in gravelly clay soil.
- *Aristida congesta* subsp. *congesta* (Tassel three awn) [Pioneer grass; Increaser II]. Tassel three awn occurs in disturbed places such as road reserves, old cultivated lands and bare patches in overgrazed veld.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.

Kathu Bushveld Indicators:

- *Eragrostis lehmanniana*
- *Schmidtia kalihariensis*
- *Stipagrostis uniplumis*
- *Schmidtia pappophoroides*

Conclusion: Species diversity increases within the area. It should also be noted that the percentage contribution of each grass identified is more equal and the area is not dominated by one grass species.



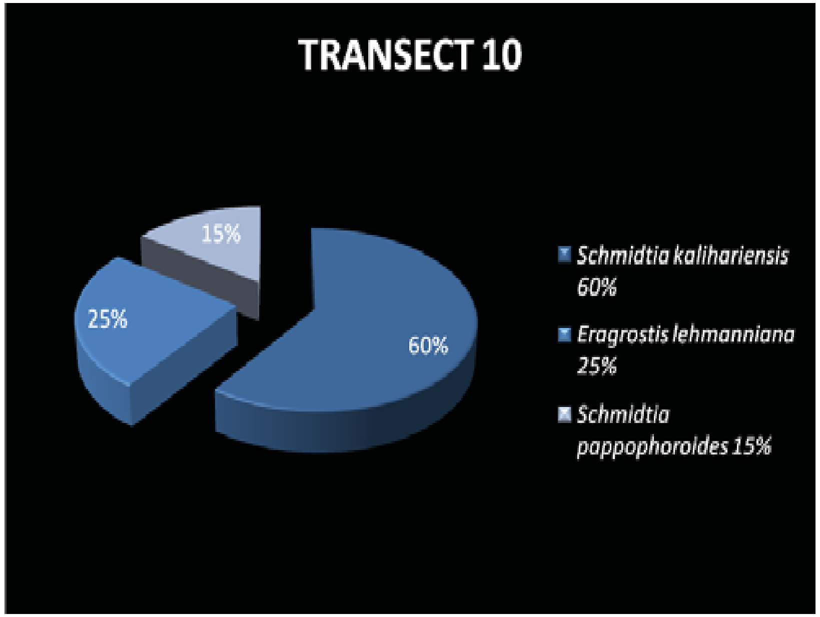
Transect 9 – Centre portion of the study area within open veld utilsed for cattle grazing.

- *Schmidtia kalihariensis* (Kalahari Sour Grass) [Pioneer grass; Increaser II]. Kalahari sour grass grows in disturbed sandy soil in arid to very arid parts.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Aristida stipitata* (Long-awned grass) [Subclimax grass; Increaser II]. Long-awned grass grows mainly in deep sandy soil and loam soil, usually in disturbed places such as roadsides and overgrazed veld. It is often associated with silver cluster leaf (*Teminalia sericea*) veld. It also occurs on rocky outcrops.
- *Schmidtia pappophoroides* (Sand Quick) [Climax grass; Increaser II]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy loam and gravelly soil. It often grows in limeveld and sometimes in gravelly clay soil.

Kathu Bushveld Indicators:
- *Eragrostis lehmanniana*
- *Schmidtia kalihariensis*
- *Schmidtia pappophoroides*

- **Conclusion:** Majority of grass species indicative of disturbance, with the exception of *Schmidtia pappophoroides.* However this grass only contributes 26% of the total species composition. Some vegetation transformation as a result of cattle grazing is therefore evident.

Figure 29: Transect 9.



Transect 10 – Northern portion of study area located relatively close to mining related activities.

- *Schmidtia kalihariensis* (Kalahari Sour Grass) [Pioneer grass; Increaser II]. Kalahari sour grass grows in disturbed sandy soil in arid to very arid parts.
- *Eragrostis lehmanniana* (Lehmann's Love Grass) [Climax grass; Increase II]. Lehmann's love grass usually grows in parts where disturbance took place in the past, such as overgrazed veld, old cultivated lands and road reserves; mostly in sandy soil. It also grows in undisturbed sandveld in arid regions.
- *Schmidtia pappophoroides* (Sand Quick) [Climax grass; Increaser II]. Sand quick grows in warm areas with a relatively low rainfall; mostly in sandy loam and gravelly soil. It often grows in limeveld and sometimes in gravelly clay soil.

Kathu Bushveld Indicators:
- *Schmidtia kalihariensis*
- *Eragrostis lehmanniana*
- *Schmidtia pappophoroides*

Conclusion: The high *Schmidtia kalihariensis* percentage is indicative of past disturbance; as what is expected due to mining activities close to the area where transect 10 was done.

Figure 30: Transect 10.

Species diversity was relatively uniform throughout the subject property. However, it is important to take the percentage of each grass species within the specific community into consideration. The less disturbed the veld the more uniform percentages will be obtained between species within the same community. Dominance of one grass species shows historical disturbances and vegetation transformation, as can be seen for all transects done within areas previously disturbed due to mining related activities as well as livestock grazing.

Grass species such as *Aristida stipitata* and *Schmidtia kalihariensis* can be used for future monitoring. A sharp increase of any of these species will indicate vegetation transformation within an area. A combination of Kathu Bushveld indicators such as *Eragrostis lehmanniana* and *Schmidtia pappophoroides* are representative of relatively undisturbed veld, however these should then occur in equal ratios within the community.

10.2 Vegetation Index Score

The information gathered during the assessment of the subject property was used to calculate the Vegetation Index Score (VIS) - see appendix C. The subject property was divided into four dominant habitat types namely the Belgravia game farm, all transformed areas, open veld and the Ga Magara riparian habitat; VIS was applied to each habitat unit. The Belgravia game farm calculated the highest score of the four habitat units assessed namely 17 falling within assessment class C (moderately modified). Some transformation as a result of historical livestock grazing was evident resulting in a lower score than expected for the habitat unit. The transformed habitat unit which includes all existing infrastructure, railway and roads with associated servitudes calculated a score of -1.7 (modified completely). This low score is mainly due to site clearing within these areas resulting in a significant loss of species diversity and abundance as well as an impact on the vegetation community located within the servitudes. The open veld unit has seen significantly less vegetation transformation and therefore calculated a score of 15 (moderately modified). The Gamagara riparian unit calculated a very low score of 0.1 (assessment class F; modified completely), mainly due to the exotic and invasive floral community dominating the vegetation. If present rehabilitation within the riparian habitat continues it will lead to some improvement of the overall ecology and an increase in the VIS score.

10.3 Exotic and invasive species

Alien invaders are plants that are of exotic origin and are invading previously pristine areas or ecological niches (Bromilow, 2001). Not all weeds are exotic in origin, but as these exotic plant species have very limited natural “check” mechanisms within the natural environment, they are often the most opportunistic and aggressively-growing species within the ecosystem. Therefore, they are often the most dominant and noticeable within an area. Disturbances of the ground through trampling, excavations or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area. Under natural conditions, these pioneer species are overtaken by sub-climax and climax species through natural veld succession. This process, however, takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition prior to the disturbance. There are many species of indigenous pioneer plants, but very few indigenous species can out-compete their more aggressively-growing exotic counterparts.

Alien vegetation invasion causes degradation of the ecological integrity of an area, causing (Bromilow, 2001):

- a decline in species diversity;
- local extinction of indigenous species;
- ecological imbalance;
- decreased productivity of grazing pastures; and
- increased agricultural input costs.

The Environmental Impact Assessment and Management Program alignment document (Ivuzi Environmental Consultants (Pty) Ltd; 2009), lists invasives previously identified within the Black Rock Surface rights area. The most abundant of the species at that time were *Prosopis* sp. (Mesquite trees). Other alien and invasive species also noted were *Acacia mellifera* (Swarthak), *Crysocoma tenuifolia* (Bitterbush), *Eriocephalus ericoides* (Kapok-bush), *Gnidia polycephala* (January-bush), *Gnidia burchellii* (Harpiusbos) and *Rhigozum trichotomum* (Driedoring).

At the time of the BAP assessment (2011) the majority of the *Prosopis* trees were restricted to the Ga Magara River habitat. Distinguishing between different *Prosopis* species is known to be difficult as *Prosopis glandulosa* var. *torreyana* hybridizes with *Prosopis velutina*. However, *Prosopis glandulosa* var. *torreyana* is a known inhabitant of riverbeds within semi-desert areas especially within the Karoo and Kalahari thornveld. It is therefore deemed highly likely that the species encountered within the Ga Magara River is *Prosopis glandulosa* var. *torreyana.* Presently the Ga Magara River is being rehabilitated with special mention of *Prosopis* sp. encroachment control and eradication. This may have resulted in the decline of *Prosopis* sp. abundances noted during the initial investigation (Environmental Impact Assessment and Management Program alignment document; Ivuzi Environmental Consultants (Pty) Ltd; 2009). Although this species is not presently regarded as the most abundant within the study area it is still deemed important for ongoing management of the species to prevent the spread of the species to other portions of the subject property.

Significant amounts of *Acacia mellifera* were noted within areas close to present or historical anthropogenic activities. *Acacia mellifera* formed impenetrable thickets in some areas within the subject property, which ultimately resulted in a significant decrease in natural floral species diversity and abundance within these areas. This Acacia specie was regarded the most invasive floral species within the study area at the time of the assessment.

Rhigozum trichotomum as well as *Acacia mellifera* are indicator species of the *Gordonia Duneveld* vegetation type. However, these species may become invasive in previously disturbed areas. At the time of the assessment the majority of *Rhigozum trichotomum* encroached areas were restricted to open veld areas that have seen less anthropogenic activity. Encroachment by this species was regarded not as severe as the *Acacia mellifera* encroachment at the time of the BAP assessment (2011) with only small communities noted that was scattered throughout open veld habitat unit. It is however deemed possible that this species may become more invasive if not controlled within mining footprint areas adjacent to open veld habitat.

Due to urban development within the Black Rock village various exotic species were introduced within urban gardens. Species such as *Melia azedarach* and *Morus nigra* were evident throughout the village. Although these species are considered exotics they still offer habitat for faunal species known to reside close to human activity and also form part of established gardens. It is therefore not deemed necessary to remove larger trees from the village, however all exotic seedlings as well as larger tree species within mining footprint areas should be removed to prevent spread of these species into open veld areas.

A species that was also found to be significantly invasive within mining footprint areas as well as in areas disturbed by farming related infrastructure was *Verbesina encelioides* (see figure below). This weed is adapted to arid sandy soil conditions and therefore eradication and future management is needed to prevent it from spreading to nearby open veld habitat.

Figure 31: ***Verbesina encelioides.***

The remainder of the exotic and invader species noted during the time of the assessment are not considered as severe as the above mentioned species. However, management of these species is still deemed necessary to prevent spread and unnecessary proliferation. It should also be noted that grass species such as *Schmidtia kalihariensis,* endemic to the area but which thrives in disturbed places was also noted in areas that were historically disturbed.

During the assessment of the study area very low alien and weed species diversity were noted (see table below). It is however evident within the region that grass species known to thrive in disturbed places, is the species noted to quickly establish if areas are disturbed. As a result the natural species diversity declines and grass species known to thrive in disturbed places dominates instead of shrub/forb weed species.

Table 15: Dominant exotic vegetation species identified during the general area assessment.

Species	English name	Type or Origin	Category*
	Forbs		
Spartium junceum	Spanish broom	Native to Europe	1
Pennisetum setaceum	Fountain grass	Native to North Africa	1
Sesamum triphyllum	Wild sesame	Weed	NA
Verbesina encelioides	Wild sunflower	Native to South America	NA
Ziziphus mucronata	Buffalo thorn	Invader	NA
Morus nigra	Black mulberry	Native to China	3
Melia azedarach	Syringa	Native to Australia	3
Eucalyptus sp.	Gum trees	Native to Australia	2
Schinus molle	Pepper tree	Native to South America	3
Prosopis glandulosa var. torreyana	Mesquite	Native to Mexico	2
Agave americana	Sisal	Native America	2
Cuscuta campestris	Dodder	Native to North America	1
Opuntia ficus-indica	Sweet prickly pear	Native to Central America	1

Species	English name	Type or Origin	Category*
Nerium oleander	Oleander	Native to the North Africa	1
Lantana camara	Lantana	Native to America	1
Ipomoea indica	Morning glory	Native to America	3
Cortaderia selloana	Pampas grass	Native to South America	1

The categories listed in the above table come from Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998. The points below serve to indicate the management requirements for each category of alien or invasive species.

- Category 1: These are prohibited plants, which must be controlled or eradicated. These plants serve no economic purpose and possess characteristics that are harmful to humans, animals or the environment.
- Category 2: These are 'invaders' with a certain useful qualities, such as a commercial use or for woodlots, animal fodder, soil stabilisation etc. These plants are allowed in demarcated areas under controlled conditions and in bio-control regions.
- Category 3: These are alien plants presently growing in, or having escaped from areas such as gardens, but is proven invaders. No further planting is allowed nor is trade in propagative material. Existing plants must be prevented from spreading and individuals within 30m of the one in fifty year flood line must be removed.

10.4 Red Data Floral Species Assessment

The EMPR document (Black Rock Manganese Ore Mine Assmang Ltd., 2002) only indicates one endangered plant specie identified within the Belgravia game farm, namely *Orbeopsis knobellii.* No other endangered or floral species considered protected were listed for the surface rights area. This species was not encountered during the BAP assessment (2011), however it is deemed that habitat for the species does exist within the Belgravia game farm. The areas surrounding the game farm has seen more vegetation transformation and therefore has significantly less possible of habitat for this species.

An assessment considering the presence of any RDL plant species, as well as suitable habitat to support any such species, was undertaken during the BAP assessment (2011). The complete PRECIS (Pretoria Computer Information Systems) red data plant list for the grid reference (2722BB) was enquired from SANBI (South African National Biodiversity Institute). No floral species considered of concern within the applicable QDS were listed. However, individuals as well as possible habitat for floral species listed within schedule 3 and 4 of Environmental and Conservation Ordinance no.19 (1974), floral species listed within the Threatened and Protected Species Regulations (NEMBA, 2004) as well as trees listed within section 15(1) of the National Forests Act, (1998) were searched for during the assessment. Protected species found within the study area are listed in the table below.

The EMPR document (2002) states that in wetter areas such as areas along streamlines the abundance of *Boscia albitrunca* increases. *Acacia haematoxylon* and *Acacia erioloba* are reported to be interspersed in open savanna between grasses tolerant of the semi desert to desert climate. Historically the entire area associated with the Black Rock surface rights area could have consisted of open savanna habitat. However, presently there is a remarkable difference between the western portion and the eastern portion of the surface rights area. At the time of the assessment the western portion with special mention of the Belgravia game farm as well as surroundings were the only areas where *Boscia albitrunca* was encountered and *Acacia haematoxylon* and *Acacia erioloba* numbers increases significantly towards the east. The only water source on the eastern portion of the surface rights area is the Gamagara River, however the last recorded flow of the river was in 1988. This may be an indication of decrease in ground water resources that may have resulted in an overall drier habitat and change in expected floral abundance and diversity.

The plant species identified were not confined to one specific area, although abundances differed between areas within the Black Rock Mine surface rights area. None of the species listed within the table below are allowed to be removed, destroyed, cultivated or transported without applying for a permit.

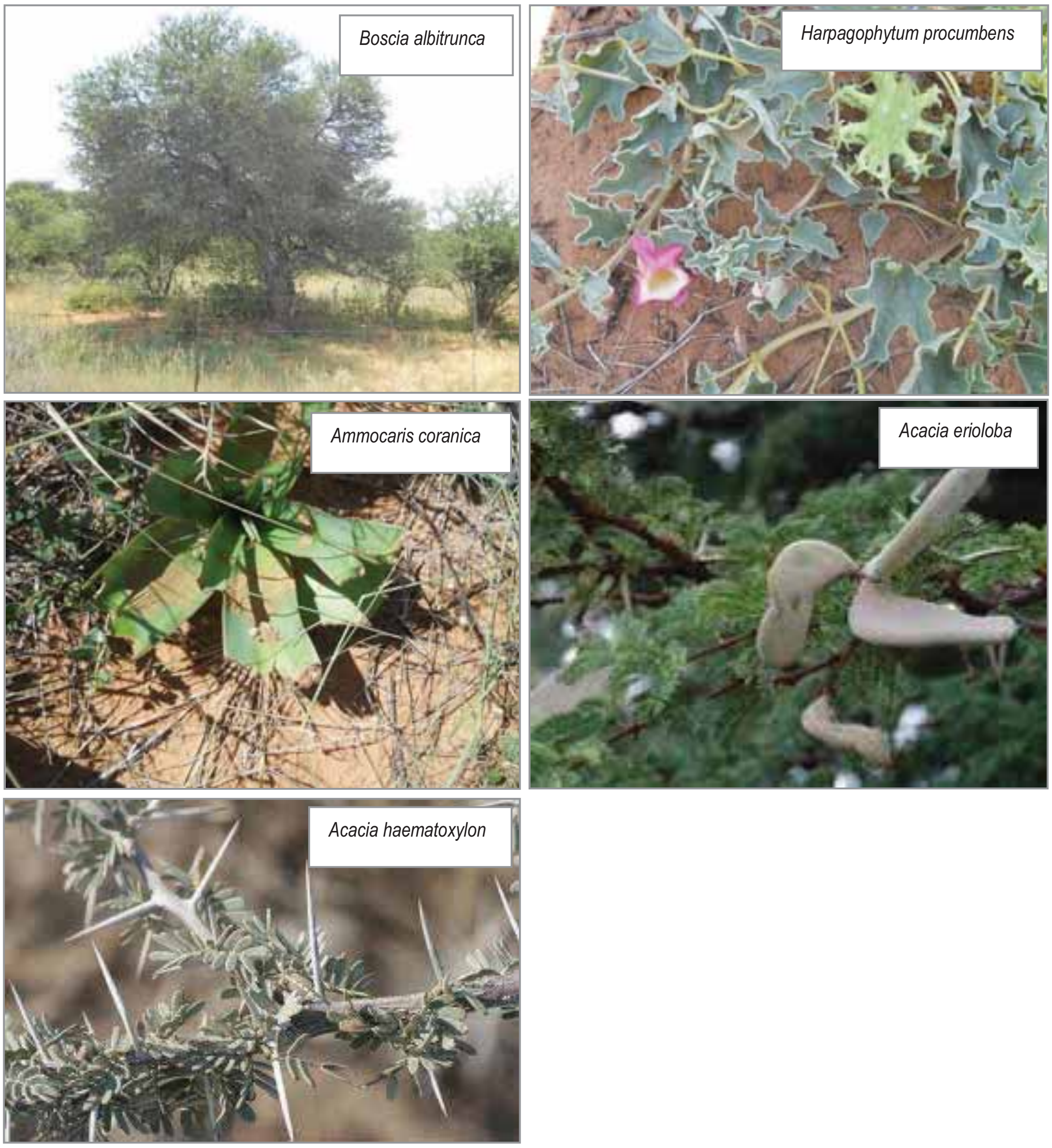


Figure 32: Protected floral species found within the subject property.

Table 16: Protected floral species found during the assessment.

Scientific name	Common name	Regulation
Acacia erioloba	Camel thorn	National Forests Act (1998)
Acacia haematoxylon	Grey camel thorn	National Forests Act (1998)
Boscia albitrunca	Shepherd's tree	National Forests Act (1998)
Ammocaris coranica	Karoo lily	Schedule 4 Environmental and Conservation Ordinance no.19 (1974)
Harpagophytum procumbens	Devil's Claw	Schedule 3 Environmental and Conservation Ordinance no.19 (1974)

10.5 Medicinal Plants

Medicinal plant species are not necessarily indigenous species, with many of them being regarded as alien invasive weeds. The majority of the medicinal plant species are located throughout the subject property and are not restricted to specific habitats within the subject property. All the species known to be of medicinal value are regarded as widespread and common for the region, except for *Harpagophytum procumbens* listed as a protected species within the Threatened and Protected species regulations (NEMBA, 2004) and *Acacia erioloba* a protected tree species (National Forests Act (1998).

Table 17: Traditional medicinal plants identified during the field assessment. Medicinal applications and application methods are also presented (van Wyk, et al., 1997; van Wyk and Gericke, 2000; van Wyk and Wink, 2004; van Wyk, Oudtshoorn, Gericke, 2009).

Scientific name	Common name	Plant part used	Uses
Elephantoriza burkei	Sumach bean	Roots	Water extracts showed antibacterial activity.
Acacia erioloba	Camel thorn	Pods, roots	Ground pods are used to treat ear infections. Roots are used to treat headache, Tuberculosis and also tooth ache.
Terminalia sericea	Silver cluster leaf	Roots	Root decoctions are used as a traditional Tswana remedy for stomach disorders and diarrhoea. Decoctions and infusions are used as eye lotions and to treat pneumonia.
Senna italica	Wild senna	Roots	Used to treat influenza, indigestion, liver and gall bladder complaints, gastrointestinal disorders, dysmenorrhoea and uterine pain.
*Ziziphus mucronata**	Buffalo-thorn	Roots, bark and leaves	Warm bark infusions are used as expectorants in cough and chest problems, while root infusions are popular as a remedy of diarrhoea and dysentery. Decoctions of roots and leaves are applied externally to boils sores and glandular swellings.
Acacia karroo	Sweet thorn	Bark, leaves and gum	The bark and leaves are a Cape remedy for diarrhoea and dysentery. The gum bark and leaves have also been used as an emollient and astringent for colds, conjunctivitis and haemorrhage.
Harpagophytum procumbens	Devil's claw	Roots	Used to treat rheumatism and arthritis, and as a general health tonic. Infusions of the dried root are a cure for digestive disorders and a tonic in lack of appetite. It is also taken as an analgesic, especially during pregnancy and the treatment continued after labour. An ointment is made from the root material which is applied to sores, ulcers and boils.

11 FAUNAL DIVERSITY

The faunal assessment included field observations (visual identification, spoor, call or dung) in conjunction with an extensive literature referencing as well as small mammal trapping. This is done due to the fact that many faunal species are nocturnal or climatic conditions during the assessment may not be suitable to enable observations to occur. In addition the levels of anthropogenic activity in the study area and surrounding area may have a significant impact on whether species will be observed. A detailed discussion of the different faunal taxa follows in the sections below.

11.1 Mammals

Small mammal trapping was conducted in areas identified as suitable small mammal habitat, however no mammals were captured. The unsuccessful trapping rate was considered a result of habitat degradation, no water flow within the riparian system of the Ga Magara River and is not considered a true presentation of the small mammal species community that inhabits the subject property. Evidence of the Common Duiker (*Sylvicapra grimmia*), White-tailed Mongoose (*Ichneumia albicauda*), Suricate (*Suricata suricatta*) and a Scrub Hare (*Lepus saxatilis*) were noted within the proposed development areas. Field signs (diggings) of Porcupine (*Hystrix africaeaustralis*) were also noted during the site assessment.

A list of small and larger mammal species recorded in the Belgravia Game farm, next to Black Rock Manganese ore is listed in Appendix B to compare species that could have occurred in these areas. The subject property in its present state is not considered optimal habitat for larger mammal species, however habitat is considered important for the survival of various smaller mammal species.

The previously mined black rock koppie on the Black rock Ore mine was encountered. This could provide suitable habitat for bat species in the area, including Threatened species occurring within the Northern Cape Province (Appendix B). Five RDL mammal species (bat species) had a probability of occurrence of more than 60%.

Figure 33: Caves found on Black Rock that could provide suitable habitat for threatened bat species.

Table 18: Northern Cape threatened mammal species with a POC of more than 60%.

Scientific name	Common name	Conservation Status	POC
Miniopterus schreibersii	Schreiber's long-fingered bat	NT	58
Rhinolophus fumigatus	Ruppell's horseshoe bat	NT	61
Rhinolophus clivosus	Geoffroy's horseshoe bat	NT	61
Rhinilophus darlingi	Darling's horseshoe bat	NT	62
Rhinolophus denti	Dent's horseshoe bat	NT	61

11.2 Birds

All bird species seen or heard during this time of the assessment were recorded. This was done for the duration of three days in summer. Surveys were conducted across the entire subject property. The table below lists all the bird species identified during the assessment. The complete list of bird species expected for the QDS 2722BB (Roberts Multimedia Birds of Southern Africa) is included in Appendix B.

Table 19: Bird species recorded during the bird survey.

Common Name	Scientific Name	Conservation Status
Cape turtle Dove	*Streptopelia capicola*	Not Threatened
Red-eyedDove	*Streptopelia semitorquata*	Not Threatened
Laughing Dove	*Streptopelia senegalensis*	Not Threatened
Jocobin Cuckoo	*Oxylophus jacobinus*	Not Threatened
Barn Owl	*Tyto alba*	Not Threatened
African Palm Swift	*Cypsiurus parvus*	Not Threatened
Little Swift	*Apus affinis*	Not Threatened
Lilac-breasted Roller	*Coracias caudata*	Not Threatened
Southern Yellow-billed Hornbill	*Tockus leucomelas*	Near Endemic
Pied Crow	*Corvus albus*	Not Threatened
Cape Crow	*Corvus capensis*	Not Threatened

Common Name	Scientific Name	Conservation Status
African Red-eyed Bulbul	*Pycnonotus nigricans*	Near Endemic
Kalahari Robin	*Cercotrichas paena*	Near Endemic
Cape Glossy Starling	*Lamprotornis nitens*	Near Endemic
Southern Masked-Weaver	*Ploceus velatus*	Not Threatened
Crowned Plover	*Vanellus coronatus*	Not Threatened
Cape Sparrow	*Passer melanurus*	Near Endemic
Groundscraper Thrush	*Psophocichla litsitsirupa*	Not Threatened
Great Sparrow	*Passer motitensis*	Not threatened
Yellow Wagtail	*Motacilla flava*	Not Threatened
Lesser grey shrike	*Lanius minor*	Not Threatened
Swallow-tailede Bee-eater	*Merops hirundineus*	Not Threatened
Yellow Canary	*Serinus flaviventris*	Near Endemic

A total of three RDL bird species showed a POC of more than 60 %. All RDL bird species with a POC of more than 60 % is listed in the table below. The majority of these bird species are known to reside in either bushveld or grassland habitat.

The subject property has mainly undisturbed grassland and bushveld but activities such as the mining and grazing of cattle from the adjacent farmers makes the habitat less suitable for RDL bird species to occur. As a result the bird species of concern as listed below that inhabits savanna grasslands are more likely to be found on the Belgravia Game farm, next to Black Rock Manganese ore.

The White-backed Vulture builds its stick nest on the top of large trees, using camel thorn *Acacia erioloba.* It generally prefers arid savanna with scattered trees such as Mopane *(Colosphermum mopane)* woodland, while largely avoiding forests, deserts and treeless grassland and shrubland. The Cape Vulture is a cliff-dwelling bird and typically occurs in breeding colonies that range in size from tens to thousands of birds on large, vertical rock faces. From these central places, colony members forage over hundreds of kilometres in search of large animal carcasses on which to scavenge. The European roller (*Coracias garrulous)* is a fairly common summer visitor. Sightings of these birds are in woodland, bushveld and even grassland where it perches on power lines.

Table 20: Northern Cape threatened bird species with a POC of more than 60%.

Scientific name	Common name	Conservation Status	POC
Gyps africanus	African White-backed Vulture	NT	62
Gyps coprotheres	Cape Griffon (Cape vulture)	VU	61
Coracias garrulus	European Roller	NT	62

11.3 Reptiles

The only reptile species that were identified during the assessment, namely *Dendroaspis polylepis* (Black Mamba) were found dead along the roadside. The subject property could possibly offer habitat for various other reptile species within all the identified habitat units, however reptile species of concern (Table 21) will be restricted to areas with less anthropogenic activities such as the eastern portion of the subject property, where mining activities currently take place.

Table 21: Northern Cape threatened reptile species

Scientific name	Common name	Conservation Status	POC
Acontophiops lineatus	Woodbush Legless Skink	VU	42
Typhlosaurus lomiae	Lomi's Blind Legless Skink	VU	46
Cordylus cataphractus	Armadillo Girdled Lizard	VU	23
Cordylus mclachlani	McLachlan's Girdled Lizard	VU	20
Cordylus lawrenci	Lawrence Girdled Lizard	NT	20
Psammobates geometricus	Geometric Tortoise	EN	43

11.4 Amphibians

The Ga Magara River could have provided habitat for a variety of amphibian species. Historically the Ga Magara River could have been very important in terms of function and service provision within the region, however dewatering caused by mining activity upstream resulted in less water entering the system and overtime a shift from riparian to terrestrial ecological conditions. Thus no amphibian populations were noted and no RDL amphibian species were encountered on the subject property. The table below lists the RDL frog species of Northern Cape.

Table 22: Northern Cape threatened frog species

Scientific name	Common name	Conservation Status
Breviceps macrops	Desert Rain Frog	VU
Cacosternum karooicum	Karoo caco	DD
Pyxicephalus adspersus	Giant Bullfrog	NT
Strongylopus springbokensis	Namaqua Stream Frog	VU

11.5 Invertebrates

The invertebrate assessment conducted was a general assessment with the purpose of identifying common species and taxa in the study area. As such the invertebrate assessment will not be an indication of the complete invertebrate diversity potential of the proposed development site and surrounding area. Representatives of commonly encountered families in the Insecta class that was observed during the assessment are listed in the table below.

Table 23: General results from invertebrate collecting during the assessment of the subject property.

Insects	Comments
Order: Lepidoptera (Butterflies & Moths) Family: Nymphalidae Subfamily Danainae *Danaus chrysippus aegyptius* (African monarch) Family: Pieridae Subfamily: Coliadinae *Catopsilia florella* (African migrant) *Eurema brigitta brigitta* (Broad-bordered grass yellow) Subfamily: Pierinae *Colotis lais* (Kalahari Orange Tip) Family: Noctuidae (Agrotidae) *Cyligramma latona* (Cream-striped Owl)	Visual observations.
Order: Orthoptera (Grasshoppers, Crickets & Locusts) Family: Acrididae Family: Gryllidae	Visual observations and sweep-netting.
Order: Hymenoptera & Isoptera (Ants, Wasps & Termites) Family: Formicidae Family: Vespidae Family: Termitidae	Visual observations.
Order: Hemiptera (Bugs) Family: Pentatomidae	Visual observations.

Order: Diptera (Flies) Family: Tabanidae *Haematopota* (Clegs)	Visual observations
Order: Odonata Family: Coenagrionidae (Pond damsels) Africallagma glaucum (Swamp bluet)	Visual observations and sweep netting

No suitable habitat was found for the two RDL listed butterfly species. *Anthene lindae* (Linda's Hairtail) which has been recorded within the Witsand Nature reserve. They usually occur in areas where *Acacia erioloba* is sparsely scattered. *Crysoritis trimeni* (Trimen's Opal) occurs within vegetated coastal dunes, thus no suitable habitat within the subject property was found for these species to occur.

11.6 Araneae

No evidence was encountered of the Mygalomorphae arachnids (Trapdoor spiders) in the grassland habitat unit. After thorough searching no burrows were identified, and it should be noted that these species are notoriously difficult to detect.

12 FAUNAL RED DATA SPECIES ASSESSMENT

All the faunal species that were assessed during the calculation of the RDSIS for the site are included in Appendix B. However, only the species that was found to have a 60% or greater chance of being found on the site and therefore involved in the calculation of the sensitivity score are presented in the table below. Eight species were found to have a POC of 60% or greater, discussed in detail in the sections above.

Table 24: Threatened faunal species with a 60% or greater Probability of Occurrence (POC) on the subject property

Species	Common Name	Red List Status	POC
Miniopterus schreibersii	Schreiber's long-fingered bat	NT	58
Rhinolophus fumigatus	Ruppell's horseshoe bat	NT	61
Rhinolophus clivosus	Geoffroy's horseshoe bat	NT	61
Rhinilophus darlingi	Darling's horseshoe bat	NT	62
Rhinolophus denti	Dent's horseshoe bat	NT	61
Gyps africanus	African White-backed Vulture	NT	62
Gyps coprotheres	Cape Griffon (Cape vulture)	VU	61
Coracias garrulus	European Roller	NT	62

The eight species presented in the table above were then used to calculate the RDSIS for the site, the results of which are presented in the following table.

Table 25: Red Data Sensitivity Index Score calculated for the subject property.

Red Data Sensitivity Index Score	
Average Total Species Score	**47**
Average Threatened Taxa Score	**47**
Average (Ave TSS + Ave TT/2)	**47**
% Species greater than 60% POC	**27%**
RDSIS of Site	**37%**

The RDSIS assessment of the property provided a moderate score of 37%, indicating low to medium importance to RDL faunal species conservation within the region.

13 WETLAND ASSESSMENT RESULTS

13.1 Ecoregion and Ecostatus

The subject property is located in the Orange River catchment and the study area forms part of the quaternary catchment D41K, D41L and D41M. According to the ecological importance classification for the quaternary catchment, the D41K and M systems can be classified as a resilient system which, in its present state, can be considered a Class B (Largely natural) stream. The D41L system can be classified as a moderately sensitive system which, in its present state, can be considered a Class B (Largely natural) stream.

Studies undertaken by the Institute for Water Quality Studies assessed all quaternary catchments as part of the *Resource Directed Measures for Protection of Water Resources*. In these assessments, the Ecological Importance and Sensitivity (EIS), Present Ecological Management Class (PEMC) and Desired Ecological Management Class (DEMC) were defined, and serve as a useful guideline in determining the importance and sensitivity of aquatic ecosystems prior to assessment, or as part of a desktop assessment. This database was searched for the quaternary catchments of concern (D41K, D41L and K41M) in order to define the EIS, PEMC and DEMC. The findings are based on a study undertaken by Kleynhans (1999) as part of “A procedure for the determination of the ecological reserve for the purpose of the national water balance model for South African rivers”.

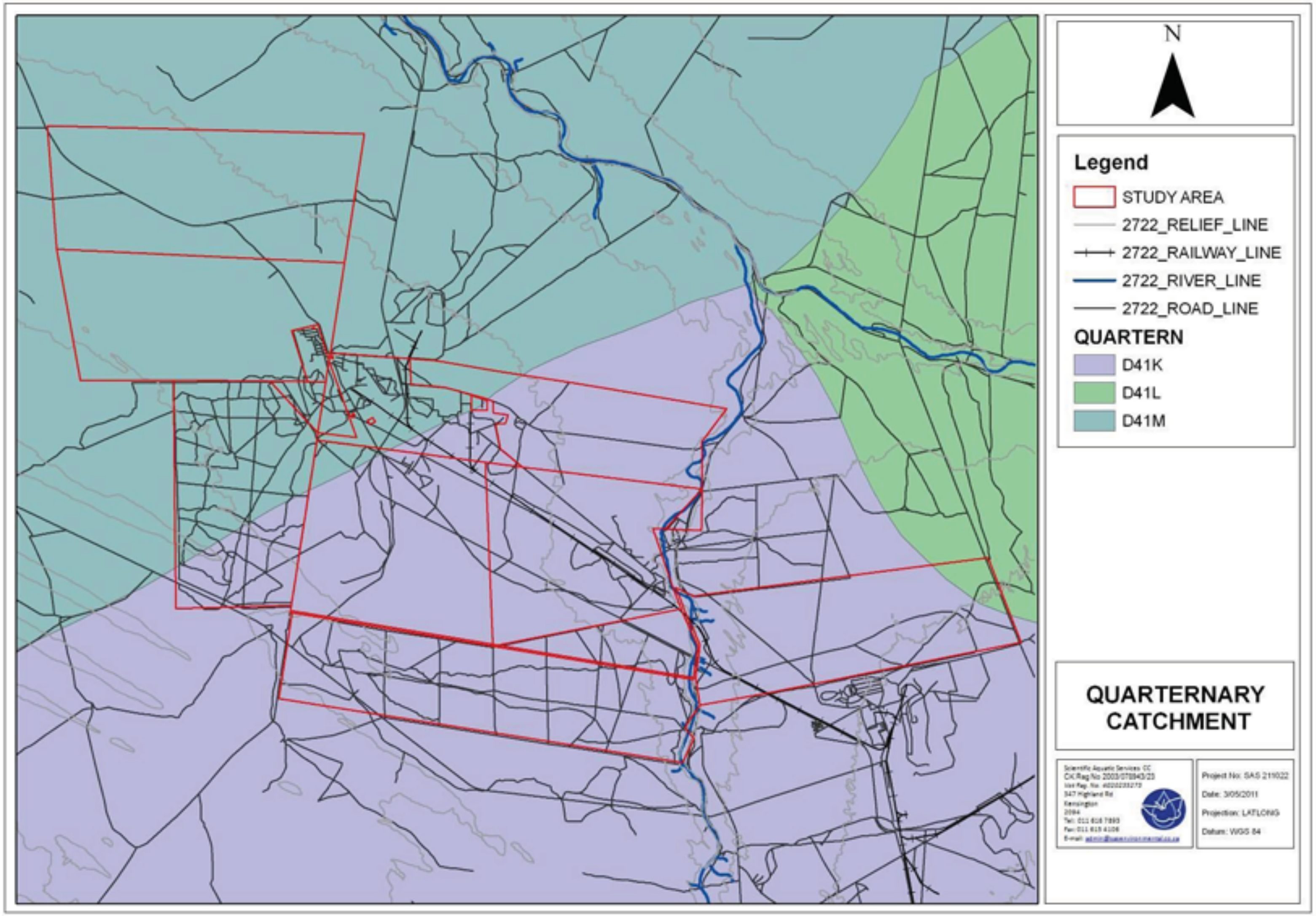


Figure 34: Quaternary Catchments pertaining to the subject property

The points below summarise the impacts on the aquatic resources in the **D41K** quaternary catchment (Kleynhans 1999):

- Moderately low impact on bed structure has occurred within the quaternary catchment mainly as a result of sediment.
- Moderately low flow modification has occurred within the system.
- There has only been a marginal impact in the catchment as a result of introduction of instream biota.
- Moderately low impact from inundation is evident at the present time within drainage systems.

In terms of ecological functions, importance and sensitivity, the following points summarise the conditions in the **D41K** quaternary catchment:

- The quaternary catchment provides a low diversity of habitat.
- The quaternary catchment has a low importance in terms of natural area conservation.
- The quaternary catchment is regarded as having very low importance for rare and endangered species conservation.
- The quaternary catchment is considered of low importance in terms of provision of migration routes in the instream and riparian environments.
- The quaternary catchment has a low importance in terms of providing refugia for aquatic community members.
- The quaternary catchment can be considered to have marginal sensitivity to changes in water quality and flow.
- The quaternary catchment is of low importance in terms of species richness.

The points below summarise the impacts on the aquatic resources in the **D41L** quaternary catchment (Kleynhans 1999):

- Moderately low impact on bed structure has occurred within the quaternary catchment as a result of sediment.
- Moderately low flow modification has occurred within the system.
- There has only been a marginal impact in the catchment as a result of introduction of instream biota with special mention of the fish species *Cyprinus carpio*.
- Moderately low impact from inundation is evident at the present time within the drainage systems.

In terms of ecological functions, importance and sensitivity, the following points summarise the conditions in the **D41L** quaternary catchment:

- The quaternary catchment provides a moderate diversity of habitat.
- The quaternary catchment has a high importance in terms of natural area conservation.
- The quaternary catchment is regarded as having a low importance for rare and endangered species conservation.
- The quaternary catchment is considered of low importance in terms of provision of migration routes in the instream and riparian environments.
- The quaternary catchment has a high importance in terms of providing refugia for aquatic community members.
- The quaternary catchment can be considered to have high sensitivity to changes in water quality and flow.
- The quaternary catchment is of moderate importance in terms of species richness.

The points below summarise the impacts on the aquatic resources in the **D41M** quaternary catchment (Kleynhans 1999):

- Moderately low impact on bed structure has occurred within the quaternary catchment as a result of sediment.
- Moderately low flow modification has occurred within the system.
- There has only been a marginal impact in the catchment as a result of introduction of instream biota.
- Moderately low impact from inundation is evident at the present time within the drainage systems.

In terms of ecological functions, importance and sensitivity, the following points summarise the conditions in the **D41M** quaternary catchment:

- The quaternary catchment provides a low diversity of habitat.
- The quaternary catchment has a low importance in terms of natural area conservation.
- The quaternary catchment is regarded as having marginal importance for rare and endangered species conservation.
- The quaternary catchment is considered of low importance in terms of provision of migration routes in the instream and riparian environments.

- The quaternary catchment has a low importance in terms of providing refugia for aquatic community members.
- The quaternary catchment can be considered to have marginal sensitivity to changes in water quality and flow.
- The quaternary catchment is of low importance in terms of species richness.

13.2 Wetland System Characterisation

Two features were identified, one of which is located within the eastern-portion of the Black Rock Mine surface rights area, namely the Ga Magara River and one located within the decommissioned Perth Mine considered a tributary of the Ga Magara River namely the Witleegte River. Both features had similar characteristics and were therefore considered one system, as discussed below. It should be noted that ponding due to historical mining activities within the open cast areas of the Perth Mine is not considered natural and was therefore not included within this assessment; however less impacted areas upstream and downstream did form part of this assessment.

The feature was categorised with the use of the *Wetland System Characterisation Methodology*. The results are illustrated in the figure below. It should be noted that some discrepancies may exists mainly due to significant transformation within the system resulting in a riparian area that could have historically been classified as a upper perennial system with water surface present but the decrease in water within the system led to a significant change in river characteristics. The system characterisation results are however considered representative of the river at the time of the assessment.

RIVERINE SYSTEM:		LOWER PERRENIAL:		NON-VEGETATED
Wetlands contained within channels.	→	Substrate consists mainly of mud and sand.	→	Includes surfaces with less than 30% surface area cover of vegetation other than pioneer species.

Figure 35: Wetland categorisation for the wetland feature.

13.3 River Function Assessment

River function and service provision were assessed within the study area. The average score for the river is presented in the following table as well as the radar plot in the figure that follows the table.

Table 26: Riparian functions and service provision.

ECOSYSTEM SERVICE	
Flood attenuation	1.4
Streamflow regulation	1
Sediment trapping	1.8
Phosphate assimilation	0.6
Nitrate assimilation	0
Toxicant assimilation	1.1
Erosion control	1
Biodiversity maintenance	1.2
Carbon Storage	0
Water Supply	0.8
Harvestable resources	0.8
Cultivated foods	0
Tourism and recreation	0.5
Education and resource	1
SUM	**11.2**
Average score	**0.8**

From the results of the assessment, it is evident that the wetland feature overall has a moderately low level of ecological function and service provision. The wetland feature is the most important in terms sediment trapping and flood attenuation, however these two results can also be considered significantly low. Historically the Ga Magara River could have been very important in terms of function and service provision within the region, however dewatering caused by mining activity upstream resulted in less water entering the system and overtime a shift from riparian to terrestrial ecological conditions. The system no longer supports any aquatic ecological activity and the absence of water will most likely have affected terrestrial species to some degree which relied on the system as a source of drinking water or for breeding such as in the case of amphibians.

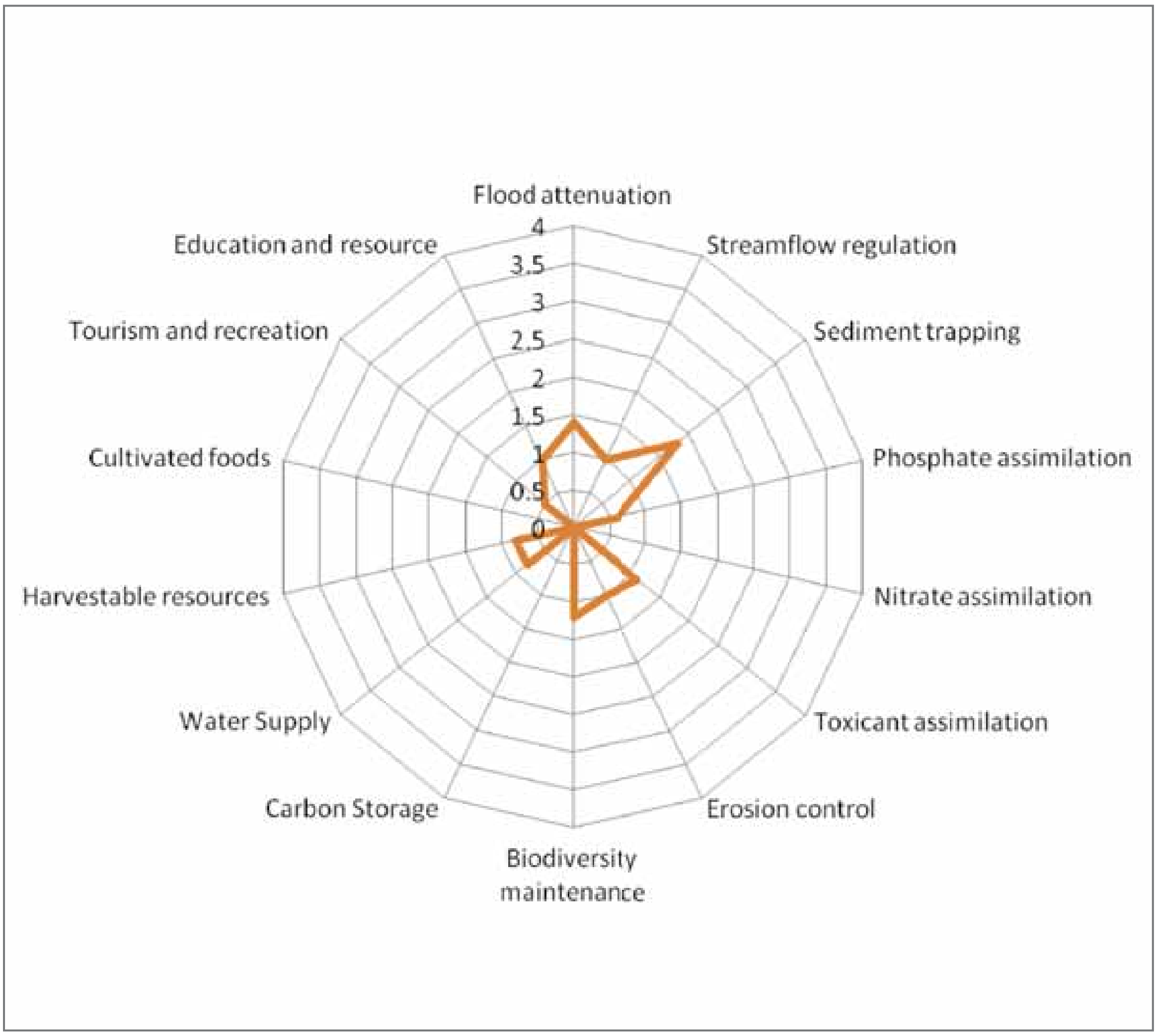


Figure 36: Radar plot of wetland services provided.

13.4 Present Ecological State

The result for the criteria and attributes used for the calculation of the PES is stipulated in the table below.

Table 27: Criteria and Attributes used with the calculation of the PES.

	Wetland feature	
Criteria and Attributes	**Score**	**Confidence**
Hydrologic		
Flow modification	0	4
Permanent Inundation	3	2
Water quality		
Water Quality Modification	3	3
Sediment load modification	3	3
Geomorphic		
Canalisation	2	3
Topographic Alteration	3	3
Biota		
Terrestrial Encroachment	0	4
Indigenous Vegetation Removal	2	3
Invasive plant encroachment	1	3
Alien fauna	4	4
Overutilisation of biota	4	4
Total	**25**	
Mean	**2**	

The mean score obtained calculated a moderately low score of 2, indicating the PES falls within class D – largely modified.

13.5 Ecological Management Class

The results obtained from the wetland feature assessment indicate relatively high presence of transformation on all levels of ecology and functionality. If water flow within the system could have been increased and the overall state of riparian ecology reinstated it would have been reasonable to set the EMC class at C (moderately modified), however due to persisting dry conditions expected in the future it is deemed appropriate if the EMC class remain the same class D (largely modified).

13.6 Wetland delineation and sensitivity mapping

During the assessment, the following temporary zone indicators were used:

- Dewatering caused by mining activity upstream resulted in less water entering the system and a shift from a riparian vegetation community to terrestrial; in turn leading to a decrease in floral species expected to occur in riparian habitats. However, isolated species such as *Setaria sphacelata* var. *sphacelata* and *Cymbopogon excavates* were still indicative of the temporary zone in less disturbed areas and was used as primary wetland indicators.

- Terrain units were useful in identifying the temporary zone boundary and used as secondary wetland indicator.
- No surface water is currently present within the permanent zone of the Ga Magara River therefore surface water as temporary zone indicator was of limited use.
- Soil form as indicator was of limited use due to sandy soil conditions increased by dewatering upstream as well as prolonged disturbance within the system.

Upon the assessment of the area, the various wetland vegetation components were assessed. Dominant species were characterised as either wetland or terrestrial species. The wetland species were then further categorised as temporary, seasonal and permanent zone species. This characterisation is presented in the table below, including the terrestrial species identified on the subject property. Due to no surface water in the system no permanent zone species were identified at the time of the assessment.

Table 28: Floral species identified during wetland zone delineation

Terrestrial species	Temporary zone species	Seasonal zone species	Permanent zone species
Aristida congesta subsp congesta	*Setaria sphacelata var sphacelata*	*Setaria verticillata*	
Eragrostis lehmanniana	*Cymbopogon excavatus*	*Setaria sphacelata var sphacelata*	
Schmidtia pappophoroides	*Grewia flava*	*Cynodon dactylon*	
Aristida meridionalis			

Table 29: Summary of the wetland feature.

Item	Description
Site number	1
Quaternary catchment	D41K, D41L and K41M
Aquatic ecoregion	Oranje ecoregion
Vegetation type	Gordonia Duneveld
System Modifiers	Chemical
Wetland system characterisation	Riverine system; Lower perennial; Non-vegetated
Wetland function and service provision	Moderately low
Present Ecological State	Class D – largely modified
Ecological Management Class	Class D - largely modified
Wetland soil	Wetland soil conditions of limited use during the delineation.
Wetland vegetation	The figure below depicts the increase in *Grewia flawa* encountered during the wetland assessment.  Areas dominated by *Cynodon dactylon* (figure below); no other grass species encountered within this area. *Cynodon dactylon* is an invading grass species dominating previously disturbed areas. 

Surface water	No surface water was noted during the assessment.
Terrain units	Terrain units evident in the photograph below. 

A recommended buffer of 32 meters for the riparian feature is advocated that will aid in the conservation of habitat within the subject property and will also help to ultimately achieve the ecological management class of the wetland feature as determined by the *South African Wetland Assessment Classification System,* sections above. The location of the features in relation to the Black Rock Mine and Perth Mine is conceptually depicted in the figure below.

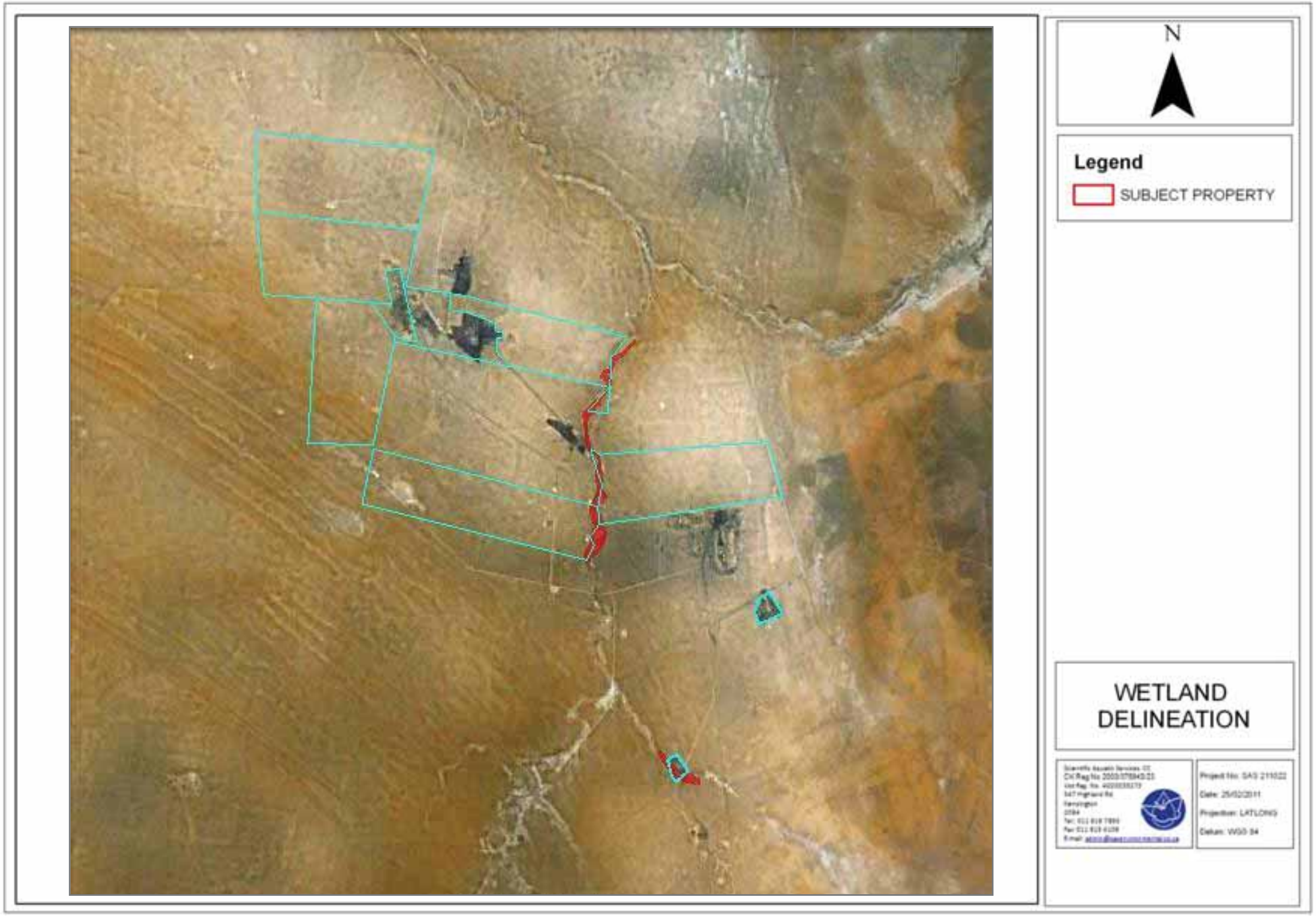


Figure 37: Location of the two features in relation to the subject property.

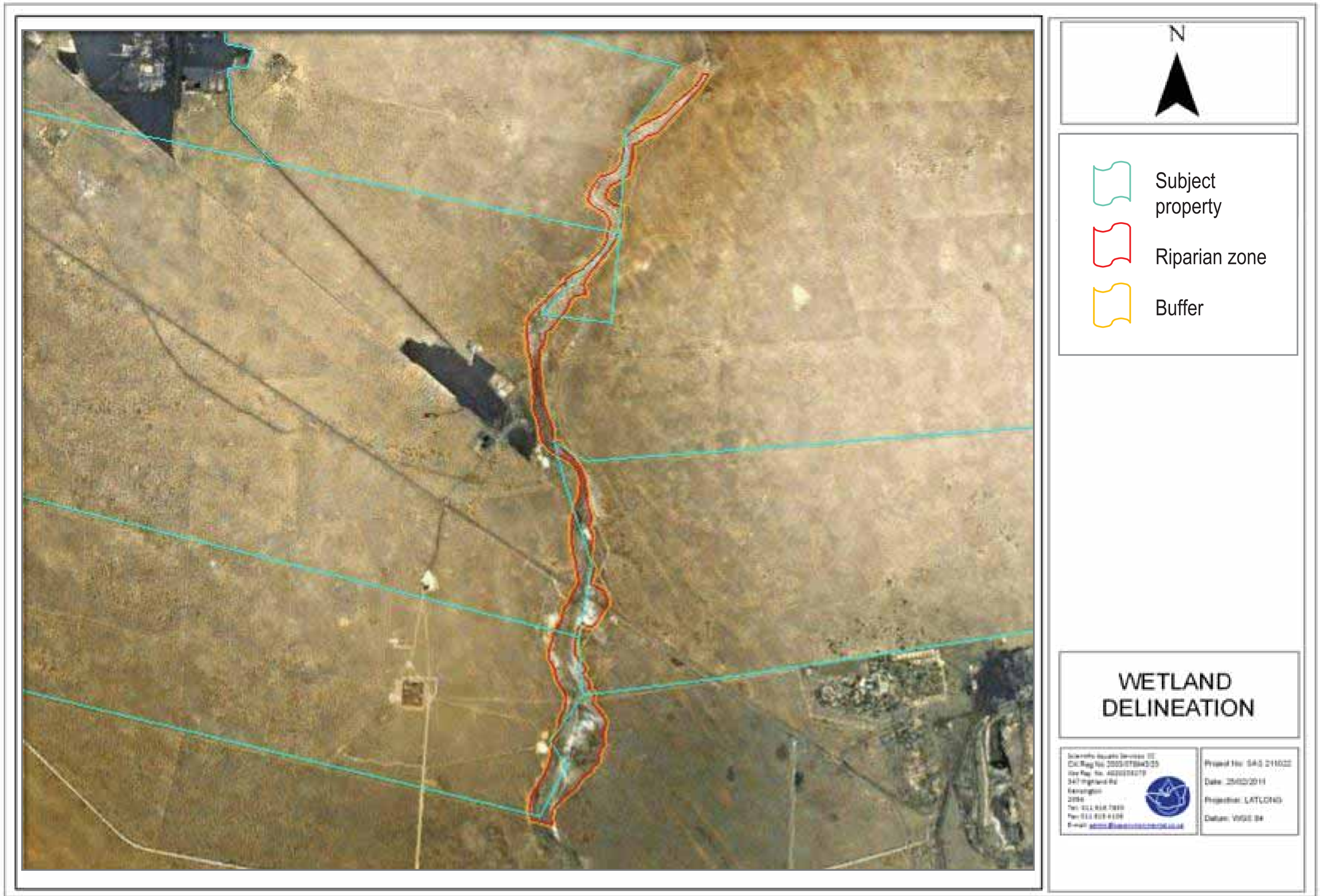


Figure 38: Riparian feature with buffer within the Black Rock Mine surface rights area.

Figure 39: Riparian feature with buffer within the Perth Mine.

14 BIODIVERSITY STATUS DETERMINATIONS

Following the methodology as described in Section 5.5, the Biodiversity Status (BS) for each management unit was calculated. The BS and objectives for each of the management units are set out below.

14.1 Belgravia game farm

Table 30: EIS and HUV Value Calculation for the Belgravia game farm.

Ecological Sensitivity and Importance			
EI	**FL**	**CV**	**ESI**
9	12	12	11
Human Use Value			
SV	**AV**	**RV**	**HUV**
6	6	9	7

Table 31: Biodiversity Status (BS) Combination Matrix for the Belgravia game farm.

	HUV			
ESI	**Very high HUV**	**High HUV**	**Moderate HUV**	**Low HUV**
Very high ESI	Very high	**Very high**	Very high	High
High ESI	Very high	High	High	Moderate
Moderate ESI	High	Moderate	Moderate	Low
Low ESI	Moderate	Moderate	Low	Low

Table 32: Biodiversity Status and Specific Objectives for Belgravia game farm.

Very high BS	Preserve and enhance the biodiversity of the system, maintain genetic and ecosystem diversity.

14.2 Footprint Areas

Table 33: EIS and HUV Value Calculation for Footprint Areas

Ecological Sensitivity and Importance			
EI	**FL**	**CV**	**ESI**
3	3	3	3
Human Use Value			
SV	**AV**	**RV**	**HUV**
3	3	3	3

Table 34: Biodiversity Status (BS) Combination Matrix for Footprint Areas

	HUV			
ESI	**Very high HUV**	**High HUV**	**Moderate HUV**	**Low HUV**
Very high ESI	Very high	Very high	Very high	High
High ESI	Very high	High	High	Moderate
Moderate ESI	High	Moderate	Moderate	Low
Low ESI	Moderate	Moderate	Low	Low

Table 35: Biodiversity Status and Specific Objectives for Footprint Areas

Low BS	Optimise human use value while improving biodiversity levels of the specific system.

14.3 Open grassland

Table 36: EIS and HUV Value Calculation for Open grassland.

Ecological Sensitivity and Importance			
EI	FL	CV	ESI
6	6	6	6
Human Use Value			
SV	AV	RV	HUV
6	6	3	5

Table 37: Biodiversity Status (BS) Combination Open grassland.

	HUV			
ESI	**Very high HUV**	**High HUV**	**Moderate HUV**	**Low HUV**
Very high ESI	Very high	Very high	Very high	High
High ESI	Very high	High	High	Moderate
Moderate ESI	High	Moderate	Moderate	Low
Low ESI	Moderate	Moderate	Low	Low

Table 38: Biodiversity Status and Specific Objectives for Open grassland.

Moderate BS	Preserve and enhance biodiversity and optimise human use value

14.4 Riparian system

Table 39: EIS and HUV Value Calculation for Riparian system

Ecological Sensitivity and Importance			
EI	FL	CV	ESI
3	3	6	4
Human Use Value			
SV	AV	RV	HUV
3	6	3	4

Table 40: Biodiversity Status (BS) Combination Matrix for Riparian system

	HUV			
ESI	**Very high HUV**	**High HUV**	**Moderate HUV**	**Low HUV**
Very high ESI	Very high	Very high	Very high	High
High ESI	Very high	High	High	Moderate
Moderate ESI	High	Moderate	**Moderate**	Low
Low ESI	Moderate	Moderate	Low	Low

Table 41: Biodiversity Status and Specific Objectives for Riparian system

Moderate BS	Preserve and enhance biodiversity and optimise human use value

15 ASSESSMENT OF IMPACT SIGNIFICANCE

The tables below serve to summarise the significance of perceived impacts on the floral biodiversity of the subject property. The table presents the impact assessment according to the method described above. The table also indicates the required mitigatory measures needed to minimise the impact. The table presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures; assuming that they are fully implemented.

15.1 Activity Related Impacts

IMPACT 1: IMPACT ON THE RIPARIAN AREAS

IMPACT 1A: ENCROACHMENT OF INFRASTRUCTURE ON THE RIPARIAN AREAS

- The encroachment of infrastructure or construction/operational waste materials into riparian areas can affect the habitat integrity of these areas.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
4 Life of operation	2 Unlikely	4 Harmful	4 Regional	5 Permanent	Medium high (negative)
Score	-6	-13			-78

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
4 Life of operation	1 Almost never	4 Harmful	4 Activity specific	5 Post closure	Medium low (negative)
Score	-5	-13			-65

Any impacts which occur will be activity specific and for a long duration and impacts will occur throughout the life cycle of the project, however the impact is unlikely. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are significantly reduced to a medium-low level.

IMPACT 1B: IMPACT ON THE RIPARIAN AREAS DUE TO SEEPAGE AND SPILLAGES

- Seepage from facilities such as MRD's RWD's, general dirty water areas as well as spillages of hydrocarbons, has the potential to contaminate the groundwater environment which in turn can affect water quality in surface water sources in the area.

Phase of the mining operation

Construction	**Operational**	**Decommissioning**	**Closure**

Impact significance before mitigation

Likelihood		**Consequence**			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
2 Six monthly	3 Infrequent	4 Harmful	3 Local area	5 Post closure	Medium low (negative)
Score	-5	-12			-60

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
1 Low	2 Highly unlikely	2 Potentially harmful	3 Local area	5 Post closure	Low (negative)
Score	-3	-10			-30

Any impacts which occur will affect the local area for a long duration and impacts may occur throughout the life cycle of the project. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts can be reduced to a low level.

IMPACT 1C: IMPACT DUE TO VEHICLES ON THE RIPARIAN AREAS

- Vehicles may impact upon sensitive riparian areas during rehabilitation, resulting in a loss of habitat.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
4 Likely	4 Often	3 Significant	2 Mine specific	4 Life of operation	Medium low (negative)
Score	-8	-9			-72

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
2 Very seldom	2 Highly unlikely	2 Small	2 Mine specific	3 One year to ten years	Low (negative)
Score	-4	-7			-28

Any impacts which occur due to rehabilitation will be activity specific and for a long duration and impacts will occur throughout the life cycle of the project. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are significantly reduced to a low level.

IMPACT 1D: INEFFECTIVE REHABILITATION MAY IMPACT ON THE RIPARIAN AREAS

- Ineffective rehabilitation of riparian areas could cause siltation and changes in the hydrological functioning of these areas.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
2 Six monthly	2 Highly unlikely	3 Significant	1 Activity specific	2 One month to one year	Very low (negative)
Score	-4	-6			-24

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
1 Low	1 Almost never	2 Potentially harmful	1 Activity specific	2 One month to one year	Very low (negative)
Score	-2	-5			-10

Any impacts which occur will be activity specific and for a period of one month to a year, impacts have a low possibility of occurring throughout the life of the mine and rehabilitation. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are reduced.

IMPACT 2: IMPACTS ON FLORAL BIODIVERSITY

IMPACT 2A: INDISCRIMINATE FIRES AND INEFFECTIVE MONITORING MAY IMPACT ON FLORAL BIODIVERSITY

- Indiscriminate fires by construction personnel may lead to uncontrolled fires, impacting on floral communities of the property.
- Ineffective monitoring of the burning regime could lead to either destruction of existing plant communities or in the case of decreased burning frequency, dead organic matter build-up, preventing establishment of healthy plant communities. This will lead to a decrease in the availability of fodder for herbivores and may also pose a physical threat to the safety of fauna on the property.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 Annually	-1 Almost never	-3 Significant	-2 Mine specific	-1 One day to one month	Very low (negative)
Score	-2	-6			-12

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Frequency of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 Annually	-1 Almost never	-1 Insignificant	-1 Activity specific	-1 One day to one month	Very Low (negative)
Score	-2	-3			-6

Any impacts which occur will be mine specific and for a relatively short duration and impacts could occur annually in the drier season. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are reduced.

IMPACT 2B: DESTRUCTION OF HABITAT MAY IMPACT ON FLORAL BIODIVERSITY

- Mining related activities may lead to destruction of habitat and overall loss of biodiversity through expansion activities, road construction, waste facilities etc.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-5 Permanent	-5 Definitely	-4 Great	-2 Mine specific	-4 Life of operation	Medium high (negative)
Score	-10	-10			-100

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-4 Likely	-2 Highly unlikely	-2 Small	-2 Mine specific	-4 Life of operation	Low (negative)
Score	-6	-8			-48

Any impacts which occur will be activity specific and for a long duration and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are significantly reduced to a low level.

IMPACT 2C: IMPACTS DUE TO DUST ON FLORAL BIODIVERSITY

- Dust generated by ineffective rehabilitation of exposed areas may impact on the floral characteristics of the property.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-5 Daily	-5 Daily	-3 Significant	-2 Mine specific	-4 Life of operation	Medium to high (negative)
Score	-10	-9			-90

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-3 Seldom	-1 Insignificant	-1 Activity specific	-1 One day to one month	Very Low (negative)
Score	-6	-8			-12

Any impacts which occur will have a mine specific affect for the life of the operation and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are significantly reduced to a low level.

IMPACT 2D: IMPACTS ON FLORAL BIODIVERSITY DUE TO ALIEN FLORAL SPECIES

- Construction and introduction of foreign material e.g. soils may lead to the further introduction of alien floral species, impacting on the floral characteristics of the subject property.
- Ineffective removal of alien invader species and exposed areas could lead to re-establishment of invasive species and the formation of nodes of distribution, impacting on floral community rehabilitation efforts.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-5 Daily	-5 Daily	-4 Great	-3 Local area	-5 Post closure	High (negative)
Score	-10	-12			-120

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-5 Daily	-5 Daily	-4 Great	-2 Mine specific	-4 Life of operation	Medium to High (negative)
Score	-10	-10			-100

Any impacts which occur will have an effect on the local area and for a very long duration. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts, are significantly reduced from a high level to a medium high level.

IMPACT 2E: IMPACTS ON FLORAL BIODIVERSITY DUE TO TERRESTRIAL FLORAL SPECIES ENCROACHMENT

- Ineffective removal and monitoring of terrestrial floral species such as *Acacia mellifera* and *Verbesina enceliodes* in disturbed areas.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-5 Daily	-5 Daily	-4 Great	-3 Local area	-5 Post closure	High (negative)
Score	-10	-12			-120

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-5 Daily	-5 Daily	-4 Great	-2 Mine specific	-4 Life of operation	Medium to High (negative)
Score	-10	-10			-100

Any impacts which occur will have an effect on the local area and for a very long duration. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts, are significantly reduced from a high level to a medium high level.

IMPACT 3: IMPACT ON RDL AND MEDICINAL FLORAL SPECIES

All mining related activities that may impact on the RDL floral community of the study area are discussed below.

IMPACT 3A: IMPACT ON RDL AND MEDICINAL FLORAL SPECIES DUE TO COLLECTION

- There is the potential for collection of RDL species in the area which will lead to increased impact on these populations.
- Increased potential for harvesting pressure on medicinal plant species such as *Harpagophytum procumbens.*
- With the increased population in the area there may be a potential for increased firewood collection with special mention of *Acacia erioloba.*

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-4 Weekly	-4 Often	-3 Great	-3 Local area	-4 Life of operation	Medium high (negative)
Score	-8	-10			-80

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-1 Almost never	-1 Insignificantly	-1 Activity specific	-3 One to ten years	Very Low (negative)
Score	-2	-5			-6

Any impacts which occur will affect the local area for a long duration and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are significantly reduced from a medium high level to a very low level.

IMPACT 3B: IMPACT ON RDL AND MEDICINAL FLORAL SPECIES DUE TO UNPLANNED REMOVAL AND HABITAT DESTRUCTION

- Large scale mining activities in certain areas such as open veld areas may lead to the loss of RDL floral taxa which rely on specific areas in the landscape for survival.
- Unplanned removal of protected floral species during mining expansion activities will lead to a loss of communities within the study area and impact on overall diversity within the region.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-3 Infrequent	-5 Daily	-3 Significant	-2 Mine specific	-5 Permanent	Medium high (negative)
Score	-8	-11			-88

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-2 Temporary	-2 Very seldom	-3 Significant	-1 Activity specific	-3 One to ten years	Low (negative)
Score	-4	-7			-28

Any impacts which occur will be mine specific and permanent. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts, are significantly reduced from a medium high level to a low level.

IMPACT 3C: IMPACT ON RDL AND MEDICINAL FLORAL SPECIES DUE TO INDISCRIMINATE FIRES

- Indiscriminate fires by personnel may lead to uncontrolled fires, impacting on available habitat for RDL species and RDL community.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-1 Almost never	-3 Significant	-2 Mine specific	-1 One day to one month	Very low (negative)
Score	-	-6			-12

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-1 Almost never	-1 Insignificant	-1 Activity specific	-1 One day to one month	Very low (negative)
Score	-2	-3			-6

Any impacts which occur will be mine specific and for a relatively short duration and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts, are significantly reduced.

IMPACT 4: IMPACTS ON FAUNAL BIODIVERSITY

All mining related activities that may impact on the faunal community of the study area are discussed below.

IMPACT 4A: IMPACTS ON FAUNAL BIODIVERSITY DUE TO INDISCRIMINATE FIRES AND POACHING / TRAPPING

- Indiscriminate fires by construction personnel may lead to uncontrolled fires, impacting on floral communities of the property.
- Poaching and trapping due to increased human activity in the area may lead to increased impacts on the faunal resources of the area.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-2 Temporary	-4 Infrequent	-3 Significant	-3 Local area	-4 Life of operation	Medium to low (negative)
Score	-6	-10			-60

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-1 Almost never	-1 Insignificant	-1 Activity specific	-3 One year to ten years	Very low (negative)
Score	-62	-5			-10

Any impacts which occur will occur within the local area and for life of the operation and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts, are significantly reduced from medium low to a very low level.

IMPACT 4B: IMPACTS ON FAUNAL BIODIVERSITY DUE TO MINING ACTIVITIES LEADING TO HABITAT DESTRUCTION AND LOSS OF MIGRATORY ROUTES

- Mining related activities may lead to destruction of habitat and overall loss of biodiversity.
- Impacts on habitat may lead to a loss of migratory routes of more mobile species.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-5 Daily	-5 Daily	-3 Significant	-2 Mine specific	-4 Life of operation	Medium to high (negative)
Score	-10	-9			-90

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-2 Likely	-2 Highly unlikely	-2 Small	-2 Mine specific	-2 Life of operation	Very low (negative)
Score	-4	-6			-24

Any impacts which occur will be mine specific and for a long duration and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts, are significantly reduced from a medium to high level to a low level.

IMPACT 4C: IMPACTS ON FAUNAL BIODIVERSITY DUE TO INTRODUCTION OF ALIEN INVADER SPECIES

- Construction and introduction of foreign material e.g. soils may lead to the further introduction of alien invader species, impacting on the availability of food for grazing and browsing fauna.
- Ineffective removal of alien invader species and exposed areas could lead to re-establishment of invasive species, impacting on food availability for grazing and browsing fauna.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-2 Temporary	-4 Regularly	-3 Significantly	-3 Local area	-5 Post closure	Medium to high (negative)
Score	-6	-11			-66

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-2 Very seldom	-2 Small	-2 Mine specific	-2 One month to a year	Very low (negative)
Score	-6	-8			-18

Any impacts which occur will influence the local area for a long duration. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts, are significantly reduced from a medium high level to a very low level.

IMPACT 4D: IMPACTS ON FAUNAL BIODIVERSITY DUE TO NOISE GENERATION

- Noise generated by blasting and mining activities may impact on the faunal integrity of the property.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-4 <Life of operation	-4 Regularly	-2 Small	-3 Local area	-1 One day to one month	Low (negative)
Score	-8	-6			-48

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-1 Almost never	-1 Insignificant	-1 Activity specific	-1 One day to one month	Low (negative)
Score	-6	-8			-48

Any impacts which occur will impact on the local area for a relatively short duration and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are reduced.

IMPACT 4E: IMPACTS ON FAUNAL BIODIVERSITY DUE TO DUST GENERATION AND INHALATION

- Dust generated by ineffective rehabilitation of exposed areas may impact on the floral characteristics of the property which in turn could have an impact on possible grazing habitat of faunal species.
- Dust inhaled by faunal species over extended periods of time may have an impact on their health.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-4 Life of operation	-4 Regularly	-2 Small	-2 Mine specific	-4 Life of operation	Medium to low (negative)
Score	-8	-8			-64

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-1 Very seldom	-1 Insignificant	-1 Activity specific	-1 One day to one month	Very low (negative)
Score	-2	-3			-6

Any impacts which occur will influence the mining area for a long duration. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts, are significantly reduced from a medium low level to a very low level.

IMPACT 5: IMPACT ON RDL FAUNAL SPECIES

All mining related activities that may impact on the floral community of the study area are discussed below.

IMPACT 5A: IMPACT ON RDL FAUNAL SPECIES DUE TO INDISCRIMINATED FIRES

- Indiscriminate fires by construction personnel may lead to uncontrolled fires, impacting on RDL faunal communities of the property with specific mention of the open veld habitat unit and the Belgravia game farm.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-2 Temporary	-3 Seldom	-2 Potentially harmful	-2 Mine specific	-2 One month to one year	Low (negative)
Score	-5	-6			-30

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-1 Almost never	-1 Insignificant	-1 Activity specific	-1 One day to one month	Very low (negative)
Score	-2	-3			-6

Any impacts which occur will be mine specific and for a relatively short duration and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts, are reduced from a low level to a low level.

IMPACT 5B: IMPACT ON RDL FAUNAL SPECIES DUE TO THE COLLECTION OF RDL SPECIES

- There is the potential for collection of RDL species in the area which will lead to increased impact on these populations.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-2 Temporary	-3 Seldom	-4 Great	-3 Mine specific	-1 One day to one month	Low (negative)
Score	-5	-8			-40

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
1 <Annually	2 Highly unlikely	2 Small	2 Mine specific	4 Life of operation	Very Low (negative)
Score	-3	-8			-24

Any impacts which occur will be activity and locally specific and for a long duration and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are significantly reduced to a low level.

IMPACT 5C: IMPACT ON RDL FAUNAL SPECIES DUE TO MINING ACTIVITIES CAUSING LOSS OF RDL TAXA

- Large scale mining activities in certain areas such as open pit areas may lead to the loss of RDL faunal taxa which rely on specific areas in the landscape for survival. Examples of this include Ridges and wetlands.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
4 Likely	4 Likely	4 Great	3 Local area	4 Life of operation	Medium high (negative)
Score	-8	-11			-88

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
4 Likely	2 Highly unlikely	2 Small	2 Mine specific	4 Life of operation	Low (negative)
Score	-6	-8			-48

Any impacts which occur will impact the local area for a long duration and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are significantly reduced to a low level.

IMPACT 6: SOIL IMPACTS

Impacts on topsoil stockpiles are discussed below.

IMPACT 6A: IMPACT ON SOIL DUE TO EROSION

- Erosion of topsoil during construction may impact on floral species composition and suitable habitat of the property.
- Erosion of topsoil stockpiles may lead to a loss of soil required for rehabilitation work.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-1 Almost never	-1 Insignificant	-1 Activity specific	-1 One day to one month	Very low (negative)
Score	-2	-3			-6

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-1 Almost never	-1 Insignificant	-1 Activity specific	-1 One day to one month	Very low (negative)
Score	-2	-3			-6

Any impacts which occur will be activity specific and for a short duration, but are however unlikely to happen. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are unlikely to change to a lower level.

IMPACT 6B: IMPACT ON SOIL DUE TO CONTAMINATION

- Soils may become contaminated by specific problem substances as well as general salinisation and through changes in pH which could lead to changes in soil productivity, species composition, diversity dominance and abundance.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-4 Regularly	-5 Daily	-3 Significant	-2 Mine specific	-4 Life of operation	Medium to high (negative)
Score	-9	-9			-81

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-1 <Annually	-2 Very seldom	-2 Small	-1 Activity specific	-1 One day to one month	Very low (negative)
Score	-3	-4			-12

Any impacts which occur will be mine specific and for a long duration and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are, significantly reduced from a medium high level to a very low level.

IMPACT 7: INEFFECTIVE REHABILITATION

Impacts on overall biodiversity as a result of ineffective rehabilitation are discussed below.

IMPACT 7A: INEFFECTIVE REHABILITATION AND MONITORING AS WELL AS IMPACT BY VEHICLES ON SENSITIVE AREAS

- Ineffective rehabilitation and monitoring of disturbed areas could lead to loss of species diversity.
- Vehicles may impact upon sensitive riparian areas during rehabilitation, resulting in a loss of habitat.

Phase of the mining operation

Construction	Operational	Decommissioning	Closure

Impact significance before mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-5 Daily	-5 Daily	-4 Great	-3 Local area	-5 Permanent	High (negative)
Score	-10	-12			-120

Impact significance after mitigation

Likelihood		Consequence			
Frequency of activity	*Freq of impact*	*Benefit/Severity of impact*	*Spatial/Population Scope*	*Duration*	*Rating*
-4 Life of operation	-3 Infrequent	-3 Significant	-2 Mine specific	-4 Life of operation	Medium to low (negative)
Score	-7	-9			-63

Any impacts which occur will affect the local area permanently and are likely to affect the receiving environment. If mitigation measures are implemented, the likelihood of impacts occurring and the consequence of the impacts are significantly reduced from a high level to a medium to low level.

15.2 Impact Assessment Conclusion

The table below serves as a summary of the key findings made during the impact assessment process.

Table 42: Summary of impact significance.

Significance Rating	Very High	High	Medium-High	Medium-Low	Low	Very Low
Pre-Mitigation	0	3	9	4	3	4
Post-Mitigation	0	0	2	2	6	13

The majority of the negative impacts associated with the facility will be experienced during the lifetime of the project, most of which are predicted to have a medium to high significance. It is envisaged that impacts can be well mitigated leading to medium to low significance for most impacts.

Mitigation measures are set out below as part of the Biodiversity Action Plan. It is envisaged that these measures are sufficient to effectively manage the negative impacts that the project may have on biodiversity resources in the area.

15.3 Cumulative Impacts

Cumulative impacts can be described as an accumulation of existing and future impacts from all activities within the region. These impacts may combine and exacerbate an already problematic impact. Possible cumulative impacts on the biodiversity of the subject property that may result from the mining operations are:

- Destruction of habitat through encroachment of mining activities into areas considered of higher sensitivity such as open veld, the Belgravia Game Reserve as well as habitat associated with the Ga Magara River system.
- Loss of species diversity with special mention of RDL species identified during the assessment as well as a loss of available habitat in addition to the loss of habitat due to farming related activities.
- Dust and noise generated may affect faunal habitat already decreased by mining footprint.
- Loss of migratory routes of more mobile faunal species. The mining area is presently fenced off.
- Loss of overall biodiversity as a result of cumulative impacts of other mining entities located around the Black Rock surface rights area. Cumulative impacts as a result of Black Rock, Wessels, Kalagadi Manganese and Mamatwan Mines in close proximity to

each other may lead to mining related impacts greater than what can be expected for only mine; such as migratory corridors, amount of dust generated as well as loss of habitat within the region.

Overall cumulative impacts on faunal and floral resources during the lifetime of the mine are deemed significant and relative action plans need to be implemented for future conservation of faunal and floral species within the area. The degree to which long term impacts occur will be determined by the post closure land use of the area as well as the level of rehabilitation that takes place.

16 BIODIVERSITY ACTION PLAN

The biodiversity action plans are set out below in Table 14. Factors that will need to be considered with respect to implementation of these plans include the following:

- integration into local municipal policy and plans as well as relevant Spatial Development Plans;
- integration into existing group policy and management systems, including the Biodiversity and Land Management Plan, Closure Plan and Environmental Management Plan;
- identification and liaison with stakeholders and neighbouring properties especially with respect to weed/invader and erosion control action plans and;
- post closure land use;
- available budget and manpower for implementation, management and maintenance.

It is also important that some measurements of the biodiversity actions are carried out to determine the effectiveness of plans, and to justify the costs and the allocation of time and manpower to such an exercise. It is therefore suggested that a fixed-point monitoring system be developed for each of the sites where ecosystem variables such as species diversity, species abundance, crown and basal cover can be recorded on an annual basis. This could include fixed-point photography methods as a further means of documenting change. To further add value to the biodiversity and land management plan, specialist studies can be conducted within the identified site, either as stand-alone specialist studies or as part of a sponsored/funded research program. Specific field studies could include avifaunal, invertebrate, reptile and floral species studies as species diversity of these taxa are likely to be highly variable as a result of seasonal changes.

The integration of biodiversity principles and the actions being undertaken by the group should also be implemented into the training and environmental education of staff. Training could include general aspects, such as the importance of biodiversity, and could extend to specialist training in the construction of firebreaks.

The biodiversity action plans should also tie in with the closure plan and objectives for the mine and associated areas. These objectives should address all aspects of the operation, including soil and water related aspects and provide, at least, broad commitments. The overall strategic objective of any closure plan can be summarised as being remediation of the operation to a condition that it is fit for the intended use beyond closure. The action plans were prioritised as follows:

PRIORITY RANK	**COLOUR**
HIGH	
MODERATE	
LOW	

Table 43: Biodiversity Action Plans and for the Black Rock Mine surface rights area as well as decommissioned Perth and Devon Mines.

OBJECTIVE	ACTION	ACTIVITIES	IMPACT	MANAGEMENT UNIT	PRIORITY	RESPONSIBLE PERSON	TARGET DATE
To allow staff to fully understand the concept of Biodiversity and its importance	Design a training program which informs staff about the relevance and importance of biodiversity management	• Identify key concepts of biodiversity applicable to the Black Rock Mine surface rights as well as decommissioned Perth and Devon Mine areas at the hand of the BAP • Identify important biodiversity related issues as set out in the BAP • Inform staff of RDL and protected floral species within the Black Rock Mine surface rights as well as decommissioned Perth and Devon Mine areas • Inform staff about dominant alien vegetation species within the Black Rock Mine surface rights as well as decommissioned Perth and Devon Mine areas area • Design an interactive training program for staff • Inform staff and visitors about biodiversity related issues through visible propaganda on each of the facilities	1C; 2A; 2C; 3A; 3B; 4A; 4C; 5A; 7A	MU1 MU2 MU3 MU4			
Application for relevant permits regarding disturbance of any RDL and protected floral species within the Black Rock Mine surface rights as well as decommissioned Perth and Devon Mine areas	Identification and counting of RDL species within areas earmarked for development	• Appoint relevant specialists to undertake a study wherein all RDL and protected species are identified and counted in any new areas to be disturbed • Appointment of an ECO to oversee the removal and rescue and relocation of all protected and RDL floral species • Application for relevant permits for removal, destruction, transport, rescue and relocation as well as propagation of RDL/protected floral species	3A, 3B, 3C	MU1 MU2 MU3 MU4			

OBJECTIVE	ACTION	ACTIVITIES	IMPACT	MANAGEMENT UNIT	PRIORITY	RESPONSIBLE PERSON	TARGET DATE
Conservation of RDL and protected floral species identified within the surface rights area	Community and mine specific actions to promote the conservation of RDL and protected floral species within the region.	• Establishment of a nursery wherein protected and RDL floral species are propagated for the use in future rehabilitation • The use of RDL and protected floral species in the greening of facility grounds • Providing local schools with RDL and protected floral species on environmental days celebrated in South Africa such as National Arbour Week • Supporting research projects within the Northern Cape specifically directed towards RDL and protected species within the province • Implementation of a replacement program for indigenous trees instead of alien/invasives with special mention of the Black Rock village	3A, 3B, 3C	MU1 MU2 MU3 MU4			
Conservation of faunal and floral habitat specific to the region	Implementation of a biodiversity offset initiative	• Identification of a suitable biodiversity offset initiative that will ensure the conservation of faunal and floral habitat • Ensure project sustainability for timeframes estimated	1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D, 2E, 3A, 3B, 3C, 4A, 4B 4C, 4D, 4E, 5A, 5B, 5C	MU2 MU3 MU4			
Invertebrate assessment on the Belgravia game farm as well as grassland surroundings	Detailed invertebrate study of the area which will form the baseline information for future invertebrate monitoring	• Assign an invertebrate specialist to conduct an assessment within the Belgravia game farm and grassland areas to identify any sensitive habitat or species of concern that may inhabit the Black Rock surface rights area • Followed by a invertebrate monitoring assessment focussing on spatial and temporal variations as well as identification of possible impacts and action plans to minimise mining related impacts on the invertebrate community	4A, 4B 4C, 4D, 4E, 5A, 5B, 5C	MU1			

OBJECTIVE	ACTION	ACTIVITIES	IMPACT	MANAGEMENT UNIT	PRIORITY	RESPONSIBLE PERSON	TARGET DATE
Control and eradication of exotic/weed floral species within the Black Rock village, Hostel complex as well as surroundings	Community specific actions in order to eradicate and manage exotic/weed floral species	• Implementation of a replacement program for indigenous trees instead of alien/invasives with special mention of the Black Rock village and Hostel complex with surroundings • Inform community about dominant alien vegetation species within the Black Rock Mine village and Hostel complex with surroundings • Implement alien vegetation control plan specific for the exotic/weed species identified within the Black Rock Mine village and Hostel complex with surroundings	2D	MU3			
To have high quality reference resources available in order to allow staff to better identify and understand faunal and floral characteristics of the area	Compile a library of faunal and floral literature applicable to the area. Specific emphasis must be placed on RDL species, invasive species and their control methods, endemic species and their conservation	• Conduct research into suitable, reliable literature • Obtain literature and compile library • Library must be easily accessible to all applicable personnel	1C; 2A; 2C; 3A; 3B; 4A; 4C; 5A; 7A	MU1 MU2 MU3 MU4			
To ensure that exposed soils and steep slopes are stable and not eroding excessively quickly	Erosion control and rehabilitation	• Identify activities which are causing erosion and incision of any of the drainage features in the Activity Footprint areas • Obtain relevant legislative approval for any activities to be undertaken within the drainage features to rectify excessive erosion • Reprofiling of the banks of disturbed drainage areas to a maximum gradient of 1:3 to ensure bank stability • Reinforce banks and drainage features where necessary with gabions, reno mattresses and geotextiles. • Reseed any areas where earthworks have taken place to prevent further erosion	6A; 7A	MU4			

OBJECTIVE	ACTION	ACTIVITIES	IMPACT	MANAGEMENT UNIT	PRIORITY	RESPONSIBLE PERSON	TARGET DATE
To ensure that surface water resources are not impacted upon by mining activities	Hazardous materials control, erosion control, water quality control	• Ensure that all hazardous storage containers comply with the relevant SABS standards to prevent leakage. Regularly inspect all construction vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. Erosion management measures must be implemented to prevent soils from eroding into surface water resources. • Ensure that all runoff and process water are adequately contained in the dirty water system to prevent discharge of dirty water to the receiving environment. Water quality within the receiving environment should also be continuously and regularly monitored.	1B, 6B	MU1 MU2 MU3 MU4			
To ensure that groundwater resources are not affected by mining activities	Sustainable use of groundwater	• Ensure that all activities impacting on geohydrological resources of the property are managed according to the relevant DWAF Licensing regulations and groundwater monitoring requirements. • Ensure that all MRD's and WRD's are maintained and regularly inspected for seepage. Ensure that all hazardous storage containers comply with the relevant SABS standards to prevent leakage. Regularly inspect all vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. • Contain all dirty water in the dirty water stream before treatment and discharge. Ensure that all activities impacting on ground water resources of the property are managed according to the relevant DWAF Licensing regulations and ground water monitoring requirements.	1A	MU1 MU2 MU3 MU4			

OBJECTIVE	ACTION	ACTIVITIES	IMPACT	MANAGEMENT UNIT	PRIORITY	RESPONSIBLE PERSON	TARGET DATE
To ensure that dust associated with mining activities does not impact upon the regional ecology	Dust control	• Ensure that all roads and construction areas are regularly sprayed with water in order to curb dust generation • If any excessive dying out of vegetation occurs in areas of dust generation, measures to mitigate the impact should be immediately sought	2B, 4E	MU1 MU2 MU3 MU4			
To ensure that noise associated with the mining activities do not impact upon faunal species	Noise control	• Ensure that noise levels do not exceed the relevant standards	4D	MU1 MU2 MU3 MU4			
To ensure that soil contamination does not impact on the ecological integrity of the facility.	Soil pollution control	• Ensure that all MRD's and WRD's are maintained and regularly inspected for seepage. Ensure that all hazardous storage containers comply with the relevant SABS standards to prevent leakage. Regularly inspect all vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil.	6B	MU1 MU2 MU3 MU4			
Eradication of weed and invader species on the study area	Removal of alien and invasive species	• Develop a comprehensive alien vegetation monitoring program which should include ○ Identification of priority areas ○ Liaison with surrounding stakeholders, and the local municipality to control upstream and surrounding nodes of seed production ○ Identify priority species to control in consultation with relevant stakeholders ○ Develop protocols for the removal of all alien species ○ Removal of species • Re-assessment and monitoring of the area to determine success of the action and any follow-up measures required	2C, 4C	MU1 MU2 MU3 MU4			

OBJECTIVE	ACTION	ACTIVITIES	IMPACT	MANAGEMENT UNIT	PRIORITY	RESPONSIBLE PERSON	TARGET DATE
Greening of facility grounds with indigenous species to improve aesthetic qualities of the facility, maintain and increase species diversity of the area and create a green consciousness among staff.	Identify and design areas to be greened with indigenous, endemic as well as RDL and protected floral species.	• Identify areas to be greened • Identify floral species to be utilised • Identify suitable maintenance methods (water, fertilizer, etc.) • As far as possible, employ local community members • Source plants from established nursery • Design and implement landscape development plans • Continuously monitor efficacy of landscaping	3B; 7A	MU3			
Species utilised in the greening of facility areas can be cultivated in a nursery operated by the Black Rock Mine facility. This is also a viable long-term option as the nursery can be used to produce floral species, which will be utilised in the closure rehabilitation of the mining areas. This will also be an effective exercise to ascertain which species are suited to cultivation and re-establishment, providing valuable information which can be utilized during rehabilitation	Establish a nursery focusing on RDL/ Protected/ Endemic/ Medicinal plants to be utilised during operations and rehabilitation greening activities	• Obtain relevant permits for the transport/ handling/ propagation of protected species • Design and implement a nursery on the Black Rock Mine property • It is recommended that the nursery employs members of local communities, which with their knowledge of flora endemic to the region will prove to be valuable assets. Their involvement with the nursery will aid in employment and contribute financially to local communities through the multiplier effect	3A, 3B, 3C	MU1 MU2 MU3 MU4			
To have the Black Rock Mine surface rights as well as decommissioned Perth and Devon Mine areas free of litter and domestic waste	Removal of litter and solid waste	• Liaison with stakeholders and surrounding landowners to ensure that surrounding sources of litter are addressed • Identify a suitable area for disposal of collected solid waste • Removal of litter and solid waste	1A, 4B	MU1 MU2 MU3 MU4			

OBJECTIVE	ACTION	ACTIVITIES	IMPACT	MANAGEMENT UNIT	PRIORITY	RESPONSIBLE PERSON	TARGET DATE
To prevent damage to property by fire and possible safety issues and complaints received about dangerous conditions on the Black Rock Mine surface rights as well as decommissioned Perth and Devon Mine areas	Access control	• Identify areas where the value of the biological resource warrants protection and therefore controlled access by the public • Maintenance of fences to ensure that access control is maintained	2A, 3C 4A, 5A	MU1 MU2 MU4			
Prevent damage to property and impacts on biodiversity from fires	Veld fire management	• Construct and maintain fire breaks on the property in compliance with legislated requirements. • Train relevant staff members in the philosophy, construction and maintenance of fire breaks	2A, 3C 4A, 5A	MU1 MU2 MU4			
Increase biodiversity value by the rehabilitation of disturbed areas, removal of alien and invasive species and the establishment of No-Go areas within the riparian area and associated 32 meter buffer	Establish a No-Go biodiversity reserve within the riparian area and associated 32 meter buffer	• Establish a No-Go biodiversity reserve within the riparian area and associated 32 meter buffer on the property in order to ensure preservation of remaining resources and faunal migratory connectivity • Rehabilitate areas previously disturbed by overgrazing and mining related disturbances with special mention of the areas located close to the Ga Magara River and Witleegte stream • Continually implement an annual alien and invasive floral species eradication program • Monitor changes in biodiversity in the designated areas	1A, 1C, 1D, 2C, 4C, 7A	MU1 MU2 MU3 MU4			

OBJECTIVE	ACTION	ACTIVITIES	IMPACT	MANAGEMENT UNIT	PRIORITY	RESPONSIBLE PERSON	TARGET DATE
Ensure that no activities encroach into areas of ecological sensitivity	Compare plans of surface activities regularly to the areas of mapped sensitivity	• The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. • All areas of increased ecological sensitivity should be marked as such. • Edge effects of mining activities in these areas including erosion and alien control need to be strictly managed in these areas. • Compare the positions of existing infrastructure to the areas of mapped sensitivity. • Compare any expansion of existing activities to the areas of mapped sensitivity. • Consider the position of any new developments in relation to the areas of mapped sensitivity. Where possible new developments should not encroach into the areas of sensitivity.	1A, 1C, 4B, 7A	MU1 MU4			
To ensure that rehabilitation and closure activities are at a suitable level to ensure that no latent impacts on the receiving environment occur and the Present Ecological State of the system is maintained	Employ specialist consultants to assist in developing the detailed rehabilitation and closure plans Ensure that monitoring takes place during the after care and maintenance period to ensure that any latent impacts are identified	• Ensure that alien/exotic removal is done as effective as possible to prevent proliferation of these species after rehabilitation • Increase the present ecological state of areas within the Ga Magara River and Witleegte stream previously disturbed by mining related activities • Ensure the reintroduction of RDL/Protected floral species removed as a result of mining related activities	1A, 1C, 1D, 2C, 3B, 4B, 7A	MU1 MU2 MU3 MU4			
To ensure that all future developments take biodiversity management issues into consideration	Ensure that all proposed expansion and closure plans take biodiversity management aspects into consideration as part of the planning and design phase of a proposed development or closure plan	• Initiate trials with designated sample plots in which the suitability of various grass and tree species are tested to ensure that the most suitable species are utilised for large scale rehabilitation. • Appoint relevant ecological specialists to provide input into the decision making and design process of new facilities and the closure of existing facilities • Ensure that ecological issues are sufficiently considered as part of the overall design and project execution of any development or closure activity	1A, 2C, 3B , 4B, 4E, 7A	MU1 MU2 MU3 MU4			

OBJECTIVE	ACTION	ACTIVITIES	IMPACT	MANAGEMENT UNIT	PRIORITY	RESPONSIBLE PERSON	TARGET DATE
To ensure that rehabilitation and closure activities are at a suitable level to ensure that the area recovers to the intended post closure land use	Employ specialist consultants to assist in developing the detailed rehabilitation and closure plans to ensure that the plan will allow sufficient recovery of the area to take place to be sustainable Ensure that sufficient after care and maintenance takes place and that sufficient budget for these activities is made available to ensure that rehabilitation measures become established and self sustaining	• Appoint relevant ecological specialists to provide input into the decision making and design process of new facilities and the closure of existing facilities. • The after care and maintenance program must be suitably designed to ensure self sustaining closure. • Attention must be paid to: ○ Development of KPI's for aftercare and maintenance activities ○ Frequency of aftercare and maintenance activities ○ Duration of aftercare and maintenance activities ○ Focus areas of aftercare and maintenance activities	1A, 1C, 1D, 2C, 3B, 4B, 7A	MU1 MU2 MU3 MU4			

17 EMERGENCY ACTION PLANS

Fire

Uncontrolled fires pose a serious threat to biodiversity on the property. Blazes must be controlled according to safety measures designed by the Black Rock Mine SHEQ Department, as would be the case with fire in any part of the mining operation.

Spillages

Spillages of hazardous substances pose a threat to soil quality, water resources and overall ecological integrity of the property. Spillages must be managed as set out in the EMPR and SHEQ management measures of the Black Rock Mine operation.

18 REHABILITATION PLANS

18.1 Principles of rehabilitation

The following principles should be followed during the planning, implementation and post-implementation phases of the rehabilitation process:

- Comprehensively define and plan the rehabilitation process prior to any disturbance taking place.
- Define and agree upon end-goals for the rehabilitation process, such as land-use, rehabilitation objectives, areas to be rehabilitated, etc.
- Prevent and continually manage the propagation and establishment of alien and invasive species.
- As far as is practical, implement concurrent rehabilitation in order to limit degradation of soil biota.
- Limit the footprint area of the disturbing activity in order to minimise environmental damage.
- Rehabilitation earthworks should aim to reshape the disturbed areas to represent the area prior to disturbance and to present a safe, functional and sustainable environment.
- Visual impacts of rehabilitated areas must be minimised by recreating natural landforms and ensuring that reshaped areas are visually suited to surrounding landscapes.
- Natural landforms such as drainage lines, undulating areas and ridges, which have been damaged during activities, must be restored.
- Implement erosion control measures to prevent the loss of topsoil during and after construction activities.

- Suitably classify and manage all hazardous waste present on the activity footprint or in surrounding areas as a result of the activity.
- Classify all stripped topsoil according to soil classification principles manage stockpiles and re-apply stripped soils during rehabilitation.
- Rip and aerate all compacted soils in order to allow for plant establishment and growth.
- Revegetate all disturbed areas with suitable floral cover and methods.
- After completion of activities ensure that the site is safe for use by the intended land users and remove all activity equipment.
- Implement a monitoring plan to determine the efficacy of the rehabilitation exercise.

18.2 Rehabilitation objectives

Before any rehabilitation measures are implemented, it is of vital importance to define goals and objectives for the rehabilitation procedures. These objectives include:

- Defining an end-use for the area in question.
- Ascertain whether the proposed end-use is compatible with the land capability of the area.
- Resources allocated to rehabilitation procedures must be sufficient to ensure effective rehabilitation.
- Contractors entrusted with rehabilitation operations must be suitably qualified.
- Planning of rehabilitation must be implemented as part of the planning and pre-construction phase of the proposed project.
- Continual record-keeping must be implemented in order to ensure effective and responsible rehabilitation.
- Monitoring and aftercare must be implemented in order to ensure efficacy of rehabilitation.

18.3 Elementary rehabilitation methods

18.3.1 Preparation prior to rehabilitation

- Rehabilitation should preferably be undertaken before the first rains start to prevent erosion.
- The side slopes of steep areas are to be graded to a slope of approximately 1:3 in order to prevent excessive erosion and to allow vegetation to establish sufficient root growth and in line with Health and safety requirements for closure.
- All excess rock is to be removed from the slopes of these areas in order to allow for sufficient root growth.

- Side slopes of the rehabilitation areas are to be covered by topsoil sourced from the topsoil stockpiles which were created during the clearing of the open pit areas and tailings areas.
- The layer of topsoil on the side slopes should be at least 300 mm thick.
- Care should be taken to ensure that the topsoil does not contain any large rocks or remnants of alien invasive species. This can be accomplished by screening the topsoil before application.
- After application of the topsoil, “Hessian socks” should be installed in order to prevent erosion of the topsoil and also for the purpose of soil stability and supplying secure substrate for seed germination. These “Hessian socks” should then be placed at 500mm intervals along contour which are filled with a hydro seeding mixture as described below.

18.3.2 Hydro-seeding.

- A grass mixture utilising endemic grasses with special mention of grasses known to be not invasive within the area, such as *Aristida meridionalis, Centropodia glauca, Stipagrostis ciliata, Eragrostis lehmanniana* and *Schmidtia pappophoroides,* should be utilised in the seeding process.
- The seed mixture should be incorporated into mulch which includes fertiliser and germination acceleration agents.
- The seed mulch should then be used to fill the “Hessian socks”.
- The seeded areas should then be irrigated.
- Weekly monitoring should take place in order to ascertain the efficacy of the seeding and to repair any areas where gullies or rills are forming.

18.3.3 Maintenance

- Along the crest of steep gradients a 1 meter high Hessian screen should be placed around the facility to assist with the trapping of seeds and to protect the crest from wind erosion.
- Regular application of fertiliser should take place in order to ensure efficient establishment of vegetation cover until such time as sufficient organic matter is being produced by the established grasses to allow for self sustaining growth.
- The process of Unification can be utilised to ensure a constant supply of organic compost (fertiliser). This entails the establishment of a ‘compost heap’, where cleared indigenous organic matter is stored and allowed to break down naturally to the point of resembling garden compost.

- Care must be taken to ensure that **ONLY** indigenous plant matter is utilised for this process, as the presence of alien invaders may cause the establishment of invader plant communities in the rehabilitated areas.

18.4 *Establishment of natural Kathu Bushveld* and *Gordonia Dunveld on the rehabilitated areas.*

- Once sufficient basal cover has been established, the introduction of species representative of the applicable vegetation types may commence.
- Introduction of these species should commence through the stages of natural succession, i.e. Pioneer species (grasses, herbaceous species), Secondary species (grasses, small shrubs, and small trees) and Climax state (larger shrubs, large trees).
- This process will also occur naturally as seeds from the neighbouring areas are introduced and germinate.
- Certain tree species with special mention of *Acacia erioloba, Acacia haematoxylon* and *Boscia albitrunca* can be selectively introduced, however consideration will need to be given to rooting depths and soil stability as well as the ability of the trees to establish on the subject area.
- A test area should be designated to test possible tree species to be introduced for their ability to grow in different substrates. This should commence immediately in order to allow informed decision making once rehabilitation commences.
- The primary goal is to achieve a stable, climax state, representative of the vegetation types where the ecological function of the plant community is tolerant of most environmental conditions it encounters.

19 BIODIVERSITY MONITORING PLAN

19.1 Monitoring philosophy and requirements

Prudent biodiversity monitoring on the property is of utmost importance, as this will ensure a continual flow of data, enabling all parties involved to accurately assess and manage biodiversity related progress and issues. To ensure the accurate gathering of data, the following techniques and guidelines should be followed:

- Fixed point monitoring should be applied as the preferred method of monitoring.
- All data gathered should be measurable (qualitative and quantitative).
- Monitoring report should be repeatable and temporally and spatially comparable.
- Data should be auditable.
- Data gathered should be an accurate representation of the Present Ecological State of the subject property, as well as the various floral communities and habitat units represented by each monitoring site.
- Data, when compared to previous sets, should show spatial and temporal trends.
- Data gathered should represent all aspects of all communities i.e. grasses, forbs, shrubs and trees.
- General habitat unit overviews should also be undertaken.
- Monitoring of protected species populations must also take place.

19.2 Legal/formal compliance framework

- Environment Conservation Act (1989) and related EIA regulations;
- National Environmental Management Act (1998); (NEMA);
- Mineral and Petroleum Resources Development Act (2002);
- National Environmental Management: Biodiversity Act (2004);
- The Protected Areas Act (Act 57 of 2003) (In conjunction with the National Environmental Management: Biodiversity Act of 2004);
- Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983);
- National Water Act (1998);
- National Forests Act (1998);
- National Heritage Resources Act (1999);
- Convention on Biological Diversity (1995);

19.3 Black Rock Mine Biodiversity monitoring system

19.3.1 Monitoring Infrastructure/Sites/ Localities

In addition to general assessments of each habitat unit, specific fixed monitoring points are also deemed necessary. The figure below presents the fixed monitoring points for the Black Rock Mine surface rights area monitoring program.

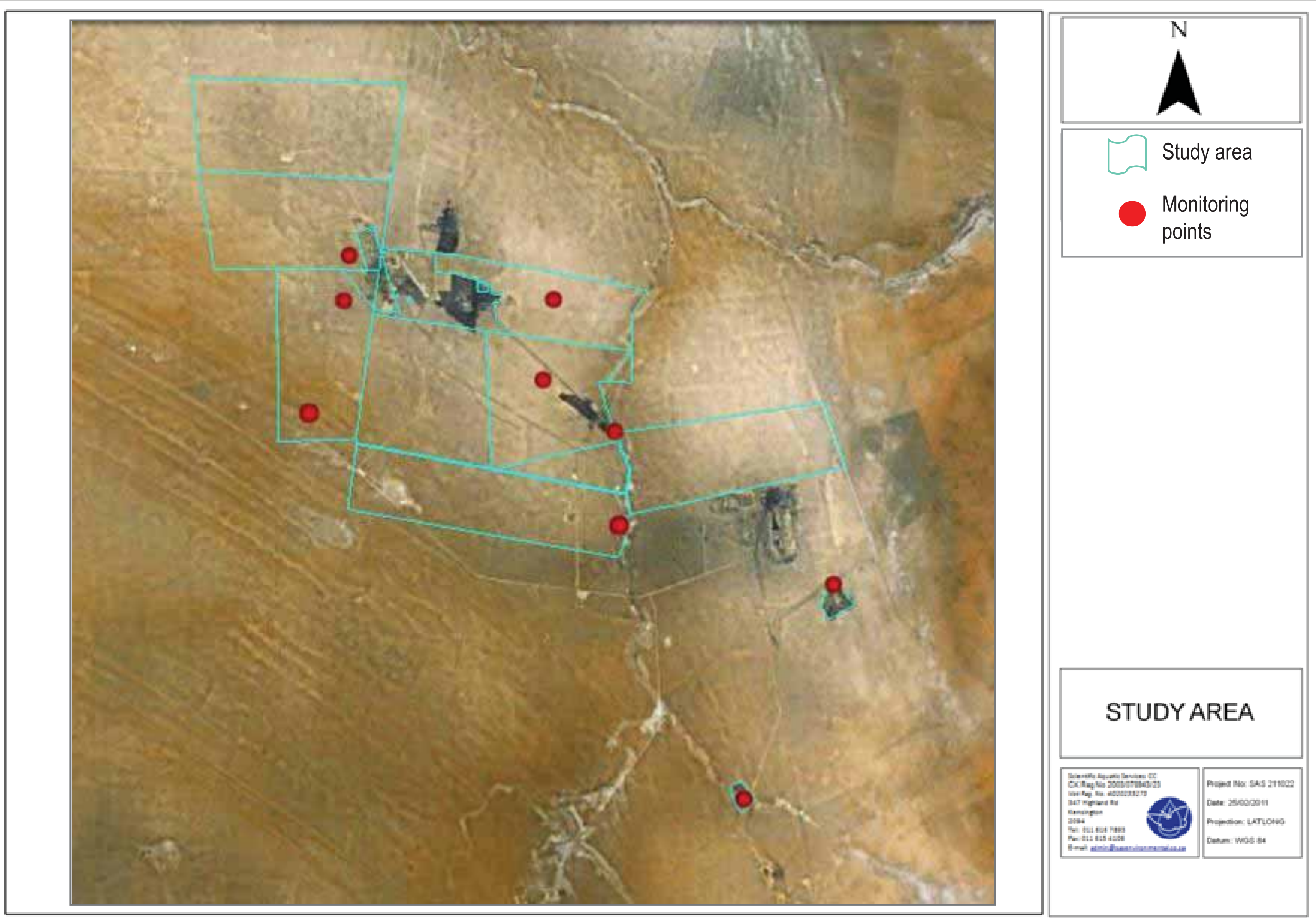


Figure 40: Fixed monitoring points on the property are indicated by red dots.

19.3.2 Monitoring/Sampling Frequency

Monitoring should occur on an annual basis in the summer growing season. In order to ensure that temporal comparisons can be made assessments should take place at the same time each year.

19.3.3 Monitoring/Sampling Technique

Step 1: Data collection

Before any routine monitoring can begin, baseline data must be available to provide a standard against which to detect change. Baseline data is collected and analysed with the aim of defining the present state of the vegetation under the existing environment or management regime.

Step 2: Apply pre-monitoring management

Recovery of vegetation after some form of management can greatly influence the measurement of species diversity. For example the recovery of grassland after a fire can be rapid, but seldom involves change in the species diversity. In other words shortly after a fire a different assemblage of species will be present to the assemblage of species that would be present one year after a fire. This does not mean that the first assemblage of species has disappeared, it simply means that they are dormant and not noticeable, but are waiting for the same conditions that occur shortly after a fire to return, when they will again grow and produce and set seed. This cyclical phenomenon is known as recovery succession and in the case of vegetation recovery after fire is known as pyric succession.

With this in mind, it is important in certain types of vegetation to record the sequence of management events, such as fire, that occurred before the vegetation species diversity is measured, with the aim of taking all follow up measurements after the same sequence of events.

Step 3: Locate the plots in the field

Plots are located for the first time in the field using a GPS and the coordinates determined from the map above. At each point in the field locate a square plot of 40 X 40m and permanently mark and record GPS coordinates of each corner of the plot. Thereafter all follow up surveys will be undertaken in the same permanently marked plots.

Step 4: Collect data

For the herbaceous layer (grasses and forbes), record within each permanently located 40 X 40 m plot, the nearest, rooted living plant to each of 200 points spaced 3m apart. For each point record the species name on a field form.

For the woody layer (trees and shrubs), record within the same permanently located 40 X 40 m plots each living woody plant and record the species name on a field form.

19.3.3.1 Monitoring/Sampling Equipment

- Sampling plot equipment, which includes pegs, string, measuring tape.
- GPS.
- Sample bags.
- Reference collection.

19.3.4 Information Generation Protocols

19.3.4.1 Reporting Frequency

Reporting should follow after monitoring has taken place, i.e. annually.

19.3.4.2 Report Content

All aspects pertaining to floral diversity and sensitive habitats as covered by the Biodiversity Action Plan should be included in the annual monitoring report.

19.4 Faunal Data Capturing Protocols

19.4.1 Monitoring/Sampling Frequency

Monitoring should occur on an annual basis in the summer growing season. In order to ensure that temporal comparisons can be made assessments should take place at the same time each year.

19.4.2 Monitoring/Sampling Technique

- Ad libitum recording, of all faunal species observed through direct visual observation or identified by calls, tracks, scats and burrows are recorded;

- Bird census involving 15 minute point counts on the monitoring points on the assessment site;
- Sweep netting and pitfall traps to gather information of the invertebrate community;

19.4.3 Monitoring/Sampling Equipment

- Sweep nets
- Pitfall traps
- Binoculars
- Sampling bags/buckets
- Reference lists

19.4.4 Information Generation Protocols

19.4.4.1 Reporting Frequency

Reporting should follow after monitoring has taken place, i.e. annually with assessments of the general faunal integrity of the site.

19.4.4.2 Report Content

All aspects pertaining to faunal diversity and sensitive habitats as covered by the Biodiversity Action Plan should be included in the annual monitoring report.

20 CONCLUSIONS AND RECOMMENDATIONS

With the implementation of the biodiversity management procedures outlined in this report, the potential negative impacts of the Black Rock Mine on the surrounding environment should be reduced to medium or low significance during the operational and decommissioning phases. The action plans will lead to enhanced value of the resources in the vicinity of the Black Rock Mine and will assist in creating opportunities for the community to learn about the biodiversity of the area. The information gathered through monitoring programs will assist in a better understanding of the ecology of the area in the vicinity of the operations, and will assist in ensuring that closure activities reach the desired goals for post closure land use and biodiversity conservation.

21 REFERENCES

Acocks, J. P. H. (1988). Third Edition. *Veld Types of South Africa.* Memoirs of the Botanical Survey of South Africa No. 57, Botanical Research Institute, RSA

Barnes, K. N. (Ed). (2000). *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.* Birdlife South Africa, Johannesburg, RSA.

Branch, B. (1998). Third Edition. *Field Guide to Snakes and Other Reptiles in Southern Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Branch, W. R. (Ed). (1988). *South African Red Data Book of Reptiles and Amphibians.* South African National Scientific Programmes Report No. 151

Bromilow, C. (2001). Revised Edition, First Impression. *Problem Plants of South Africa.* Briza Publications, Pretoria, RSA.

Carruthers, V. (2001). *Frogs and Frogging in Southern Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Germishuizen, G & Clarke, B. (2003). First Edition, First Impression. *Illustrated Guide to the Wildflowers of Northern South Africa.* Briza Publications, Pretoria, RSA.

Germishuizen, G & Meyer, N. L. (Eds.) (2003). The Plants of Southern Africa: An Annotated Checklist. Strelitzia 14.

Henderson, L. (2001). *Alien Weeds and Invasive Plants*. Agricultural Research Council, RSA.

Henderson, L & Musil, K. J. (1987). *Plant Invaders of the Transvaal.* Department of Agriculture and Water Supply, Bulletin 412, RSA.

Henning, G. A & Henning, S. F. (1989). *South African Red Data Book of Butterflies.* South African National Scientific Programmes Report No. 158

Leeming, J. (2003). *Scorpions of Southern Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Leroy, A. & Leroy, J. Second Edition. (2003). *Spiders of Southern Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Low, A. B. & Rebelo, A.G. (Eds) (1998). *Vegetation of South Africa, Lesotho and Swaziland.* Department of Environmental Affairs and Tourism, Pretoria, RSA.

Manning, J. (2003). *Photographic Guide to the Wild Flowers of South Africa.* Briza Publications, Pretoria, RSA.

Marais, J. (2004). *A Complete Guide to the Snakes of Southern Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Minter, L. R., Burger, M., Harrison, J. A., Braack, H. H., Bishop, P. J., & Kloepfer, D. (Eds). (2004). *Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland.* SI/MAB Series #9. Smithsonian Institute, Washington, DC, USA.

Mucina, L. & Rutherford, M. C. (Eds). (2006). *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria, RSA.

Nienaber, H. (2004) Ecological Study of the Plant Communities of the Farm Dwarsrivier 372 KT, Mpumalanga Province, with Management Recommendations. Centre of Wildlife Management, University of Pretoria.

Odum, E. P. (1971). Third Edition. *Fundamentals of Ecology.* Saunders College Publishing, Philadelphia, USA.

Pfab, M. F. & Victor, J. E. (2002). *Threatened Plants of Gauteng.* SA Journal of Botany, Volume 68, Number 3 (pages 370 – 375). NISC (Pty) Ltd, RSA.

Picker. M., Griffiths. C. & Weaving. A. (2004). New Edition. *Field Guide to Insects of South Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Pooley, E. (2005). First Edition, Second Impression. *A Field Guide to Wild Flowers of Kwazulu-Natal and the Eastern Region.* The Flora Publications Trust, Durban, RSA.

Rutherford, M. C. & Westfall, R. H. (1994). *Biomes of Southern Africa: An Objective Categorization.* National Botanical Institute, Pretoria, RSA.

Siebert, S.J. (2001). *Vegetation of the Ultramafic Soils of the Sekhukhuneland Centre of Plant Endemism, South Africa.* Unpublished Ph.D. Thesis, University of Pretoria.

Siebert, S.J. Van Wyk, A.E. and Bredenkamp, G.J. 2001. (In press). The Physical Environment and Major Vegetation Types of Sekhukuneland. *Journal of Botany* (67). South Africa.

Sinclair, I., Hockey, P. & Tarboton, W. (2002). Third Edition. *Sasol Birds of Southern Africa.* Struik Publishers, Cape Town, RSA

Skinner, J. D. & Smithers, R. H. N. (1990). Second Edition. *The Mammals of the Southern African Sub-Region.* University of Pretoria, Pretoria, RSA.

Stephen R.D. & Stephen V.C. (2007). Distribution and Conservation Recommendations of the Endemic Cicada *Pycna sylvia*, in the der Brochen valley, Mpumalanga. (Unpublished).

Tainton, N. M. (Ed) (1999). *Veld Management in South Africa.* University of Natal Press, Pietermaritzburg, RSA.

Van Oudtshoorn, F. (2004). Second Edition, Third Print. *Guide to Grasses of South Africa.* Briza Publications, Pretoria, RSA.

Van Wyk, B., & Malan, S. (1998) Second Impression. *Field Guide to the Wild Flowers of the Highveld.* Struik Publishers, Cape Town, RSA.

Van Wyk, B & Smith, G. (2005). Second Edition, Second Impression. *Guide to the Aloes of South Africa.* Briza Publications, Pretoria, RSA.

Van Wyk, B & Van Wyk, P. (1997). *Field Guide to Trees of Southern Africa.* Struik Publishers, Cape Town, RSA.

Van Wyk, B., Van Oudtshoorn, B. & Gericke, N. (2005). First Edition, Fourth Impression. *Medicinal Plants of South Africa.* Briza Publications, Pretoria, RSA.

Venter, F & Venter, J. (2002) Second Edition. *Making the most of Indigenous Trees.* Briza Publications, Pretoria, RSA.

Walker, C. (1988). Fourth Edition. *Signs of the Wild.* Struik Publishers (Pty) Ltd, Cape Town, RSA

Westfall, R. H., Van Staden, J. M., Panagos, M. D., Breytenbach, P. J. J. & Greeff, A. (1996). *Scale-related Vegetation Sampling*. Agricultural Research Council, Range and Forage Institute, Roodeplaat.

Woodhall, S. (2005). *Field Guide to Butterflies of South Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

The South African National Biodiversity Institute is thanked for the use of data from the National Herbarium, Pretoria (PRE) Computerised Information System (PRECIS).

APPENDIX A: Flora

Table 44: Floral species identified during the assessment of the subject property.

Trees	Graminoids	Shrubs/forbs	Invaders
Elephantoriza burkei	*Pogonarthria squarrosa*	*Commelina benghalensis*	*Spartium junceum*
Acacia erioloba	*Heteropogon contortus*	*Senna italica*	*Pennisetum setaceum*
Acacia haematoxylon	*Cenchrus ciliaris*	*Ipomoea sinensis*	*Sesamum triphyllum*
Acacia hebeclada	*Aristida congesta subsp congesta*	*Ipomoea obscura*	*Verbesina encelioides*
Boscia albitrunca	*Centropodia glauca*	*Harpagophytum procumbens*	*Ziziphus mucronata*
Ehretia rigida	*Setaria verticillata*	*Pergularia daemia subsp. daemia*	*Morus alba*
Grewia flava	*Eragrostis echinochloidea*	*Tapinanthus rubromarginatus*	*Melia azedarach*
Terminalia sericea	*Cynodon dactylon*		*Eucalyptus sp.*
Searsia lancea	*Digitaria eriantha*		*Schinus molle*
Celtis africana	*Eragrostis lehmanniana*		*Prosopis glandulosa*
	Schmidtia kalihariensis		*Agave americana*
	Stipagrostis uniplumis		*Cuscuta campestris*
	Aristida meridionalis		
	Aristida stipitata		
	Anthephora pubescens		
	Setaria sphacelata var sphacelata		
	Cymbopogon excavatus		
	Melinis repens		
	Schmidtia pappophoroides		

Table 45: Expected floral species list for the quarter degree grid 2722BB supplied by Sanbi Precis Database.

Family	Species	Threat status	SA Endemic	Growth forms
ACANTHACEAE	*Monechma genistifolium (Engl.) C.B.Clarke subsp. australe (P.G.Mey.) Munday*	LC	No	Dwarf shrub, shrub
AMARANTHACEAE	*Hermbstaedtia fleckii (Schinz) Baker & C.B.Clarke*	LC	No	Herb
AMARANTHACEAE	*Sericorema remotiflora (Hook.f.) Lopr.*	LC	No	Herb
ANACARDIACEAE	*Searsia dregeana (Sond.) Moffett*	LC	No	Shrub
ANACARDIACEAE	*Searsia erosa (Thunb.) Moffett*	LC	No	Shrub
ASTERACEAE	*Berkheya ferox O.Hoffm. var. tomentosa Roessler*	LC	No	Shrub
ASTERACEAE	*Dimorphotheca zeyheri Sond.*	LC	No	Herb
ASTERACEAE	*Geigeria ornativa O.Hoffm. subsp. ornativa*	LC	No	Herb
ASTERACEAE	*Pentzia calcarea Kies*	LC	No	Shrub, suffrutex
CAPPARACEAE	*Cleome angustifolia Forssk. subsp. diandra (Burch.) Kers*	LC	No	Herb
CHENOPODIACEAE	*Salsola kali L.*		No	Herb
CHENOPODIACEAE	*Salsola patentipilosa Botsch.*	LC	Yes	Dwarf shrub
CONVOLVULACEAE	*Merremia verecunda Rendle*	LC	No	Herb
CUCURBITACEAE	*Acanthosicyos naudinianus (Sond.) C.Jeffrey*	LC	No	Herb, succulent
CYPERACEAE	*Cyperus margaritaceus Vahl var. margaritaceus*	LC	No	Cyperoid, herb, mesophyte
FABACEAE	*Crotalaria virgultalis Burch. ex DC.*	LC	No	Shrub
FABACEAE	*Cullen tomentosum (Thunb.) J.W.Grimes*	LC	No	Herb
FABACEAE	*Indigastrum argyraeum (Eckl. & Zeyh.) Schrire*	LC	No	Herb
FABACEAE	*Indigofera alternans DC. var. alternans*	LC	No	Herb
FABACEAE	*Indigofera hololeuca Benth. ex Harv.*	LC	No	Herb
FABACEAE	*Melolobium candicans (E.Mey.) Eckl. & Zeyh.*	LC	No	Dwarf shrub, herb, shrub
FABACEAE	*Melolobium humile Eckl. & Zeyh.*	LC	Yes	Dwarf shrub
FABACEAE	*Prosopis glandulosa Torr. var. glandulosa*		No	Shrub, tree
FABACEAE	*Prosopis velutina Wooton*		No	Shrub, tree
FABACEAE	*Tephrosia burchellii Burtt Davy*	LC	No	Herb
GISEKIACEAE	*Gisekia pharnacioides L. var. pharnacioides*	LC	No	Herb
IRIDACEAE	*Moraea longistyla (Goldblatt) Goldblatt*	LC	Yes	Geophyte, herb
IRIDACEAE	*Moraea pallida (Baker) Goldblatt*	LC	No	Geophyte, herb
LAMIACEAE	*Stachys spathulata Burch. ex Benth.*	LC	No	Herb
LOPHIOCARPACEAE	*Corbichonia rubriviolacea (Friedrich) C.Jeffrey*	LC	No	Herb, succulent
MALVACEAE	*Grewia flava DC.*	LC	No	Shrub
MOLLUGINACEAE	*Limeum myosotis H.Walter var. myosotis*	LC	No	Herb
OROBANCHACEAE	*Striga gesnerioides (Willd.) Vatke*	LC	No	Herb, parasite
POACEAE	*Anthephora argentea Gooss.*	LC	No	Graminoid

Family	Species	Threat status	SA Endemic	Growth forms
POACEAE	*Aristida adscensionis L.*	LC	No	Graminoid
POACEAE	*Aristida congesta Roem. & Schult. subsp. congesta*	LC	No	Graminoid
POACEAE	*Aristida stipitata Hack. subsp. spicata (De Winter) Melderis*	LC	No	Graminoid
POACEAE	*Aristida vestita Thunb.*	LC	No	Graminoid
POACEAE	*Brachiaria marlothii (Hack.) Stent*	LC	No	Graminoid
POACEAE	*Chrysopogon serrulatus Trin.*	LC	No	Graminoid
POACEAE	*Coelachyrum yemenicum (Schweinf.) S.M.Phillips*	LC	No	Graminoid
POACEAE	*Cymbopogon pospischilii (K.Schum.) C.E.Hubb.*		No	Graminoid
POACEAE	*Cynodon dactylon (L.) Pers.*	LC	No	Graminoid
POACEAE	*Enneapogon cenchroides (Licht. ex Roem. & Schult.) C.E.Hubb.*	LC	No	Graminoid
POACEAE	*Enneapogon desvauxii P.Beauv.*	LC	No	Graminoid
POACEAE	*Eragrostis echinochloidea Stapf*	LC	No	Graminoid
POACEAE	*Eragrostis lehmanniana Nees var. lehmanniana*	LC	No	Graminoid
POACEAE	*Eragrostis pallens Hack.*	LC	No	Graminoid
POACEAE	*Eragrostis trichophora Coss. & Durieu*	LC	No	Graminoid
POACEAE	*Eustachys paspaloides (Vahl) Lanza & Mattei*	LC	No	Graminoid
POACEAE	*Fingerhuthia africana Lehm.*	LC	No	Graminoid
POACEAE	*Megaloprotachne albescens C.E.Hubb.*	LC	No	Graminoid
POACEAE	*Pogonarthria squarrosa (Roem. & Schult.) Pilg.*	LC	No	Graminoid
POACEAE	*Schmidtia kalahariensis Stent*	LC	No	Graminoid
POACEAE	*Setaria verticillata (L.) P.Beauv.*	LC	No	Graminoid
POACEAE	*Sporobolus fimbriatus (Trin.) Nees*	LC	No	Graminoid
POACEAE	*Stipagrostis ciliata (Desf.) De Winter var. capensis (Trin. & Rupr.) De Winter*	LC	No	Graminoid
POACEAE	*Tragus racemosus (L.) All.*	LC	No	Graminoid
POACEAE	*Tricholaena monachne (Trin.) Stapf & C.E.Hubb.*	LC	No	Graminoid
POLYGALACEAE	*Polygala leptophylla Burch. var. leptophylla*	LC	No	Dwarf shrub
POLYGALACEAE	*Polygala seminuda Harv.*	LC	No	Dwarf shrub, herb
POLYGONACEAE	*Oxygonum delagoense Kuntze*	LC	No	Herb
RICCIACEAE	*Riccia albolimbata S.W.Arnell*		No	Bryophyte
SANTALACEAE	*Thesium hystrix A.W.Hill*	LC	No	Dwarf shrub, parasite, shrub
SCROPHULARIACEAE	*Selago mixta Hilliard*	LC	Yes	Herb

Vegetation Index Score-Habitat unit 1 Belgravia Game Farm

EVC=[[(EVC1+EVC2)/2]

EVC 1 - Percentage natural vegetation cover:

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Site score						X
EVC 1 score	0	1	2	3	4	5

EVC2 - Total site disturbance score:

Disturbance score	0	Very Low	Low	Moderately	High	Very High
Site score		X				
EVC 2 score	5	4	3	2	1	0

SI=(SI1+SI2+SI3+SI4)/4)

	Trees (SI1)		Shrubs (SI2)		Forbs (SI3)		Grasses (SI4)	
Score:	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State
Continuous							X	X
Clumped				X		X		
Scattered	X	X	X		X			
Sparse								

Present State (P/S) = Currently applicable for each habitat unit

Perceived Reference State (PRS) = If in pristine condition

Each SI score is determined with reference to the following scoring table of vegetation distribution for present state versus perceived reference state.

	Present state (P/S)			
Perceived Reference state (PRS)	Continuous	Clumped	Scattered	Sparse
Continuous	3	2	1	0
Clumped	2	3	2	1
Scattered	1	2	3	2
Sparse	0	1	2	3

PVC=[(EVC)-((exotic x 0.7) + (bare ground x 0.3))

Percentage vegetation cover (exotic):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %		X				
PVC Score	0	1	2	3	4	5

Percentage vegetation cover (bare ground):

RIS

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %		X				
PVC Score	0	1	2	3	4	5

Extent of indigenous species recruitment	**0**	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
						X
RIS	**0**	**1**	**2**	**3**	**4**	**5**

VIS = [(EVC)+((SIxPVC)+(RIS))] = 17

The final VIS scores for each habitat unit are then categorised as follows:

Vegetation Index Score	Assessment Class	Description
25	**A**	Unmodified, natural
20 to 24	**B**	Largely natural with few modifications.
15 to 20	**C**	Moderately modified
10 to 15	**D**	Largely modified
5 to 10	**E**	The loss of natural habitat extensive
<5	**F**	Modified completely

Vegetation Index Score-Habitat unit 2 Open veld

EVC=[[(EVC1+EVC2)/2]

EVC 1 - Percentage natural vegetation cover:

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Site score						X
EVC 1 score	0	1	2	3	4	5

EVC2 - Total site disturbance score:

Disturbance score	0	Very Low	Low	Moderately	High	Very High
Site score			X			
EVC 2 score	5	4	3	2	1	0

SI=(SI1+SI2+SI3+SI4)/4)

	Trees (SI1)		Shrubs (SI2)		Forbs (SI3)		Grasses (SI4)	
Score:	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State
Continuous							X	X
Clumped		X		X		X		
Scattered	X		X		X			
Sparse								

Present State (P/S) = Currently applicable for each habitat unit

Perceived Reference State (PRS) = If in pristine condition

Each SI score is determined with reference to the following scoring table of vegetation distribution for present state versus perceived reference state.

	Present state (P/S)			
Perceived Reference state (PRS)	Continuous	Clumped	Scattered	Sparse
Continuous	3	2	1	0
Clumped	2	3	2	1
Scattered	1	2	3	2
Sparse	0	1	2	3

PVC=[(EVC)-((exotic x 0.7) + (bare ground x 0.3))

Percentage vegetation cover (exotic):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %		X				
PVC Score	0	1	2	3	4	5

Percentage vegetation cover (bare ground):

RIS

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %		X				
PVC Score	0	1	2	3	4	5

Extent of indigenous species recruitment	**0**	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
						X
RIS	**0**	**1**	**2**	**3**	**4**	**5**

VIS = [(EVC)+((SIxPVC)+(RIS))] = 15

The final VIS scores for each habitat unit are then categorised as follows:

Vegetation Index Score	Assessment Class	Description
25	A	Unmodified, natural
20 to 24	B	Largely natural with few modifications.
15 to 20	C	Moderately modified
10 to 15	D	Largely modified
5 to 10	E	The loss of natural habitat extensive
<5	F	Modified completely

Vegetation Index Score-Habitat unit 3 Transformed

1. **EVC=[[(EVC1+EVC2)/2]**

EVC 1 - Percentage natural vegetation cover:

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Site score		X				
EVC 1 score	0	1	2	3	4	5

EVC2 - Total site disturbance score:

Disturbance score	0	Very Low	Low	Moderately	High	Very High
Site score						X
EVC 2 score	5	4	3	2	1	0

2. **SI=(SI1+SI2+SI3+SI4)/4)**

	Trees (SI1)		Shrubs (SI2)		Forbs (SI3)		Grasses (SI4)	
Score:	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State
Continuous							X	
Clumped								X
Scattered	X		X		X			
Sparse		X		X		X		

Present State (P/S) = Currently applicable for each habitat unit

Perceived Reference State (PRS) = If in pristine condition

Each SI score is determined with reference to the following scoring table of vegetation distribution for present state versus perceived reference state.

	Present state (P/S)			
Perceived Reference state (PRS)	Continuous	Clumped	Scattered	Sparse
Continuous	3	2	1	0
Clumped	2	3	2	1
Scattered	1	2	3	2
Sparse	0	1	2	3

PVC=[(EVC)-((exotic x 0.7) + (bare ground x 0.3))

Percentage vegetation cover (exotic):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %		X				
PVC Score	0	1	2	3	4	5

RIS

Percentage vegetation cover (bare ground):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %						X
PVC Score	0	1	2	3	4	5

Extent of indigenous species recruitment	**0**	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
		X				
RIS	**0**	**1**	**2**	**3**	**4**	**5**

VIS = [(EVC)+((SIxPVC)+(RIS))] = -1.9

The final VIS scores for each habitat unit are then categorised as follows:

Vegetation Index Score	Assessment Class	Description
25	**A**	Unmodified, natural
20 to 24	**B**	Largely natural with few modifications.
15 to 20	**C**	Moderately modified
10 to 15	**D**	Largely modified
5 to 10	**E**	The loss of natural habitat extensive
<5	**F**	Modified completely

Vegetation Index Score-Habitat unit 4 River

1. **EVC=[[(EVC1+EVC2)/2]**

EVC 1 - Percentage natural vegetation cover:

Vegetation cover %	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Site score				X		
EVC 1 score	0	1	2	3	4	5

EVC2 - Total site disturbance score:

Disturbance score	0	Very Low	Low	Moderately	High	Very High
Site score					X	
EVC 2 score	5	4	3	2	1	0

2. **SI=(SI1+SI2+SI3+SI4)/4)**

	Trees (SI1)		Shrubs (SI2)		Forbs (SI3)		Grasses (SI4)	
Score:	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State	Present State	Perceived Reference State
Continuous							X	
Clumped		X						
Scattered	X		X		X			X
Sparse				X		X		

Present State (P/S) = Currently applicable for each habitat unit

Perceived Reference State (PRS) = If in pristine condition

Each SI score is determined with reference to the following scoring table of vegetation distribution for present state versus perceived reference state.

	Present state (P/S)			
Perceived Reference state (PRS)	**Continuous**	**Clumped**	**Scattered**	**Sparse**
Continuous	3	2	1	0
Clumped	2	3	2	1
Scattered	1	2	3	2
Sparse	0	1	2	3

PVC=[(EVC)-((exotic x 0.7) + (bare ground x 0.3))

Percentage vegetation cover (exotic):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %				X		
PVC Score	0	1	2	3	4	5

Percentage vegetation cover (bare ground):

	0%	1-5%	6-25%	26-50%	51-75%	76-100%
Vegetation cover %			X			
PVC Score	0	1	2	3	4	5

RIS

Extent of indigenous species recruitment	**0**	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
				X		
RIS	**0**	**1**	**2**	**3**	**4**	**5**

VIS = [(EVC)+((SIxPVC)+(RIS))] = 0.1

The final VIS scores for each habitat unit are then categorised as follows:

Vegetation Index Score	Assessment Class	Description
25	A	Unmodified, natural
20 to 24	B	Largely natural with few modifications.
15 to 20	C	Moderately modified
10 to 15	D	Largely modified
5 to 10	E	The loss of natural habitat extensive
<5	F	Modified completely

APPENDIX B: Fauna

Table 46: All the faunal species assessed for the subject property in the calculation of the Red Data Sensitivity Index Score

Common name	Species	Red List Status
African Wild cat	*Felis lybica*	VU
Aardvark	*Orycteropus afer*	VU
Southern African Hedgehog	*Atelerix frontalis*	Rare
Rough-haired golden mole	*Chrysospalax villosus*	VU
Juliana's golden mole	*Amblysomus julianae*	CR
Woosnam's Desert Rat	*Zelotomys woosnami*	Rare
Brown hyaena	*Hyaena brunnea*	Rare
Small spotted cat	*Felis nigripes*	VU
Cheetah	*Acinonyx jubatus*	VU
Lion	*Panthera leo*	VU
Wild dog	*Lycaon pictus*	EN
White rhinoceros	*Ceratotherium simum*	NT
Schreiber's long-fingered bat	*Miniopterus schreibersii*	NT
Ruppell's horseshoe bat	*Rhinolophus fumigatus*	NT
Geoffroy's horseshoe bat	Rhinolophus clivosus	NT
Darling's horseshoe bat	Rhinilophus darlingi	NT
Dent's horseshoe bat	Rhinolophus denti	NT
Maccoa Duck	*Oxyura maccoa*	NT
Jackass Penguin	*Spheniscus demersus*	VU
Southern Giant Petrel	*Macronectes giganteus*	NT
Northern Giant Petrel	*Macronectes halli*	NT
Sooty Shearwater	*Puffinus griseus*	NT
Lesser Flamingo	*Phoeniconaias minor*	NT
Cape Gannet	*Morus capensis*	VU
Crowned Cormorant	*Phalacrocorax coronatus*	NT
Bank Cormorant	*Phalacrocorax neglectus*	EN
Cape Cormorant	*Phalacrocorax capensis*	NT
Lesser Kestrel	*Falco naumanni*	VU
Red-footed Falcon	*Falco vespertinus*	NT
Egyptian Vulture	*Neophron percnopterus*	EN
African White-backed Vulture	*Gyps africanus*	NT
Cape Griffon	*Gyps coprotheres*	VU
White-headed Vulture	*Trigonoceps occipitalis*	VU
Black Harrier	*Circus maurus*	VU
Pallid Harrier	*Circus macrourus*	NT
Denham's Bustard	*Neotis denhami*	NT
Blue Bustard	*Eupodotis caerulescens*	NT
Corncrake	*Crex crex*	NT
Blue Crane	*Anthropoides paradiseus*	VU
African Black Oystercatcher	*Haematopus moquini*	NT
Chestnut-banded Plover	*Charadrius pallidus*	NT
Black-tailed Godwit	*Limosa limosa*	NT
Eurasian Curlew	*Numenius arquata*	NT
Black-winged Pratincole	*Glareola nordmanni*	NT
Damara Tern	*Sterna balaenarum*	NT

Common name	Species	Red List Status
European Roller	*Coracias garrulus*	NT
Melodious Bushlark	*Mirafra cheniana*	NT
Red Lark	*Certhilauda burra*	VU
Sclater's Lark	*Spizocorys sclateri*	NT
Long-tailed Pipit	*Anthus longicaudatus*	DD
Linda's Hairtail	*Anthene lindae*	VU
Trimen's Opal	*Chrysoritis trimeni*	VU
Baboon spider	*Harpactira hamiltoni*	NE
Trapdoor spider	*Idiops fryi*	NE
Trapdoor spider	*Idiops pretoriae*	NE
Trapdoor spider	*Idiops gunningi*	NE
Scorpion	*Hadogenes gunningi*	NE
Scorpion	*Hadogenes gracilis*	NE
Scorpion	*Hadogenes longimanus*	NE

Table 47: List of mammal species previously recorded within the Belgravia Game farm, next to Black Rock Manganese ore (Personal communication with Mr. Francois Heyderich)

Common name	Species	Red List Status
Blue Wildebeest	*Connochaetes taurinus*	LC
Red Hartebeest	*Alcelaphus buselaphus*	LC
Blesbok	*Damaliscus dorcas phillipsi*	Endemic
Grey Duiker	*Sylvicapra grimmia*	LC
Springbok	*Antidorcas marsupialis*	LC
Gemsbok	*Oryx gazella*	LC
Kudu	*Tragelaphus strepsiceros*	LC
Nyala	*Tragelaphus angasii*	LC
Eland	*Taurotragus oryx*	LC
Waterbuck	*Kobus ellipsiprymnus*	LC
Impala	*Aepyceros melampus*	LC
Steenbok	*Raphicerus campestris*	LC
Burchell's Zebra	*Equus bruchelli*	LC
Giraffe	*Giraffa camelopardalis*	LC
Caracal	*Felis caracal*	LC
African Wild cat	*Felis lybica*	VU
Cape Fox	*Vulpes chama*	LC
Bat-eared Fox	*Otocyon megalotis*	LC
Striped polecat	*Ictonyx striatus*	LC
Small-spotted Genet	*Genetta genetta*	LC
Suricate	*Suricata suricatta*	LC
Yellow mongoose	*Cynictis penicillata coombsii*	LC
Aardvark	*Orycteropus afer*	VU
Porcupine	*Hystrix africaeaustralis*	LC
Rock dassies	*Procavia capensis*	LC
Warthog	*Phacochoerus aethiopicus*	LC

Table 48: Roberts Multimedia Birds of Southern Africa listing bird species expected to occur in the QDS 2722 BB
R=Resident ; **E**=Endemic ; **BM**=Breeding Migrant ; **NBM**=Non breeding Migrant; **V**=Vagrant ; **A**=Abundant ; **VC**=Very Common ; **C**=Common ; **U**=Uncommon ; **R**=Rare ; **#**=Rare bird Record

Map Status	English Name	Scientific
E-C	Cape Penduline Tit	Anthoscopus minutus
R-U	Buffy Pipit	Anthus vaalensis
NBM-C	Eurasian Swift	Apus apus
R-U	Tawny Eagle	Aquila rapax
R-C	Kori Bustard	Ardeotis kori
E-VC	Pririt Batis	Batis pririt
E-C	Chat Flycatcher	Bradornis infuscatus
E-VC	Marico Flycatcher	Bradornis mariquensis
R-C	Spotted Eagle Owl	Bubo africanus
R-C	Giant Eagle Owl	Bubo lacteus
R-C	Spotted Dikkop	Burhinus capensis
R-U/C	Redcapped Lark	Calandrella cinerea
R-VC	Fawncoloured Lark	Calendulauda africanoides
E-VC	Sabota Lark	Calendulauda sabota
R-C	Goldentailed Woodpecker	Campethera abingoni
NBM-U	Eurasian Nightjar	Caprimulgus europaeus
BM-C	Rufouscheeked Nightjar	Caprimulgus rufigena
R-VC	Familiar Chat	Cercomela familiaris
E-VC	Kalahari Robin	Cercotrichas paena
NBM-C	Caspian Plover	Charadrius asiaticus
E-VC	Spikeheeled Lark	Chersomanes albofasciata
BM-U/C	Diederik Cuckoo	Chrysococcyx caprius
NBM-U	White Stork	Ciconia ciconia
R-C	Blackbreasted Snake Eagle	Circaetus pectoralis
NBM-U	Black Harrier	Circus maurus
NBM-U	Montagu's Harrier	Circus pygargus
BM-C	Jacobin Cuckoo	Clamator jacobinus
R-VC/A	Lilacbreasted Roller	Coracias caudata
NBM-U	Eurasian Roller	Coracias garrulus
R-C	Purple Roller	Coracias naevia
R-U	Common Quail	Coturnix coturnix
R-VC	Wattled Starling	Creatophora cinerea
BM-U	African Cuckoo	Cuculus gularis
E-U	Burchell's Courser	Cursorius rufus
R-U/C	Temminck's Courser	Cursorius temminckii
R-U/C	Cardinal Woodpecker	Dendropicos fuscescens
R-A	Forktailed Drongo	Dicrurus adsimilis
R-C	Yellowbellied Eremomela	Eremomela icteropygialis
E-C	Greybacked Finchlark	Eremopterix verticalis
R-C	Blackcheeked Waxbill	Estrilda erythronotos
E-VC	Whitewinged Korhaan	Eupodotis afraoides
E-VC	Redcrested Korhaan	Eupodotis ruficrista
E-VC	Whitecrowned Shrike	Eurocephalus anguitimens
R-C	Lanner Falcon	Falco biarmicus
R-U	Rednecked Falcon	Falco chicquera
R-U	Rock Kestrel	Falco rupicolis
R-C	Greater Kestrel	Falco rupicoloides
NBM-U	Western Redfooted Kestrel	Falco vespertinus
R-C/VC	Pearlspotted Owl	Glaucidium perlatum
E-VC	Violeteared Waxbill	Granatina granatina
R-U	Whitebacked Vulture	Gyps africanus
E-U	Cape Vulture	Gyps coprotheres
NBM-U	Booted Eagle	Hieraaetus pennatus
NBM-U	Icterine Warbler	Hippolais icterina

Map Status	English Name	Scientific
BM-VC	Greater Striped Swallow	Hirundo cucullata
R-C/VC	Rock Martin	Hirundo fuligula
NBM-VC	Eurasian Swallow	Hirundo rustica
E-VC	Glossy Starling	Lamprotornis nitens
E-VC	Crimsonbreasted Shrike	Laniarius atrococcineus
R-A	Fiscal Shrike	Lanius collaris
NBM-VC	Redbacked Shrike	Lanius collurio
NBM-C	Lesser Grey Shrike	Lanius minor
E-U	Rufouseared Warbler	Malcorus pectoralis
E-VC	Pale Chanting Goshawk	Melierax canorus
R-U/C	Gabar Goshawk	Melierax gabar
NBM-VC	Eurasian Bee-eater	Merops apiaster
R-VC	Swallowtailed Bee-eater	Swallowtailed Bee-eater
E-C	Eastern Clapper Lark	Mirafra fasciolata
E-U	Monotonous Lark	Mirafra passerina
NBM-C	Spotted Flycatcher	Muscicapa striata
E-VC	Anteating Chat	Myrmecocichla formicivora
R-VC	Helmeted Guineafowl	Numida meleagris
R-VC	Namaqua Dove	Oena capensis
R-C	Capped Wheatear	Oenanthe pileata
NBM-U	Eurasian Golden Oriole	Oriolus oriolus
R-C	African Scops Owl	Otus senegalensis
E-VC	Titbabbler	Parisoma subcaeruleum
E-C	Ashy Tit	Parus cinerascens
E-VC	Southern Greyheaded Sparrow	Passer diffusus
E-A	Cape Sparrow	Passer melanurus
R-C	Great Sparrow	Passer motitensis
E-U/VC	Sociable Weaver	Philetairus socius
NBM-U	Willow Warbler	Phylloscopus trochilus
R-VC	Whitebrowed Sparrowweaver	Plocepasser mahali
R-VC	Masked Weaver	Ploceus velatus
R-C	Martial Eagle	Polemaetus bellicosus
R-VC	Pygmy Falcon	Polihierax semitorquatus
E-VC	Blackchested Prinia	Prinia flavicans
R-VC	Groundscraper Thrush	Psophocichla litsipsirupa
E-C/VC	Redbilled Francolin	Pternistis adspersus
E-U	Doublebanded Sandgrouse	Pterocles bicinctus
E-C	Burchell's Sandgrouse	Pterocles burchelli
E-VC	Namaqua Sandgrouse	Pterocles namaqua
R-U	Whitefaced Owl	Ptilopsus granti
R-U	Melba Finch	Pytilia melba
R-VC	Redbilled Quelea	Quelea quelea
R-VC	Scimitarbilled Woodhoopoe	Rhinopomastus cyanomelas
R-C	Doublebanded Courser	Rhinoptilus africanus
NBM-U	Bronzewinged Courser	Rhinoptilus chalcopterus
R-C	Secretarybird	Sagittarius serpentarius
R-U	Orange River Francolin	Scleroptila levaillantoides
R-VC	Blackthroated Canary	Serinus atrogularis
E-VC	Yellow Canary	Serinus flaviventris
E-C	Pinkbilled Lark	Spizocorys conirostris
E-VC	Scalyfeathered Finch	Sporopipes squamifrons
R-A	Cape Turtle Dove	Streptopelia capicola
R-A	Laughing Dove	Streptopelia senegalensis
R-C	Ostrich	Struthio camelus
R-VC	Longbilled Crombec	Sylvietta rufescens
BM-U	Alpine Swift	Tachymarptis melba
R-C	Bateleur	Terathopius ecaudatus
E-VC	Southern Yellowbilled Hornbill	Tockus leucomelas
R-C/VC	Grey Hornbill	Tockus nasutus

Map Status	English Name	Scientific
R-U/C	Lappetfaced Vulture	Torgos tracheliotus
E-VC	Pied Barbet	Tricholaema leucomelas
E-VC	Pied Babbler	Turdoides bicolor
R-C	Barn Owl	Tyto alba
R-VC	African Hoopoe	Upupa africana
R-VC	Crowned Plover	Vanellus coronatus
E-VC	Shafttailed Whydah	Vidua regia

Table 49: Threatened Mammal of Northern Cape (Apps, 2000)

Species	English Name	Endemic to SA	IUCN Status
	ORDER: INSECTIVORA		
Family: Erinaceidae			
Atelerix frontalis	Southern African Hedgehog	Y	Rare
Family: Chrysochloridae			
Chrysospalax villosus	Rough-haired golden mole	Y	VU B1+2c
Amblysomus hottentotus	Hottentot golden mole	Y	
Amblysomus julianae	Juliana's golden mole	Y	CR B1+2c
	ORDER: CHIROPTERA		
Family: Vespertilionidae			
Miniopterus schreibersii	Schreiber's long-fingered bat	N	NT
Rhinolophus fumigatus	Ruppell's horseshoe bat	N	NT
Rhinolophus clivosus	Geoffroy's horseshoe bat	N	NT
Rhinilophus darlingi	Darling's horseshoe bat	N	NT
Rhinolophus denti	Dent's horseshoe bat	N	NT
	ORDER: RODENTIA		
Family Muridae			
Subfamily Murinae			
Zelotomys woosnami	Woosnam's Desert Rat	Y	Rare
	ORDER: CARNIVORA		
Family: Protelidae			
Proteles cristatus	Aardwolf	Y	Rare
Family: Hyaenidae			
Hyaena brunnea	Brown hyaena	N	Rare
Family: Felidae			
Felis lybica	African Wild Cat	N	VUC2a(i)
Felis nigripes	Small spotted cat	N	VUC2a(i)
Acinonyx jubatus	Cheetah	N	VU
Panthera leo	Lion	N	VU
Family Canidae			
Subfamily Otocyoninae			
Lycaon pictus	Wild dog	N	EN
	ORDER: TUBILIDENTATA		
Family: Orycteropodidae			
Orycteropus afer	Aardvark	N	VuC2
	ORDER: PERISSODACTYLA		
Family: Rhinocerotidae			
Ceratotherium simum	White rhinoceros	N	NT

Table 50: Threatened bird species that are priorities in the Northern Cape (Avibase, 2006)

English name	Species	Threatened Status
Maccoa Duck	*Oxyura maccoa*	NT
Jackass Penguin	*Spheniscus demersus*	VU
Southern Giant Petrel	*Macronectes giganteus*	NT
Northern Giant Petrel	*Macronectes halli*	NT
Sooty Shearwater	*Puffinus griseus*	NT
Lesser Flamingo	*Phoeniconaias minor*	NT
Cape Gannet	*Morus capensis*	VU
Crowned Cormorant	*Phalacrocorax coronatus*	NT
Bank Cormorant	*Phalacrocorax neglectus*	EN
Cape Cormorant	*Phalacrocorax capensis*	NT
Lesser Kestrel	*Falco naumanni*	VU
Red-footed Falcon	*Falco vespertinus*	NT
Egyptian Vulture	*Neophron percnopterus*	EN
African White-backed Vulture	*Gyps africanus*	NT
Cape Griffon	*Gyps coprotheres*	VU
White-headed Vulture	*Trigonoceps occipitalis*	VU
Black Harrier	*Circus maurus*	VU
Pallid Harrier	*Circus macrourus*	NT

Denham's Bustard	*Neotis denhami*	NT
Blue Bustard	*Eupodotis caerulescens*	NT
Corncrake	*Crex crex*	NT
Blue Crane	*Anthropoides paradiseus*	VU
African Black Oystercatcher	*Haematopus moquini*	NT
Chestnut-banded Plover	*Charadrius pallidus*	NT
Black-tailed Godwit	*Limosa limosa*	NT
Eurasian Curlew	*Numenius arquata*	NT
Black-winged Pratincole	*Glareola nordmanni*	NT
Damara Tern	*Sterna balaenarum*	NT
European Roller	*Coracias garrulus*	NT
Melodious Bushlark	*Mirafra cheniana*	NT
Red Lark	*Certhilauda burra*	VU
Sclater's Lark	*Spizocorys sclateri*	NT
Long-tailed Pipit	*Anthus longicaudatus*	DD

Table 51: Northern Cape Province Threatened, Rare and of conservation concern Invertebrates (Leemings, 2008 & Henning *et al*., 2009)

Species	**Taxon**	**IUCN Red List Status**	**SA Red Data Book Status***	**Preliminary Regional Assessment**	Northen Cape endemic
			Butterflies		
Anthene lindae	Butterfly	VUD2	Vulnerable		Yes
Chrysoritis trimeni	Butterfly	VUA3cD2	Vulnerable		Yes
			Spiders		
Harpactira hamiltoni	Baboon spider	NE	NE	Rare	No
Idiops fryi	Trapdoor spider	NE	NE	Rare	No
Idiops pretoriae	Trapdoor spider	NE	NE	Rare	Yes
Idiops gunningi	Trapdoor spider	NE	NE	Rare	Yes
			Scorpions		
Hadogenes gunningi	Scorpion	NE	NE	Threatened	No
Hadogenes gracilis	Scorpion	NE	NE	Threatened	No
Hadogenes longimanus	Scorpion	NE		Threatened	No

Appendix E: Comments and responses report

ASSMANG LIMITED HOUSING PROJECT, BLACK ROCK MINE OPERATIONS, HOTAZEL, NORTHERN CAPE

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT (EMPR)

March 2013

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Appendix F: Environmental Management Programme (EMPr)

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT: ASSMANG LIMITED HOUSING PROJECT, BLACK ROCK MINE OPERATIONS, HOTAZEL, NORTHERN CAPE

COMPILED BY EAP:

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PREPARED FOR REVIEW BY COMPETENT AUTHORITY

Northern Cape Department of Environment and Nature Conservation (NCDENC); and

March 2013

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ABBREVIATIONS

BEP:	Best Environmental Practice
BPEO:	Best Practicable Environmental Option
DEA:	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWA:	Department of Water Affairs
EAP:	Environmental Assessment Practitioner
ECO:	Environmental Control Officer
EO:	Environmental Officer
EIA:	Environmental Impact Assessment
IAPs:	Interested and Affected Parties
IPWM:	Integrated Pollution and Waste Management
LED	Local Economic Development
MPRDA	Minerals and Petroleum Resources Development Act
NCDENC	Northern Cape Department of Environment and Nature Conservation
NEMA:	National Environmental Management Act, No. 107 of 1998
NEMA EIA	
PSM:	Project / Site Manager
RDL:	Red Data Listed
Regulations:	Regulations GN R.453, R.454, 455 and R.456 (18 June 2010), as amended. promulgated in terms of Section 24(5) read with Section 44, and Sections 24 and 24D of the National Environmental Management Act, 1998
'The Mine':	Includes Black Rock, Gloria and Nchwaning operations

1. INTRODUCTION

1.1 INTRODUCTION

EScience Associates (Pty) Ltd. (hereinafter referred to as 'ESA') were commissioned, as an independent environmental assessment practitioner (EAP), by the Assmang Black Rock Mine Operations in the Northern Cape (hereinafter referred to as the 'BRMO') to undertaken a Basic Assessment EIA process, in terms of the provisions of the National Environmental Management Act, 1998 (Act No. 107 of 1998)[NEMA] and associated 2010 EIA Regulations (GN. R. 543 of 18 June 2010). The subject EIA process is being undertaken in support of an application for environmental authorisation to the Northern Cape Department of Environmental and Nature Conservation (DENC) for a proposed housing facility on Ptn. 3 of the Nchwaning 267, Hotazel District, Northern Cape.

Regulation 22 (j) of the 2010 NEMA EIA Regulations specifies that a Basic Assessment Report is to include, "*any environmental management and mitigation measures proposed by the EAP*". These recommendations have been formalised by the EAP through the compilation of a draft environmental management programme (EMP) conforming to the requirements specified under Regulation 33, as follows:

"*A draft environmental management programme must comply with section 24N of the Act and include –*

(a) details of –

- *(i) the person who prepared the environmental management programme; and*
- *(ii) the expertise of that person to prepare an environmental management programme;*

(b) information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of—

- *(i) planning and design;*
- *(ii) pre-construction and construction activities;*
- *(iii) operation or undertaking of the activity;*
- *(iv) rehabilitation of the environment; and*
- *(v) closure, where relevant.*

(c) a detailed description of the aspects of the activity that are covered by the draft environmental management programme;

(d) an identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);

(e) proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;

(f) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures;

(g) a description of the manner in which it intends to —

(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
(ii) remedy the cause of pollution or degradation and migration of pollutants;
(iii) comply with any prescribed environmental management standards or practices;
(iv) comply with any applicable provisions of the Act regarding closure, where applicable;
(v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;

(h) time periods within which the measures contemplated in the environmental management programme must be implemented;
(i) the process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity;
(j) an environmental awareness plan describing the manner in which—

(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and
(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;

(k) where appropriate, closure plans, including closure objectives".

In addition to the above, this EMP is compiled in accordance with the Integrated Environmental Management (IEM) philosophy which aims to achieve a desirable balance between conservation and development (DEAT, 1992). IEM prescribes a methodology for ensuring that environmental management principles are fully integrated into all stages of the development process. It advocates the use of several environmental management tools that are appropriate for the various levels of decision-making. One such tool is an Environmental Management Programme (EMP).

The IEM guidelines encourage a pro-active approach to sourcing, collating and presenting information in a manner that can be interpreted at all levels. The basic principles underpinning IEM are that there be:

- informed decision-making;
- accountability for information on which decisions are taken;
- accountability for decisions taken;
- a broad meaning given to the term environment (i.e. one that includes physical, biological, social, economic, cultural, historical and political components);
- an open, participatory approach in the planning of proposals;
- consultation with interested and affected parties;
- due consideration of alternative options;
- an attempt to mitigate negative impacts and enhance positive aspects of proposals;
- an attempt to ensure that the 'social costs' of development proposals (those borne by society, rather than the Mine) be outweighed by the 'social benefits' (benefits to society as a results of the actions of the Mine);
- democratic regard for individual rights and obligations;

- compliance with these principles during all stages of the planning, implementation and decommissioning of the proposals (i.e. from 'cradle to grave'); and
- the opportunity for public and specialist input in the decision-making process.

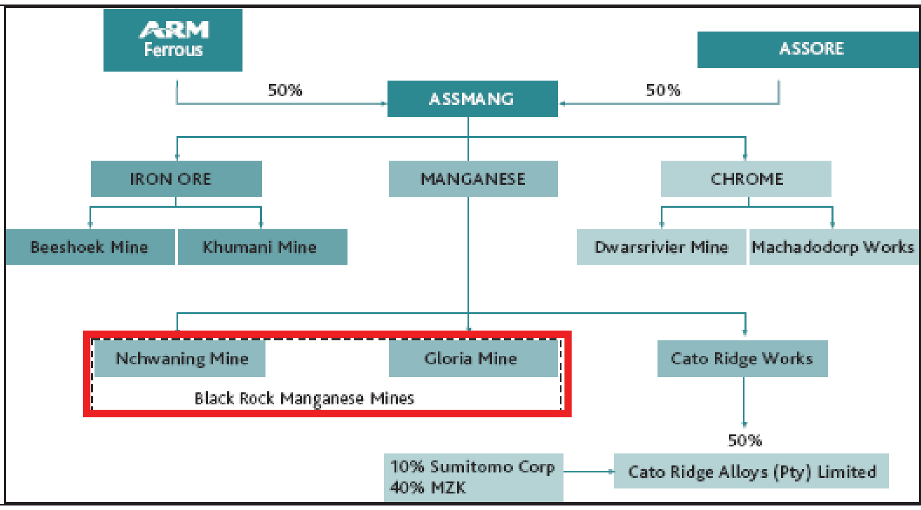
This EMP is compiled using the following concepts and implementation requirements, so that the higher principles of sustainable development are realised:

- **Continuous improvement.** The project proponent (or implementing organisation) must commit to review and to continually improve environmental management, with the objective of improving overall environmental performance.
- **Broad level of commitment.** A broad level of commitment is required from all levels of management as well as the workforce in order for the development and implementation of this EMP to be successful and effective.
- **Flexible and responsive**. The implementation of the EMP must respond to new and changing circumstances, i.e. rapid short-term responses to problems or incidents. The EMP is a dynamic "living" document and thus regular planned review and revision of the EMP must be carried out.
- **Integration across operations**. This EMP must integrate across existing line functions and operational units such as health, safety and environmental departments in a company/project. This is done to change the redundant mindset of seeing environmental management as a single domain unit.
- **Legislation.** It is understood that any development project during its construction phase is a dynamic activity within a dynamic environment. The Proponent, Engineer, Contractor and Sub-contractor must therefore be aware that certain activities conducted during construction may require further licensing or environmental approval, e.g. river or stream diversions, bulk fuel storage, waste disposal, etc. The Contractor must consult the ER, EO and ECO on a regular basis in this regard.

1.2 BACKGROUND

1.2.1 ASSMANG LIMITED

Assmang Limited is jointly owned by African Rainbow Minerals Limited (ARM) and Assore Limited, and currently has three independently operating divisions based on three respective commodities – chrome, manganese and iron ore (Figure 1-1). Assmang's Manganese Division consists of the Nchwaning II, Nchwaning III and Gloria manganese mines in the Northern Cape, as well as the ferromanganese works at Cato Ridge in Kwazulu-Natal.



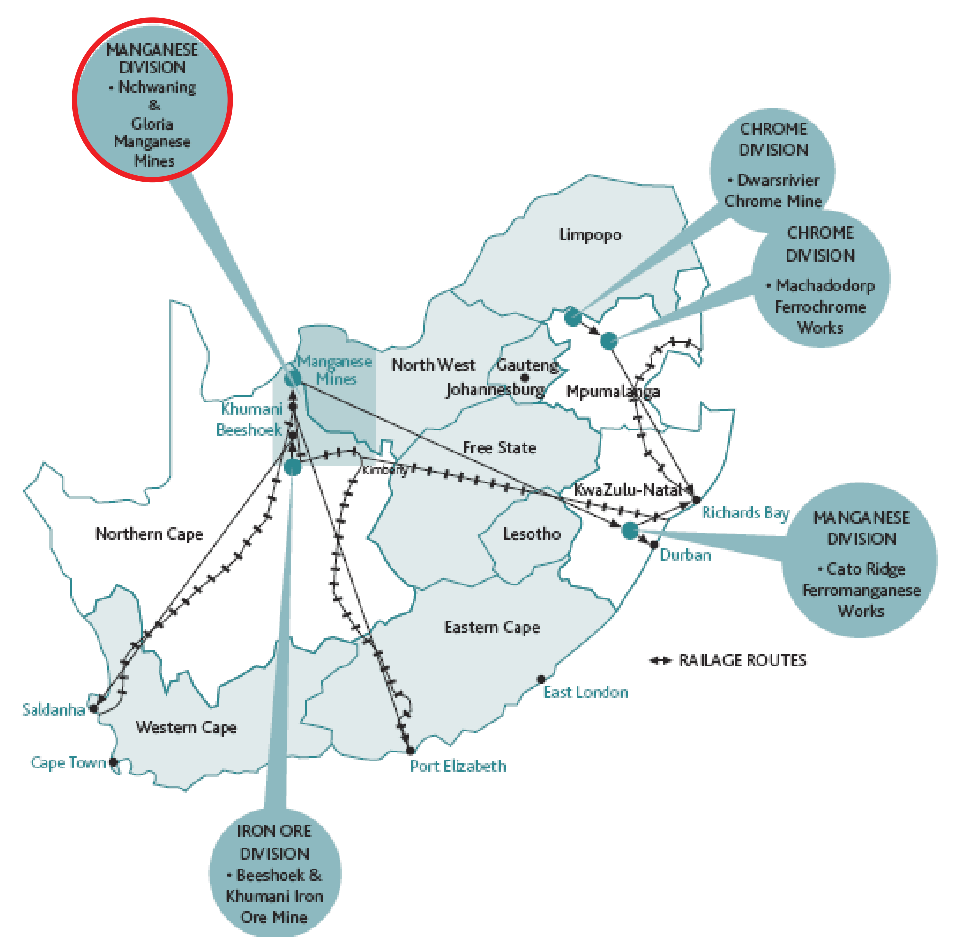


Figure 1-1: Overview of Assmang Limited South African Operations

1.3 ADMINISTRATIVE INFORMATION

The following section and associated set of tables, provides pertinent administrative information pertaining to the BRMO, associated mine lease area, as well as the environmental assessment practitioner who developed the EMP (Table 1-1 to Table 1-5).

Table 1-1: Name and Address of Mine

Owner and Name of Mine	Assmang Limited, Black Rock Mine Operations
Company Registration	1935/007343/06
Physical Address	Portion 1 of the Farm Santoy
Postal Address	PO Box 187 Santoy 8491
Telephone	(053) 751 5200
Fax	(053) 751 5252

Table 1-2: Details of Mine Environmental Specialist

Name	Mr. Bonolo Lekwa
Physical Address	Main Offices BRMO, Black Rock, Northern Cape Portion
Postal Address	PO Box 187 Santoy

	8491
Telephone	(053) 751 5302
Fax	(053) 751 5251
Email	bonolol@brmo.co.za

Table 1-3: Details of EAP	
Name of Company	EScience Associates (Pty) Ltd.
Contact Person	Mr. Bradley Thorpe
Postal Address	PO Box 2950 Saxonwold 2132 JHB
Physical Address	9 Victoria Street Oaklands 2192 JHB
Telephone	(011) 718 6380
Fax	086 512 5681
Email	bradley@escience.co.za
Qualifications	BSc. (Hons), MSc. (Env. Management) – in progress
Curriculum Vitae	Refer Appendix 3

Table 1-4: Mining Rights, Surface Rights and Title Deed Description Relevant to the BRMO

Mine	Farm Name	Title Deed	Surface Rights	Mining Rights
Black Rock	Ptn. 1 Belgravia 264	No. 541 of 1940	Assmang Limited	Assmang Limited
	Ptn. 1 Santoy 230	No. 1491 of 1970	Assmang Limited	Assmang Limited
Gloria	Ptn. 1 Gloria 226	No. 506 of 1966	Assmang Limited	Assmang Limited
Nchwaning II	Ptn. 1 Nchwaning 267	No. 541 of 1940	Assmang Limited	Assmang Limited
	Ptn. 3 Nchwaning 267	No. 1491 of 1970	Assmang Limited	Assmang Limited
Nchwaning III	Ptn. 1 Nchwaning 267	No. 541 of 1940	Assmang Limited	Assmang Limited
	Ptn. 3 Nchwaning 267	No. 1491 of 1970	Assmang Limited	Assmang Limited

Table 1-5: Project Applicable Servitudes

Mine	Servitude Type	Servitude No.
Gloria	Rail	K38 / 83S
Gloria	Water pipeline (Sedibeng Water Vaal-Gamagara Supply)	K36 / 1978S

1.4 LAND TENURE AND ADJACENT LAND USE

Assmang Limited holds both the surface- and mining rights over the properties encompassing the greater BRMO and its four constituent mining operations (i.e. Black Rock-, Nchwaning- and Gloria Mines). The land surrounding the BRMO is dominated by mining, industrial and agricultural (extensive livestock production systems) land uses (Figure 1-2). For example, land in the immediate vicinity of Black Rock Mine that is not used for mining / industrial purposes, is utilised for extensive livestock farming (i.e. sheep, goats, cattle) and game farming.

Table 1-6 and Table 1-7, in combination with Figure 1-2, provide a concise overview of mining activities and neighbouring towns associated with the Assmang BRMO.

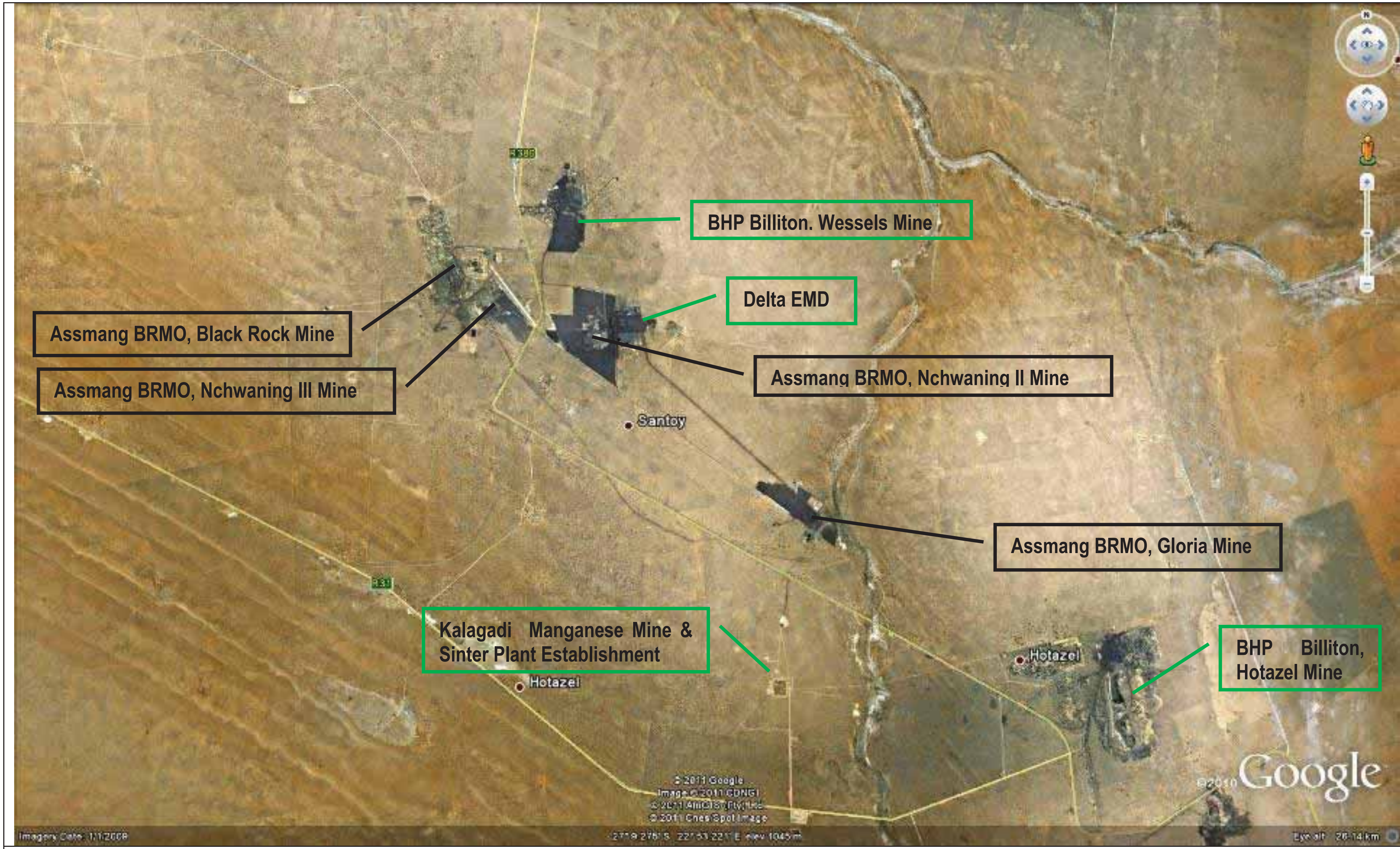


Figure 1-2: Aerial image showing Existing Mining / Industrial Land Use in the Vicinity of the Assmang Limited BRMO

Table 1-6: Neighbouring Mining / Industrial Activity/ies	
Mine / Industry	**Distance/Direction from BRMO**
Delta EMD	Immediately east of Nchwaning II Mine
BHP Billiton Wessels Manganese Mine	Approximately 1.3km north of Nchwaning II Mine
Kalagadi Manganese Mine	Approximately 2.5 km south of Gloria Mine
BHP Billiton Hotazel Manganese Mine	Approximately 7km south east of Gloria Mine

Table 1-7: Neighbouring Towns	
Town	**Distance/Direction from BRMO**
Black Rock Mine Village	Located at the BRMO
Hotazel	Approximately 17km south east of the BRMO
Kuruman	Approximately 80km south east of the BRMO
Upington	Approximately 267km south west of the BRMO
Kimberley	Approximately 320km south east of the BRMO

2. PROJECT DESCRIPTION

The Assmang Black Rock Mine Operations (BRMO) proposes to establish approximately 120 residential dwelling units at their operations north of Hotazel in the Northern Cape (proposed development footprint of 15ha in extent). Each dwelling unit would house 4 people (Figure 2-1). The project would thus ultimately provide housing for 480 Assmang employees and contractors over the operational lifetime of the mine (life of mine estimated at approximately 30 years). The proposed development (preferred site alternative, S1) would occur on Ptn. 3 of the farm Nchwaning 267 (Appendix 1 – Locality Map, refers). A second site alternative was investigated on Ptn. 1 of the farm Santoy; where this site is also owned by the BRMO.

Figure 2-1: Photograph of 4 Sleeper 'Housing Unit' Demo Model

The construction and development of the residential units is proposed in a phased manner; whereby Assmang's immediate priority is to establish an initial 40 units (Phase 1 - housing for 160 people) with an approximate development footprint of 3.5ha in extent. These 40 units are required in order to relocate staff living in hostel accommodation at the BRMO to more suitable accommodation in line with the requirements of the Mining Charter (i.e. one person per room with their own bathroom / shower and kitchenette, etc.).

The preferred development site is an undisturbed ('green-fields') site located immediately east of the Santoy Rec. Club, and north and east of the associated soccer field and pavilion (Figure 2-2). The development of such residential units elsewhere on the BRMO surface rights area is limited largely by land ownership, as well as the current operational mining activities taking place on the greater site. The preferred development site would be effectively fenced off from remaining mining activities/sites at the BRMO; whereby staff housed at the facility would need to enter the mine site through an access control point.

The proposed development would tie in with the existing sewage reticulation and associated treatment plant at the Black Rock Village (new pump station required). There would be no immediate need to upgrade the sewage treatment plant capacity as part of the development and occupation of the first 40 units (phase 1); where the treatment demand is merely being moved geographically from the hostels to the new development site, and no additional burden will be placed on the treatment plant. The development of the further 80 units (Phases 2 and 3) would potentially require the proponent to upgrade the plant and apply for any requisite licences in terms of the 'Waste Act' (Act 59 of 2008)[NEM:WA] to do so (as necessary).

Similar to the above, the potable water- and electrical demand for the development would be sourced from existing connections for each in close proximity to the site. The proposed development also makes provision for parking and hard landscaping associated therewith (e.g. internal roads, parking bays, walking paths, etc.). Access to the preferred development site would be established along the northern side of the BRMO Rec. Club.

Figure 2-2: Aerial Imagery Showing Approximate Development Footprint (15ha in extent)

3. SENSITIVE ENVIRONMENTAL FEATURES

The following section aims to briefly provide a summary of the more pertinent site sensitivities that need to be understood and acknowledged in implementing the EMP. The sensitive elements described in the section that follow were identified at the hand of specialist assessments commissioned by the BRMO in 2011/12. The said specialist assessments, furthermore, assisted in providing additional relevant information on the baseline receiving environment that has until now been lacking in relation to environmental management efforts at the greater BRMO.

3.1 BIODIVERSITY

A comprehensive specialist biodiversity assessment was commissioned for the BRMO that aimed to, *inter alia,* identify sensitive ecological features on the site applicable to the on-going mining operations on the site. Two primary elements in this regard need to be noted, as follows.

3.1.1 RED DATA LISTED PLANTS

The study most notably confirmed the presence of several red data listed (RDL) / protected floral species on the site, as shown in Figure 3-1 and Table 4-1. The species identified were not confined to one specific section of the development site, but were identified throughout all proposed development areas.

Figure 3-1: Protected Floral Species Identified on Site

Table 3-1: Protected Floral Species Identified on Site		
Scientific Name	**Common Name**	**Regulation**
Acacia erioloba	Camel Thorn	National Forests Act (1998)
Acacia haemotoxylon	Grey Camel Thorn	National Forests Act (1998)
Ammocaris coranica	Karroo Lily	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)
Harpogophytum procumbens	Devil's Claw	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)
Babiana hypogaea	Bobbejaanuintjie	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)
Boophane disticha	Bushman's poison bulb	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)

None of the aforementioned floral species may be cut, removed, relocated, or destroyed without permits having been issued by the relevant competent authorities, in terms of the legislation listed in Table 3-1.

3.2 GROUNDWATER

A specialist ground water study was commissioned by the BRMO in 2011 to inform their understanding of the hydrogeological regime applicable to their operations. Considering the geology and hydro-geological characteristics of the site (i.e. the calcrete aquifer used by the surrounding farming communities, as well as boreholes visited during the hydrocensus and used for general farming), the aquifer should be regarded as "Major aquifer system", based on the following:

- <u>Public supply and other purposes</u>: The aquifer plays a major role in the livelihood of the farming community surrounding BRMO; and
- <u>Water quality</u>: The water quality is good.

A groundwater specialist deemed there to be a low risk for the users found in the hydrocensus to be impacted by either dewatering, or contaminated groundwater originating from the proposed project. This was based on:

- The lack of groundwater encountered at BRMO; and
- Current water levels and water quality data, and the vicinity of water users encountered at BRMO during the hydrocensus.

In spite of the above and due to the presence of this major calcrete aquifer underlying the development site, as well as information gaps leading to the aforementioned impact statement, specific and focused management actions are necessary to avoid detrimental impacts on the underlying groundwater environment. All parties having a role in the implementation of the EMP need to be aware of the aquifer's importance and of the management actions required to sustain the integrity thereof.

4. ENVIRONMENTAL MANAGEMENT PROGRAMME

The environmental consequences / impacts on the receiving 'environment' associated with the proposed project are addressed within the associated Basic Assessment Report (attached hereto). This EMP is a tool used to provide the assurances that Assmang have made suitable provision for the effective mitigation of the aforementioned consequences / impacts. The EMP, furthermore, describes the method and procedures required for the effective mitigation and monitoring of impacts; where the prescribed mitigation and monitoring actions are closely linked with environmental objectives and targets that the proponent needs to achieve in order to reduce, or eliminate, negative impacts over the full project lifecycle (Aucamp, 2010).

To ensure that the impacts associated with the project are properly mitigated, managed and / or avoided (where possible), a number of specific environmental objectives have been defined for the project. The environmental objectives need to be attained and / or maintained to ensure satisfactory 'environmental' (i.e. social, economic, bio-physical) management of the directly affected area and the potential cumulative impacts on the surrounding environment.

One also needs to make a distinction between the objectives for on-going environmental management applicable to the construction and operational phases, as well as the objectives for rehabilitation of the development footprint at mine closure; where the inherent linkages between such objectives also need to be acknowledged. The most effective means of ensuring that closure objectives are achieved, is by ensuring that all preceding development phases are managed with 'mine closure' in mind, as follows:

- Design with closure in mind;
- Construct with closure in mind; and
- Operate with closure in mind.

In terms of The Constitution of the Republic of South Africa (Act No. 108 of 1996), everyone has the right to, "*an environment that is not harmful to their health or well-being and to have the environment protected, for benefit of present and future generations, though reasonable legislation and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while prompting justifiable economic and social development*". The needs of the environment, as well as Interested and Affected Parties (IAPs) should thus be integrated into overall mine management. This EMP provides a tool for meeting this objective by providing detailed mitigation and management commitments by BRMO for the proposed project (including decommissioning and rehabilitation thereof).

The environmental mitigation tables in the following sections provide the management measures recommended to manage the potential impacts rated in the Basic Assessment Report. In addition to the management measures provided the table indicates the person responsible to ensure that these commitments are adhered to and implemented and the priority of these commitments (either prior a phase, during a phase and/or on-going).

The responsible persons from the side of the proponent have assessed these commitments in detail and have committed to the specific management measures where indicated in the tables.

4.1 LEGISLATION

The environmental component of the project will comply with the requirements of, *inter alia*, the following national legislation and relevant Regulations promulgated hereunder (Table 4-1).

Table 4-1: Key legislation considered for EMP development
Constitution of South Africa (Act No. 108 of 1996);
The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002), as amended;
The National Environmental Management Act (Act No. 107 of 1998), as amended;
The National Water Act (Act No. 36 of 1998);
The Conservation of Agricultural Resources Act (Act No.43 of 1983);
The National Environmental Management: Air Quality Act (Act No. 39 of 2004);
The Hazardous Substances Act (Act No. 15 of 1973);
The National Heritage Resources Act (Act No. 25 of 1999); and
The National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

Notwithstanding the BRMO's requirements to ensure that all activities undertaken on the site (for all phases of the project) are compliant with the provisions and objectives of, *inter alia*, the aforementioned legislation, the following objectives shall act as a core frame of reference for the implementation of this plan in the event of any uncertainty(ies).

Table 4-2: Environmental Objectives for the BRMO	
Soils	To conserve and protect site soils, through practical and feasible means, such that any impact on such does not impede the BRMO from achieving the stated 'ecological' and 'end land-use' objectives for the site at closure or any other environmental objectives applicable to construction- and operational related phases of their on-going operations.
Biodiversity	To, through practical and feasible means, optimise the human use value of the site whilst still improving biodiversity levels of the specific systems present over the BRMO; toward meeting the stated 'ecological' and 'end land-use' objectives for the site at closure.
Surface- and Ground Water	To ensure that, through the implementation of appropriate pollution and storm water control and prevention measures and the efficient re-use and recapture of 'affected' water on site, that the Mine does not unnecessarily overburden ground- and surface water resources (quality and quantity) on which adjacent communities and industry in the catchment are dependent on for their livelihood and / or well-being.
Noise	No project phase should generate noise to the extent that such becomes intrusive beyond current, baseline, ambient noise levels at the site boundary.
Air	To manage emissions generated on-site (incl. fugitive dust) in such a manner that is not only legally compliant, but protective of human health and well-being.
Waste	To manage all waste generated on-site in a manner that is protective of human health and environmental resources, and that efforts to optimise waste recycling, reuse or recovery ultimately achieve a better environmental outcome than if waste were to be disposed of to landfill.

4.2 ROLES AND RESPONSIBILITIES

It is the responsibility of the BRMO to ensure that the commitments made in this chapter are realised. Mine Management needs to make sure that not only are sufficient funds set aside for this, but that a suitable management and working structure is in place. This includes a system whereby all employees, contractors, sub-contractors and anyone delivering a service to the Mine, is made aware and forced to abide by the commitments in this chapter.

4.2.1 THE PROJECT PROPONENT (ASSMANG LIMITED)

Assmang will be responsible for the overall implementation, monitoring and enforcement of the activities as outlined in the EMP. The project manager, or other senior designate from Assmang, will be responsible for overseeing that environmental compliance and monitoring is performed, and will undertake all correspondence with the relevant authorities.

Assmang remains ultimately responsible for ensuring that all activities are implemented according to the provisions of the EMP and all conditions of relevant licences/permits/approvals/authorisations. Although specific role-players will be appointed by Assmang to perform certain functions on its behalf, the ultimate responsibility is not delegated. Assmang has to ensure that sufficient resources (time, financial, human, equipment, etc.) are available to these other parties to efficiently perform their tasks in terms of the EMP. Because Assmang is liable for restoring negligent damage caused to the environment, each member of staff has to be responsible and accountable for compliance as per the EMP.

4.2.2 PROJECT/SITE MANAGER (PSM)

Assmang must appoint/designate a senior representative as Project / Site Manager (PSM) to act on its behalf. The duties of this representative, as relevant, would include:

- Ensure that the EMP is part of relevant contractual documentation so that any contractors are bound to the conditions of the EMP and relevant licences, permits / approvals / authorisations;
- Monitor the undertaking of environmental awareness training for all new personnel coming onto site, or undertake environmental awareness courses themselves;
- Appoint an Internal Environmental Officer/Specialist (IEO) to assist with day-to-day EMP implementation and monitoring duties;
- During the construction phase, the IEO must oversee all the environmental aspects relating to the development and provide auditing of compliance with the EMP;
- Ensure that the necessary waste licenses, environmental authorisation and permits have been obtained and are maintained;
- Comply with the contents of the EMP to ensure that the requirements of the EMP are met;
- Monitor and verify that the EMP is adhered to at all times and take action if the specifications are not followed;
- Monitor and verify that environmental impacts are kept to a minimum;
- Review operational procedures in conjunction with the IEO;
- Assist the IEO in finding environmentally responsible and effective solutions to any problems encountered during implementation;
- Inspect the site and surrounding areas from time to time; and
- Monitor, review and verify compliance with the EMP as reported by the IEO.

4.2.3 INTERNAL ENVIRONMENTAL OFFICER (IEO) / (PRACTITIONER)

Assmang's Internal Environmental Officer / Manager (IEO) will be responsible for monitoring, reviewing and verifying compliance with the EMP on a day-to-day basis. This role may be fulfilled by any suitably qualified and responsible representative involved with daily on-site operations (e.g. Environmental Manager / Officer / Practitioner. In particular, the IEO shall:

- Regularly inspect and continuously monitor the site to ascertain the level of compliance with the EMP;
- Maintain inspection reports on file;
- Monitor and verify through quarterly audits that the EMP is adhered to at all times and take action if the specifications are not followed;
- Monitor and verify that environmental impacts are kept to a minimum;
- Assist Assmang in finding environmentally responsible solutions to problems;
- Keep records of all activities/incidents concerning environment performance;
- Keep a register of complaints from IAPs;
- Provide material/manuals and support for raising environmental awareness of staff;
- Ensure that activities on site comply with legislation of relevance to the environment;
- Liaise with relevant authorities;
- Liaise with contractors regarding environmental management.
- Complete checklists as necessary; and
- Continually, internally review the EMP and submit monthly reports to the PSM.

a) Liaison with Authorities

The IEO would be responsible for liaising with all relevant competent authorities (e.g. NCDENC, DAFF).

b) Liaison with Contractors

The IEO will be responsible for informing the contractors of any decisions that are taken concerning the natural and social environment during the project activities. This would also include informing the contractors of the necessary corrective actions to be taken against employees transgressing the management activities stipulated in this EMP.

4.2.4 ENVIRONMENTAL CONTROL OFFICER (ECO)

It is recommended that an independent Environmental Control Officer (ECO) be appointed by Assmang to oversee relevant environmental aspects relating to this development for the construction phase. He / she would need to conduct independent quarterly, external, audits to assess compliance with the EMP and be responsible for providing feedback on potential environmental problems associated with the activities on site.

The ECO will:

- Assist the IEO in ensuring that necessary authorisations and other relevant license / permits / approvals / authorisations have been obtained;
- Undertaking routine monitoring and/or appointing a competent person / institution to be responsible for specialist monitoring, if necessary;
- Undertake independent audits with regards to compliance with the EMP;

- Compile audit reports identifying areas of non-compliance and proposals for rectification thereof; and
- Assist Assmang in achieving and maintaining first-rate environmental management practices.

4.3 MONITORING, AUDITING, RECORDING, REPORTING AND UPDATING

An essential aspect of any EMP is the review process. This includes monitoring, auditing, record keeping, reporting and updating. The findings of the review process can inform planning on the mine, allowing future operations to benefit from the experiences of the past.

4.3.1 MONITORING

Monitoring needs to be kept to a manageable task and therefore needs to target the most important instructions in the EMPR, where the risk of environmental damage is the greatest. Monitoring needs to include both a routine aspect and allow for erratic or unpredictable events, such as floods or human caused incidents (spills, etc.). Some routine monitoring can be done at varied intervals (e.g. alien vegetation observations), but other monitoring requires regular sampling to allow easy scientific analysis of the results, such as monthly or quarterly water sampling.

GN. R. 527 of 2004 states:

"55. (1) ... a holder of such a permit or right must:-
(a) conduct monitoring on a continuous basis;"

Monitoring should cover the following:

- Monitor the higher risk activities/areas more frequently;
- Regular collection of samples for scientific analysis;
- Routine observations of behaviours and practices;
- Noting of unusual events, incidents and accidents (natural and human triggered);
- Brief statement whether or not conditions of the EMP are being met; and
- Possible reasons why conditions are not being met.

4.3.2 AUDITING

Auditing can be done internally, or by an external party. Internal audits are recommended, but optional, whilst an external audit is essential, as it provides an unbiased report on the implementation of the EMPR. An audit can be a thorough audit of every single instruction in the EMP, or a strategic sample of the most important instructions, but it must be made clear which type of audit is being done.

Audits must include the following three key investigation techniques:

- Document review, including previous audit reports, technical reports, monitoring data, etc.;
- Interviews with staff (not only the ENVIRONMENTAL Manager); and

- Site visit or walkabout.

An audit must always be documented in a report that contains observations/findings and recommendations. It is recommended that an audit be conducted at least quarterly during the construction phase on the EMP.

4.3.3 RECORD KEEPING

Record keeping must be done in such a way that all information generated can be accessed easily in the future. The information must also be clearly marked or labelled so that it is obvious to what the information applies. For example, all reports must be dated, and all monitoring results must belong to a monitoring point, which is located on a map, and so on. In this regard, metadata (or data about data) is important, such as who collected the sample, when, where it was analysed, and so forth.

The following types of information typically need to be stored:

- Raw data from analyses (numbers in a database or spreadsheet) and the metadata;
- Summary statistics, graphs and analyses of data;
- Observations and comments from monitoring of the EMP implementation;
- Monitoring reports presenting the above three categories;
- Audit reports, both internal and external;
- Incident/event reports;
- Correspondence: e.g. letters showing appointment of auditors, addressing non-compliant sub-contractors, government responses, etc.;
- Authorisations and approvals;
- Master documents, such as EIA reports and the EMP (including the latest approved EMP and any approved addendums); and
- A working copy of the EMP, with proposed amendments.

4.3.4 REPORTING

Adequate monitoring, auditing and record keeping make reporting a simple task. Information and existing reports can be assembled and presented to whoever may need them. Knowing what reporting is necessary can help inform the type of monitoring and the system of record keeping. Typical reporting requirements include:

- Company performance/management system reports (e.g. performance targets);
- Company environmental/sustainability reports (part of annual reports);
- Audit reports, including review of the EMP; and
- Incident/event reports.

4.3.5 UPDATING THE EMP

An EMP is a working document. As management methods are improved and as the mine operations change, requiring new methods and allowing others to fall away, the EMP needs to be adjusted to reflect these changes.

It is recommended that a working copy of the EMP be kept available at all times and any observations, thoughts or proposals be placed in the working file for consideration later. The need to revise the EMP is dependent upon how many changes are needed. A well established operation with few changes may not need to revise its EMP for many years, whilst a fast changing operation may need a revision at least annually.

4.4 NOTE ON DEVELOPMENT PHASES

Typically an EMP is divided into the actions required for each phase of a development, namely:

- Planning and design;
- Construction;
- Operations (the life of the activity); and
- Closure and aftercare.

The mitigation tables that follow have been compiled to consist of seven (7) criteria, as follows:

- "Activity / Structure / Infrastructure" - This row will identify the issue being addressed, e.g. potential biodiversity loss through vegetation clearance;
- Environmental Aspect – That being the environmental parameter/s potentially impacted upon by the activity, structure or infrastructure under consideration;
- Impacts – Describes, for every applicable environmental aspect, the potentially negative changes that could result from the activity, structure or infrastructure under consideration;
- Mitigation Actions - This column will include all the necessary environmental management measures for each activity, structure or infrastructure under consideration;
- Measurable targets - indicate what evidence is to be used as an indication to whether, or not, the 'Management Actions' have been effectively implemented;
- Responsible Party – Indicates that party who is ultimately responsible for ensuring that the prescribed mitigation measures are appropriately implemented within the specified time-frames; and
- Time-frames / Frequency of action – This column provides time guidelines for the 'Responsible party' by which he/she is to action or manage the required mitigation.

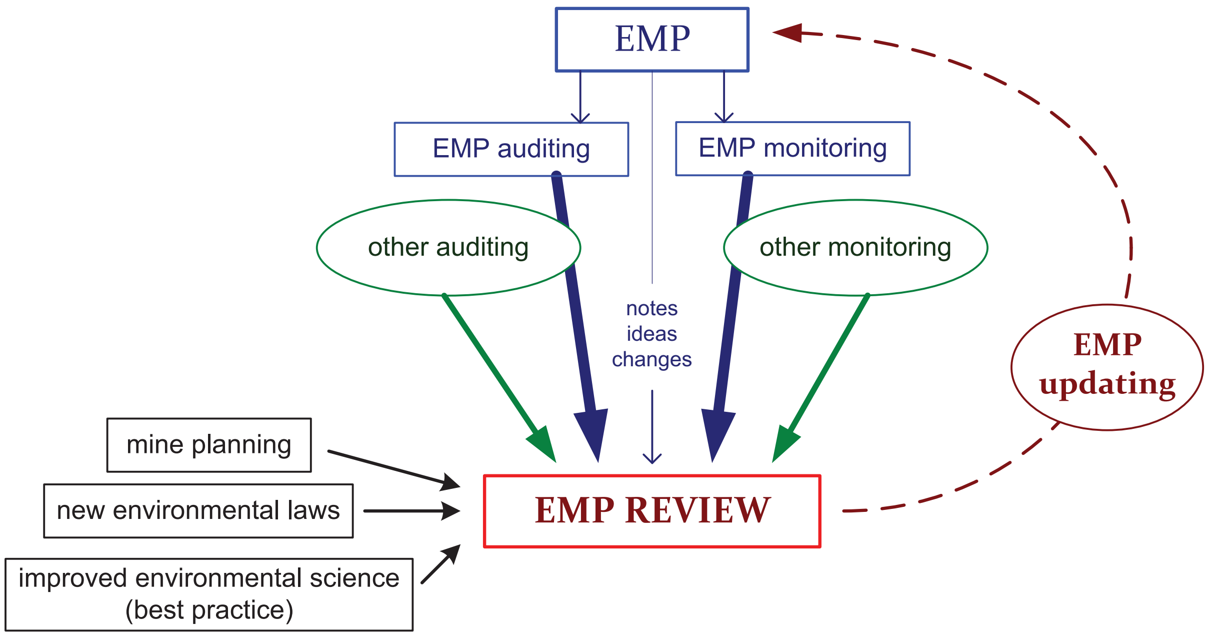


Figure 4-1: Conceptual diagram for EMP review cycle. Note the main division between internal information, such as auditing and monitoring, and external information, such as changes to environmental laws and regulations, which should provide input on the revision of the EMP.

4.5 PRE-CONSTRUCTION, PLANNING AND DESIGN

Table 4-3: Mitigation for Pre-construction, Planning and Design Phase

ASPECT	ACTIVITY	MANAGEMENT ACTIONS & MONITORING	RESPONSIBILITY	FREQUENCY
1. Project Planning & Design Phase				
1.1 Management (Set-up structures and procedures for implementation of EMP)	Update the EMP after detailed design has been completed (if necessary)	This EMP must be updated to ensure that it is relevant to the detailed design of all applicable structures and supporting infrastructure	Proponent	Once-off prior to commencement
	Update the EMPR to reflect the requirements of the Environmental Authorisation	This EMP must be updated to ensure that all specific conditions of relevant approvals, licences and authorisations issued for this project have been incorporated into the EMP.	Proponent	Once-off prior to commencement
	Appointment and duties of ECO	The project proponent must appoint an independent Environmental Control Officer (ECO) who must monitor compliance with the EMP during the construction phase on a quarterly basis.	Proponent, ECO	Once-off prior to commencement
	Management of staff and contractors	The EMP must be made binding to contractors and should be included in tender documentation for the contract.	Proponent, Contractor/s	Once-off before contractor appointments
		The EMP must be made readily available to the contractors, staff, as well as other relevant role-players associated with the project.	Proponent	Continuous
1.2 Training	Training of staff and contractors	Contractors and staff must be properly trained in all environmental aspects relating to their role in the project's construction and operation, as per requirements of the associated environmental awareness plan.	Proponent, Contractor/s	Once-off prior to commencement & update as required
1.3 Legal Compliance	Environmental Authorisation	Obtain environmental authorisation, in terms of the National Environmental Management Act (107 of 1998), from the Northern Cape Department of Environment and Nature Conservation (NCDENC) for all activities triggered in either GN. R. 543, 544 or 545 of the 2010 NEMA Regulations of 18 June 2010	Proponent	Once-off prior to commencement
	Removal / destruction of protected floral species	Permits applicable to the removal, relocation or destruction of protected floral species must be obtained prior to undertaking any such activity	Proponent	Once-off prior to commencement
	Any other conditions	All relevant management and mitigation required by the Environmental Authorisation and any other environmental authorisations or licences or permits, must be incorporated into the project design	Proponent	Once-off prior to commencement (where practical)

4.6 CONSTRUCTION PHASE

Table 4-4: Construction Camp Establishment

Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality through vehicle entrained dust generation within the camp/s	A dust palliative with at least 80% dust reduction efficiency must be applied to bare soil surfaces in the camp/s (See Appendix 4 for alternative palliative choices) **Contractor Method Statement Required.**	80% reduction in vehicle entrained dust generation	Proponent, Contractor	Initial once-off. Further application as necessary to meet target on an on-going basis
	Degraded air quality through the burning of waste	Under no circumstances is waste to be burnt, or buried, within the construction camp, or anywhere else on site	Safe disposal certificates available for all waste generated and removed from site for subsequent management	Proponent, Contractor	Continuous
Ground water	Negative quality impacts resulting from temporary ablution / sanitary facilities	Contractor/s must provide appropriate (capacity / effective containment of grey and black water), above-ground, ablution / sanitary arrangements for employees, and maintain / service such for the duration of their occupation within the camp/s **Contractor Method Statement Required.**	No contact between black /grey water and site soils. No offensive odours emanating from ablution facilities.	Proponent, Contractor	Once-off, with weekly maintenance thereafter
	Negative quality impacts resulting from cement / concrete batching activities	Concrete batching (if required) must take place on a durable, impermeable, bunded surfaces	No contact between concrete / raw material and site soils.	Proponent, Contractor	Once-off
		Run-off from batching activities must be effectively contained and prevented from entering the environment (i.e. soils, surface water) **Contractor Method Statement Required.**	No contact between potentially contaminated run-off and site soils or surface water	Proponent, Contractor	Continuous
	Negative quality impacts resulting from the storage of fuel, oil and hazardous materials	No underground fuel tanks may be established as part of the construction activities within the camp/s, or anywhere else on site during construction, or operation	No underground fuel tanks established on site	Proponent, Contractor	Continuous

Table 4-4: Construction Camp Establishment

Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		Above ground fuel, or oil storage tanks, must be located within appropriately sized, impermeable, bund walls (inclusive of valve for release of storm water ingress, unless otherwise roofed), and must not exceed 80cubic meter storage capacity (cumulative threshold for the storage of hazardous substances on site).	Bund wall capacity sized to at least 110% of the cumulative volume of fuel and oil stored therein. Records of weekly bund wall integrity inspections kept on record	Proponent, Contractor	Continuous. Weekly inspections of bund wall integrity.
		Appropriate hydrocarbon spill management kits must be kept and maintained on site wherever fuels and oils are stored, and where refuelling and /or servicing of plant, vehicles and machinery takes place, in order to manage potential hydrocarbon spillages effectively	Spill management kits available on site and replenished as necessary	Proponent, Contractor	Continuous
		Training, in the use and maintenance of the abovementioned kits, as well as any contaminated waste products, must be provided to ALL staff either directly, or indirectly, involved in any of the activities identified above	Records of training kept on record	Proponent, Contractor	Once-off, with annual refresher training every year thereafter
		Bund establishment must be compliant with BRMO 'bund wall' procedure - Env-S/UG-GN-002	Compliance with existing BRMO procedure	Proponent, Contractor	Once-off
		Hazardous material / chemical containers must be stored within appropriately sized, impermeable, bund walls (inclusive of valve for release of storm water ingress, unless otherwise roofed)	Bund wall capacity sized to at least 110% of the volume of the largest chemical container stored therein. Records of weekly bund wall integrity inspections kept on record	Proponent, Contractor	Continuous. Weekly inspections of bund wall integrity.
		Soil contaminated through the spillages of fuel, oil or hazardous materials within the construction camp must be immediately collected and placed within a dedicated, water-tight, skip/container within the camp/s, for subsequent disposal at an appropriately licensed	Dedicated 'contaminated soil' skip/container on site. Contents removed to hazardous landfill site. Safe disposal certificates	Proponent, Contractor	Continuous

Table 4-4: Construction Camp Establishment

Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		hazardous waste disposal facility	kept on record for all contaminated soil removed from site.		
	Negative quality impacts resulting from vehicle/plant workshops and wash bays	All servicing of plant and vehicles is to take place strictly within dedicated workshops within construction camp/s, or otherwise off-site at appropriate service yards.	No servicing of plant or vehicles outside of dedicated workshop areas	Proponent, Contractor	Continuous
		Furthermore, servicing and maintenance of plant and vehicles must take place on impermeable surfaces and under cover.	Covered, impermeable, platforms established for the servicing of vehicles and plant within the construction camp/s	Proponent, Contractor	Continuous
		Storm water run-off within the camp/s must be prevented from flowing through workshops and wash bays	Appropriate storm water management measures implemented, such that the generation of potentially contaminated surface water run-off is avoided	Proponent, Contractor	Continuous
		Potentially contaminated wash water must be effectively diverted, contained and managed, such that no hydrocarbon contaminants are ever in contact with site soils **Contractor Method Statement Required.**	No contact between potentially contaminated wash water and site soils or storm water flows	Proponent, Contractor	Continuous
Surface water	Generation of contaminated surface water run-off during rainfall events	Storm water diversions must be established on the up-slope of construction camp/s, such that storm water flows are diverted away from camp/s and the potential contamination of clean storm water run-off averted **Contractor Method Statement Required.**	Storm water management measures appropriately implemented	Proponent, Contractor	Once-off

Table 4-4: Construction Camp Establishment

Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Biodiversity	Reduced biodiversity due to construction camp/s establishment in green-field areas	Construction camps may only be established within the approved development footprints of the proposed project elements	No vegetation cleared, that will not already require clearing as part of the approved project elements	Proponent, Contractor	Once-off
	Poaching / killing of indigenous site fauna	Under no circumstances is the poaching, or killing, of indigenous site fauna by the contractor, or his/her employees, to be tolerated	No harm to indigenous site fauna. Records kept on file of applicable training by contractor	Proponent, Contractor	Continuous. Once-off training, with annual refreshers every year thereafter
		Non-compliance with the above condition to constitute grounds for the immediate, permanent, removal of guilty parties from site	Signed declarations by contractor and all his/her employees in acknowledgement of this provision	Proponent, Contractor	Continuous
	Destruction of site flora through unauthorised 'harvesting' thereof	Under no circumstances are wood, or medicinal plants, to be 'harvested' by the contractor, or his/her employees	No destruction / 'harvesting' indigenous site flora. Records kept on file of applicable training by contractor	Proponent, Contractor	Continuous. Once-off training, with annual refreshers every year thereafter
		Non-compliance with the above condition to constitute ground for the immediate, permanent, removal of guilty parties from site	Signed declarations by contractor and all his/her employees in acknowledgement of this provision	Proponent, Contractor	Continuous
	Anthropogenic veld fires resulting in biodiversity loss	If fires, for the purposes of cooking, are to be tolerated within the construction camp/s, the following conditions are to apply: • Must be well removed from fuel and hazardous material storage areas, in line with appropriate BRMO safety standards; • Must be well removed from indigenous vegetation (at least 15m); • Fire-extinguisher must be readily available;	Well managed, clearly designated, area/s established for cooking fires.	Proponent, Contractor	Continuous

Table 4-4: Construction Camp Establishment

Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		• Must be screened from wind with non-flammable material/s; and • Non-smouldering ash residues must be disposed of to general waste skip/s, or containers, in the camp.			
	Infestation and propagation of alien invasive floral species	Contractors must ensure that alien invasive floral species within the bounds of their camp/s are managed in accordance with relevant provisions of the BRMO alien invasive species management plan (Appendix 5)	No alien invasive floral species infestation within camp/s	Proponent, Contractor	Continuous
		Contractors to receive training and assistance by BRMO environmental officer in regard to the above requirements	Copy of BRMO alien invasive species management plan provided to contractor/s. Records available of relevant training	Proponent, Contractor	Once-off
Soils	Negative impacts on quality due to inappropriate waste management	Contractors must provide sufficient, water-tight, skips/containers on site for the <u>separate</u> storage of general and hazardous waste	Sufficient skips provided for. No mixing of general and hazardous waste streams	Proponent, Contractor	Once-off
		Under no circumstances must waste be stored on site anywhere but in the appropriate skips/containers provided for such; unless otherwise in water-tight drums placed intermittently throughout the camp/s, that will ultimately be decanted into primary waste storage skips/containers	No *ad hoc* waste stockpiling on bare soil surfaces.	Proponent, Contractor	Continuous
		Waste skips/containers must be cleared when full, such that waste doesn't over-flow onto adjacent ground	No evidence of full, or over-flowing, waste skips / bins	Proponent, Contractor	Continuous
		Safe disposal / management certificates must be obtained, and kept on file, for all waste removed from site; where the waste management facility / contractor used for such purposes must be appropriately licensed	Records of safe disposal / management certificates kept on record	Proponent, Contractor	Continuous

Table 4-4: Construction Camp Establishment

Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		/ permitted for such			
		The contractor is responsible for ensuring that wind-blown litter is collected from the bounds of the camp/s on a daily basis.	No evidence of wind-blown litter. Records of daily collections / inspections kept on record.	Proponent, Contractor	Continuous
Socio-economics	Social impacts stemming from an influx of contractors and associated employees	Only contractor/s and his/her employees, or sub-contractors, may be housed within, or gain access to, such facilities in the construction camp/s **Contractor Method Statement Required.**	Well controlled access to camp/s	Proponent, Contractor	Continuous
		Access by the contractor and his/her employees to adjacent farms (i.e. other than those falling within the ambit of the project) is strictly forbidden; unless otherwise agreed upon, in writing, by the relevant landowner/s. Trespassing is to constitute immediate grounds for the permanent removal of guilty parties form the project	No trespassing	Proponent, Contractor	Continuous
		The negative impact on housing and service delivery provision pressures could be reduced by sourcing the majority of construction workers from local communities, thus reducing the need to bring new people into the local area. In this case, the District Municipality could be approached with a request to conduct a skills audit of the nearby communities, which will allow the contractor/s to identify people with suitable skills	Use of local labour sourced from the District to the greatest extent practical	Proponent, Contractor	Continuous
General	Numerous	Contractor/s are required to provide written method statements to the ECO/BRMO environmental manager, detailing how they intend to achieve compliance with the EMP in relation to the following aspects of construction camp management:	Written, ECO/BRMO approved method statements in place as required	Contractor, BRMO environmental manager and ECO	Once-off prior to commencement

Table 4-4: Construction Camp Establishment

Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		• Dust suppression within the contractors camp; • Provision of ablution / sanitary arrangements for their employees; • Black and Grey Water Management within the camp/s; • Storm water management within the construction camp/s; and • Site access management.			

Table 4-5: : Vegetation Clearance

Activity / Structure / Infrastructure	Vegetation clearance, leading to ultimate establishment of construction camp/s, housing units and supporting ancillary infrastructure.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality through vehicle entrained dust generation	Cumulative dust deposition target thresholds, in terms of SANS 1292, 2009/11/17, must be met at the BRMO site boundary	Less than 600mg/m²/day at the BRMO Mine boundary – 30 day average	Proponent, Contractor	Continuous
Ground water	Degraded groundwater quality through hydrocarbon contamination	Plant and vehicles used on site must be well maintained / serviced, and visually inspected (at least daily) by their respective operators for hydrocarbon (i.e. oil, fuel and hydraulic fluids) leaks.	Records on file of daily visual plant and vehicle inspections	Proponent, Contractor	Continuous
Biodiversity	Destruction of habitat leading to overall loss of biodiversity (Incl. relocation, removal and destruction of protected floral species)	Vegetation clearance must be limited to the smallest area practical to enable construction activities and the establishment of structures and infrastructure. These areas need to be clearly marked out (e.g. taped off) under the supervision / assistance of the ECO and BRMO environmental manager as vegetation clearance proceeds on site. Required to ensure that all vegetation clearance is restricted to designated areas to the greatest extent practical	No unnecessary clearance of indigenous vegetation. Vegetation clearance according to a final ECO and BRMO approved 'clearance layout'.	Proponent, Contractor, ECO	Continuous

Table 4-5: : Vegetation Clearance

Activity / Structure / Infrastructure	Vegetation clearance, leading to ultimate establishment of construction camp/s, housing units and supporting ancillary infrastructure.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		No protected floral species may be removed, relocated or destroyed without the necessary permits for such having been obtained from the relevant competent authority	Copies of permits on file prior to proceeding with vegetation clearance	Proponent, Contractor	Once-off
		The removal, relocation or destruction of protected plant and tree species must be undertaken in compliance with all conditions stipulated in the above mentioned permits.	EMP appropriately updated to include specific conditions of permitting	Proponent, Contractor	Continuous
		Any *Ammocaris coranica, Harpogophytum procumbens, Babiana hypogaea* and *Boophane disticha*, or any other red data listed (RDL) plant species identified on site, need to be rescued and relocated under the guidance of a competent ecologist, or by parties trained to undertake such by a competent ecologist, as part of a species specific rescue and relocation plans formulated by a competent ecologist	Records kept of all RDL plant species rescued and relocated, as well as point of relocation thereof. Record of specialist ecologist appointment on file, as proof of involvement in rescue and relocation	Proponent, Contractor, Specialist Ecologist	Once-off, prior to commencing with broad-scale vegetation stripping.
		An indigenous tree nursery (particularly with respect to the growing of protected tree species to be destroyed) must be established by the BRMO in order to facilitate concurrent and closure rehabilitation.	The number of trees propagated and subsequently re-planted on site by completion of mine closure / rehabilitation, must at least equal the amount thereof removed during the construction phase	Proponent	Continuous
	Establishment of alien invasive floral species and associated negative impacts on biodiversity	All areas stripped of indigenous vegetation cover need to be regularly inspected for the potential establishment of alien invasive species, and appropriate control measures applied where these species are observed to have established (i.e. in accordance with the provisions of the BRMO 'alien invasive species management	Proof of training, in 'weed' identification, provided to mandated 'inspector/s. Inspection register maintained by the contractor/s, as well as	Proponent, Contractor	Weekly 'weed' inspections (Summer). Monthly 'weed' inspections (Winter) Problem species cleared within 5 calendar days of their identification.

Table 4-5: : Vegetation Clearance

Activity / Structure / Infrastructure	Vegetation clearance, leading to ultimate establishment of construction camp/s, housing units and supporting ancillary infrastructure.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		plan').	documentation of any control measures applied (location, method & effectiveness at the very least)		
		A copy of the BRMO alien invasive species management plan, inclusive of quick 'weed identification' flash-card sets, to be supplied to the relevant contractor/s involved in vegetation stripping	Proof of contractor's receipt of the management plan	Proponent	Once-off
Soils	Loss of topsoil to vegetation stripping, thereby reducing remaining available extent thereof for rehabilitation efforts at mine closure	The degree of 'topsoil' lost to vegetation stripping needs to be kept to an absolute minimum by the relevant contractor/s.	Minimal loss of topsoil with 'stripped' vegetation.	Proponent, Contractor	Continuous
	Erosion losses from exposed soil surfaces	Any runnels, or erosion channels, developing during any construction, or on-going operational and maintenance period, shall be back-filled and consolidated immediately and the area restored to the proper condition. The contractor shall not allow erosion to develop on a large scale before effecting repairs and all erosion damage shall be repaired as soon as possible (Topsoil washed away shall be replaced).	No evidence on site of erosion channels. Topsoil has been appropriately replaced where it has been lost through surface storm water flows.	Proponent, Contractor	Continuous. Remedial action within 48 hours.
Noise	Negative impacts on ambient noise levels resulting from heavy vehicle operation during vegetation stripping	Vegetation stripping to only be undertaken between 7:00am and 5:00pm on week days and 8:00am to 13:00pm on Saturdays	No 'noisy' construction activities outside of stipulated work hours	Proponent, Contractor	Continuous
		In terms of noise impact for various increases over the ambient, the National Noise Regulations define an increase of 7dB as "disturbing". Noise levels during construction must, therefore, be kept within 7dB of the baseline data at sensitive receptors.	Records of regular (six monthly) noise monitoring during the construction phase, with appropriate comparison of measured data against baseline	Proponent, Contractor, Noise Specialist	Continuous. Quarterly monitoring of ambient levels

Table 4-5: : Vegetation Clearance

Activity / Structure / Infrastructure	Vegetation clearance, leading to ultimate establishment of construction camp/s, housing units and supporting ancillary infrastructure.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
			data.		
Heritage Resources	Negative impacts on elements of cultural, or heritage, significance	Basic training needs to be provided to the relevant contractor/s, as well as their relevant vehicle / grader operator/s, in the identification of possibly encountered elements of cultural and heritage significance (e.g. archaeological sites, graves, etc.)	Proof of basic training by an appropriately qualified archaeological specialist	Proponent, Contractor, Archaeologist.	Once-off, prior to commencement of vegetation stripping
		If archaeological sites are exposed during vegetation stripping, it should immediately be reported to the Local and National Branches of the South African Heritage Resources Agency (SAHRA)	No unauthorised disturbances to elements of potential cultural, or heritage, significance	Proponent, Contractor	Continuous. Reporting of archaeological finds within 24hours
		Under no circumstances shall archaeological artefacts discovered on site during construction or operational activities be removed, destroyed or interfered with.	Compliance with the provisions of the National Heritage Resources Act (Act No. 25 of 1999)[HRA].	Proponent, Contractor	Continuous
Socio-economics	Wood harvesting 'off-set' in local communities	The wood from trees stripped during this phase of construction must be supplied to local community/ies as fire wood; unless otherwise directed in the respective 'protected tree removal/destruction permit/s'.	Recovery and use of feasible firewood stock to the greatest extent possible	Proponent, Contractor	Continuous
	Efficient reuse of all stripped vegetation	All stripped vegetation not suitable as fire wood must be chipped and utilised elsewhere on site as mulch / compost material	Recovery and use of all stripped vegetation to the greatest extent possible	Proponent, Contractor	Continuous

Table 4-6: : Topsoil Stripping

Activity / Structure / Infrastructure	Topsoil stripping, leading to ultimate establishment of construction camp/s, housing units and associated supporting infrastructure				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality through vehicle entrained dust generation	Cumulative dust deposition target thresholds, in terms of SANS 1292, 2009/11/17, must be met at the BRMO site boundary	Less than 600mg/m^2/day at the BRMO Mine boundary – 30 day	Proponent, Contractor	Continuous

Table 4-6: : Topsoil Stripping

Activity / Structure / Infrastructure	Topsoil stripping, leading to ultimate establishment of construction camp/s, housing units and associated supporting infrastructure				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
			average		
Ground water	Degraded groundwater quality through hydrocarbon contamination	Plant and vehicles used on site must be well maintained / serviced, and visually inspected (at least daily) by their respective operators for hydrocarbon (i.e. oil, fuel and hydraulic fluids) leaks.	Records on file of daily visual plant and vehicle inspections	Proponent, Contractor	Continuous
Biodiversity	Establishment of alien invasive floral species and associated negative impacts on biodiversity	All areas stripped of indigenous vegetation cover and topsoil need to be regularly inspected for the potential establishment of alien invasive species, and appropriate control measures applied where these species are observed to have established (i.e. in accordance with the provisions of the BRMO 'alien invasive species management plan').	Proof of training, in 'weed' identification, provided to mandated 'inspector/s. Inspection register maintained by the contractor/s, as well as documentation of any control measures applied (location, method & effectiveness at the very least)	Proponent, Contractor	Weekly (summer)/ monthly (winter)'weed' inspections. Problem species cleared within 5 calendar days of their identification.
		A copy of the BRMO alien invasive species management plan, inclusive of quick 'weed identification' flash-card sets, to be supplied to the relevant contractor/s involved in vegetation stripping	Proof of contractor's receipt of the management plan	Proponent	Once-off
Soils	Reduced effectiveness of rehabilitation efforts at mine closure, resulting from poor topsoil management practices	Topsoil to be stripped to a depth of at least 30cm from all development footprints and stockpiled for reuse in rehabilitation actions at mine closure	Photographic evidence of topsoil stripping, as well as data logging [source and estimated volumes(m^3)] of all new additions kept on file.	Proponent, Contractor	Continuous
		Vegetation stripping should not be conducted more than a week (7 calendar days) prior to topsoil stripping, in preparation of development, or mining	No areas left bare of vegetation for longer than a week following the 'stripping' thereof for development, or mining	Proponent, Contractor	Continuous. Seven (7) day window
		Topsoil stockpile heights must be optimised to ensure that a balance is struck between area of disturbance	Topsoil stockpile height optimisation	Proponent, Contractor	Continuous

Table 4-6: : Topsoil Stripping

Activity / Structure / Infrastructure	Topsoil stripping, leading to ultimate establishment of construction camp/s, housing units and associated supporting infrastructure				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		from stockpiling and maintenance of seed bed and residual organic material therein			
		Topsoil stockpile areas must be securely fenced, sign posted as 'no-go' areas' and subsequently marked on the BRMO surface infrastructure plan	Appropriate access control in place for topsoil stockpiles	Proponent, Contractor	Once off fence/gate establishment. Continuous access control thereafter by environmental manager
		Topsoil and subsoil must only be utilised as required for rehabilitation within the mining area, and according to a topsoil reuse plan to be compiled by the BRMO Environmental Manager	Topsoil Reuse Plan available for inspection. No unauthorised use of topsoil in contravention of the aforementioned plan.	Proponent	6 months from the DMR's acceptance of this EMPR addendum. Implementation thereof subsequent to approval is an on-going task
		Stockpiles must be monitored for alien vegetation any existing alien vegetation must be removed and destroyed.	Records kept on file of at least monthly inspections	Proponent	Continuous
		A 'topsoil balance calculation' will be held by the BRMO, showing reasonable estimates of the topsoil volumes available in stockpiles against the volumes required for rehabilitation of affected development footprints for the project.	Topsoil balance calculation used to inform preparation of Topsoil Reuse Plan	Proponent	Once off, within 6 months of the DMR's acceptance of this revised EMPR
Noise	Negative impacts on ambient noise levels resulting from heavy vehicle operation during topsoil stripping	Topsoil stripping to only be undertaken between 7:00am and 5:00pm.on weekdays, and 8:00am to 13:oopm on Saturdays.	No 'noisy' construction activities outside of stipulated work hours	Proponent, Contractor	Continuous
Heritage Resources	Negative impacts on elements of cultural, or heritage, significance	Basic training needs to be provided to the relevant contractor/s, as well as their relevant vehicle / grader operator/s, in the identification of possibly encountered elements of cultural and heritage significance (e.g. archaeological sites, graves, etc.).	Proof of basic training by an appropriately qualified archaeological specialist	Proponent, Contractor, Archaeologist.	Once-off, prior to commencement of vegetation stripping
		If archaeological sites are exposed during topsoil stripping, it should immediately be reported to the	No unauthorised disturbances to elements	Proponent, Contractor	Continuous. Reporting of archaeological finds within

Table 4-6: : Topsoil Stripping

Activity / Structure / Infrastructure	Topsoil stripping, leading to ultimate establishment of construction camp/s, housing units and associated supporting infrastructure				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		Local and National Branches of the South African Heritage Resources Agency (SAHRA),	of potential cultural, or heritage, significance		24hours
		Under no circumstances shall archaeological artefacts discovered on site during construction or operational activities be removed, destroyed or interfered with.	Compliance with the provisions of the National Heritage Resources Act (Act No. 25 of 1999)[HRA].	Proponent, Contractor	Continuous

Table 4-7: Civil- and Earthworks

Activity / Structure / Infrastructure	Establishment of structural and infrastructural foundations / founding conditions and associated, operational, compacted working 'floors'				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Topography	Soil erosion resulting from the creation of steep, unnatural, slopes	No slopes with gradient > 3:1 should be established on site; unless otherwise protected from erosion by appropriate storm water management measures, or slope stabilisation / re-vegetation	No slopes > 3:1	Proponent, Contractor	Continuous
Air Quality	Degraded air quality through vehicle entrained dust generation	Cumulative dust deposition target thresholds, in terms of SANS 1292, 2009/11/17, must be met at the BRMO site boundary	Compliance with SANS 1929:2005 – Ambient Air Quality – Limits for Common Pollutant	Proponent, Contractor	Continuous
Ground water	Degraded groundwater quality through hydrocarbon contamination	Plant and vehicles used on site must be well maintained / serviced, and visually inspected (at least daily) by their respective operators for hydrocarbon (i.e. oil, fuel and hydraulic fluids) leaks.	Records on file of daily visual plant and vehicle inspections	Proponent, Contractor	Continuous
Biodiversity	Biodiversity loss through destruction of natural habitat	Civil- and earth works may only proceed where vegetation- and topsoil stripping have been effected in compliance with the provisions of the EMP	No extension of the development footprint beyond that approved in terms of this EMPR addendum	Proponent, Contractor	Continuous
Noise	Negative impacts on ambient	Civil- and earth works to only be undertaken between	No ' noisy' construction	Proponent, Contractor	Continuous

Table 4-7: Civil- and Earthworks

Activity / Structure / Infrastructure	Establishment of structural and infrastructural foundations / founding conditions and associated, operational, compacted working 'floors'				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
	noise levels resulting from heavy vehicle operation during civil- and earthworks	7:00am and 5:00pm on weekdays, and 8:00am to 13:00pm on Saturdays	activities outside of stipulated work hours		
Heritage Resources	Negative impacts on elements of cultural, or heritage, significance	Basic training needs to be provided to the relevant contractor/s, as well as their relevant vehicle / grader operator/s, in the identification of possibly encountered elements of cultural and heritage significance (e.g. archaeological sites, graves, etc.).	Proof of basic training by an appropriately qualified archaeological specialist	Proponent, Contractor, Archaeologist.	Once-off, prior to commencement of vegetation stripping
		If archaeological sites are exposed during topsoil stripping, it should immediately be reported to the Local and National Branches of the South African Heritage Resources Agency (SAHRA),	No unauthorised disturbances to elements of potential cultural, or heritage, significance	Proponent, Contractor	Continuous. Reporting of archaeological finds within 24hours
		Under no circumstances shall archaeological artefacts discovered on site during construction or operational activities be removed, destroyed or interfered with.	Compliance with the provisions of the National Heritage Resources Act (Act No. 25 of 1999)[HRA].	Proponent, Contractor	Continuous

Table 4-8: Waste Generation and Management

Activity / Structure / Infrastructure	Construction related waste (general and hazardous) generation and management				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality due to the burning of waste	Under no circumstances should waste ever be burnt, or buried, on site	Safe waste disposal / management certificates on record for all waste generated during the construction phase	Proponent, Contractor	Continuous
Ground water	Diminished ground water quality through poor waste management practices	Waste oil generated from vehicle workshops / drip trays must be immediately stored in sealable, water-tight, steel drums or containers within an impermeable bund wall with a capacity of at least 110% of the volume of	Waste oil storage area/s appropriately bunded. Safe disposal / management certificates	Proponent, Contractor	Once-off bund establishment. Continuous requirement for storage of waste oil.

Table 4-8: Waste Generation and Management

Activity / Structure / Infrastructure	Construction related waste (general and hazardous) generation and management				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		the largest container / drum held therein – for subsequent removal from site for either recovery, or disposal thereof	on record for all oil removed from site		
		Waste oil storage areas may only be placed within relevant construction/contractor's camp/s	No waste oil storage outside of any dedicated contractor's camp/s	Proponent, Contractor	Continuous
Surface water	Surface storm water contamination through contact with waste material/s	Surface storm water run-off must not be able to flow through any waste storage areas. Nor should skips/containers, or waste storage areas, be positioned where surface water may pond or flow preferentially during rainfall events.	No contact between construction waste and surface water	Proponent, Contractor	Continuous
Soils	Soil contamination through contact with waste material/s	Waste must not be temporarily stored on bare soil surfaces; Except where: • The waste is regarded as being 'inert' (e.g. waste bricks, un-contaminated steel scrap, etc.), in terms of the definition provided for in the National Environmental Management: Waste Act (59 of 2008); • The waste will be removed from site within 30 days of the generation thereof; and • No component of the waste is susceptible to dispersal by wind	No contact between site soils and potential contaminants in construction waste/s	Proponent, Contractor	Continuous
		Construction waste generated on site by contractor/s must be gathered up daily and placed in skips/containers appropriate to the classification thereof (i.e. hazardous Vs. general waste)	No waste strewn over site over-night. No mixing of general and hazardous wastes	Proponent, Contractor	Daily, for the duration of the construction period
		Skips/containers must, therefore, be clearly marked for purpose	Waste skips clearly marked for applicable waste types to be discarded therein	Proponent, Contractor	Once-off
		Safe disposal / management certificates must be	Safe disposal /	Proponent, Contractor	Continuous, for every

Table 4-8: Waste Generation and Management

Activity / Structure / Infrastructure	Construction related waste (general and hazardous) generation and management				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		obtained for all waste removed from site	management certificates kept on record		incidence of waste removal from site
		Waste may only be taken to appropriately licensed / permitted waste management facilities	Proof of facility licensing kept on record	Proponent, Contractor	Continuous
		Waste skip/container collection and replenishment schedules must be developed and managed pro-actively by the contractor/s, in order to ensure that no skips/containers are left full and / or over-flowing for any extended period of time and that there is always appropriate temporary waste storage capacity on site	Temporary waste storage capacity available to the contractor/s	Proponent, Contractor	Continuous. No skip left full on site for more than a week.
	Unsustainable use of natural resources and unnecessary landfill airspace utilisation	Contractors will be required to provide a method statement specific to waste minimisation, reuse, recovery and recycling, as well as temporary storage and disposal; where such plans would need to be signed off by competent site environmental personnel / environmental control officer (ECO) prior to the start of construction activities. **Contractor Method Statement Required**.	Approved method statement/s on record	Proponent, Contractor	Once-off, prior to commencement

Table 4-9: Haul / Access Roads

Activity / Structure / Infrastructure	Heavy and light vehicle movements on un-surfaced site haul / access roads. Vehicle access to, and over-nighting on, site.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality through vehicle entrained dust	Dust palliation with an effectiveness of at least 80% must be applied to all un-surfaced/gravel access and haul roads for the duration of the construction period	Compliance with SANS 1929:2005 – Ambient Air Quality – Limits for Common Pollutant	Proponent, Contractor	Continuous
		Palliatives must be applied and re-applied as necessary as per the manufacturer/supplier's recommendations	Compliance with SANS 1929:2005 – Ambient Air Quality – Limits for	Proponent, Contractor	Continuous

Table 4-9: Haul / Access Roads					
Activity / Structure / Infrastructure	Heavy and light vehicle movements on un-surfaced site haul / access roads. Vehicle access to, and over-nighting on, site.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
			Common Pollutant		
		Vehicle speeds must be limited to 60 km/h on access roads unless these have bound paving, in which case sped regulations as per the relevant traffic regulations must apply. Vehicle speeds must be limited to 40 km/h on any exposed surfaces where palliatives or paving have not been applied.	Compliance with SANS 1929:2005 – Ambient Air Quality – Limits for Common Pollutant	Proponent, Contractor	Continuous
Biodiversity	Biodiversity loss through unnecessary habitat destruction	Access and haul roads may only be established, immediately adjacent to (within 10m), or directly between, the anticipated development footprints of the approved layout. All access and haul roads to be depicted on plan, subject to approval by ECO and BRMO environmental manager	No ad hoc, un-planned development of access / haul roads. All access and haul roads established to the satisfaction of the ECO and BRMO environmental manager	Proponent, Contractor, ECO	Continuous
		The hauling of materials and vehicle access to and from development sites must be strictly maintained to designated access/haul roads on site	No evidence of random, un-planned, road creation on site	Proponent, Contractor	Continuous
	Loss of biodiversity due to death / injury to indigenous site fauna	A speed limit of 60km/hr is applicable to all heavy and light vehicles used on site; where dust palliatives have been applied	No evidence of speeding vehicles on site	Proponent, Contractor	Continuous
Noise	Negative impacts on ambient noise levels resulting from heavy vehicle movements on site	Construction activities to be limited to between 7:00am and 5:00pm on weekdays, and 8:00am to 13:00pm on Saturdays	No 'noisy' construction activities outside of stipulated work hours	Proponent, Contractor	Continuous

Table 4-10: Raw / Construction Material Stockpiles and Storage	
Activity / Structure / Infrastructure	Storage of raw/construction materials on site during the construction phase

Environmental Aspect	Impact	Management Actions	Target	Responsible Party	Time-frame / Frequency
Biodiversity	Biodiversity loss through unnecessary habitat destruction	Raw / construction material storage may only take place within the development footprints of project structures and infrastructure, or designated construction camp/s	No storage of materials in 'green-field' areas	Proponent, Contractor	Continuous
Soils	Soil contamination through inappropriate storage of hazardous construction materials	Where daily quotas / stocks of hazardous materials are to be stored outside of the construction camp/s, the materials must be stored such that there is no contact between the material and site soils	No contact between site soils and hazardous construction materials	Proponent, Contractor	Continuous

4.7 OPERATIONAL PHASE

Table 4-11: Waste Generation and Management

Activity / Structure / Infrastructure	Operational phase waste management				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality due to the burning of waste	Under no circumstances should waste ever be burnt, or buried, on site	Safe waste disposal / management certificates on record for all waste generated during the construction phase	Proponent, Contractor	Continuous
Ground water **Surface water** **Soils**	Degraded environmental quality due to inappropriate waste management practices	The applicability of the existing BRMO 'waste management procedure' - Env-S/UG-GN-0012 (Appendix 11) must be extended to include all proposed project elements and updated accordingly	Compliance with existing procedural requirements in respect of waste management	Proponent	Continuous

Table 4-12: Energy and Natural Resource Use Efficiency and Optimisation

Activity / Structure / Infrastructure	Energy and Natural Resource Use Efficiency and Optimisation				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Energy efficiency	Positive: Off-set demand for electricity from the national grid	The proponent should install solar geysers for each of the housing units to off-set the demand for power from the national grid.	Solar geysers established. Establishment of sustainable developments.	Proponent	Once-off installation, with maintenance thereafter at suppliers recommended intervals.
Water use efficiency	Positive: Off-set demand from the VG pipeline.	All showers in the dwelling units should be fitted with water efficient shower heads	Required shower heads fitted	Proponent	Once-off
	Inefficient water use through excessive evaporation	The watering of gardens, or any other soft landscaping at the development must not take place between 8:00am and 17:00pm daily	No watering inside of the specified time periods	Proponent	Continuous.

Table 4-13: Biodiversity

Activity / Structure / Infrastructure	Alien invasive control and soft landscaping				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Alien invasive species	Loss of biodiversity through the establishment and propagation of alien invasive floral species	The potential presence of alien invasive species on, and adjacent to the housing development must be monitored and appropriately managed, in accordance	No evidence of alien invasive species occurrence within the	Proponent	Continuous

		with the BRMO alien invasive species management plan (Appendix 5).	development footprint. Records kept of any remediation effected at the site (i.e. problematic species, nature of remedial efforts, date and party who effected remedial solution)		
		The use of herbicides on site must be undertaken according to the BRMO environmental procedure for the use of herbicides (Env-S/UG-GN-003- Appendix 7).	Compliance with applicable operational procedure	Proponent	Continuous
		Only indigenous floral species representative of the Kathu Bushveld vegetation type may be used for landscaping purposes within the development	No evidence of the panting of exotic, or inappropriate (i.e. other than Kathu Bushveld species) floral species	Proponent, specialist ecologist/Landscaper	Continuous
	Lowering of regional biodiversity as a result of mining and activities supportive thereof.	The BRMO must manage their potential impacts on site biodiversity through the implementation of the BRMO Biodiversity Action Plan (BAP).	Compliance with the operational management provisions of the BRMO BAP.	Proponent	Continuous

5. ENVIRONMENTAL MONITORING PLAN

5.1 DUST FALLOUT

Because of the potential impact the haul road PM_{10} entrainment has on ambient air quality, it is required that the Proponent implements a palliative abatement method on unpaved road surfaces, with a minimum abatement efficiency of 80%. The monitoring of the effectiveness thereof will be needed, and it is proposed that this be done at least at the locations indicated in Figure 5-1 and Table 5-1). The locations were chosen so that while they will still be able to collect dust from the surroundings it will not result in the over-estimation of ambient dust emissions by being placed too close to any haul roads and product stockpile areas.

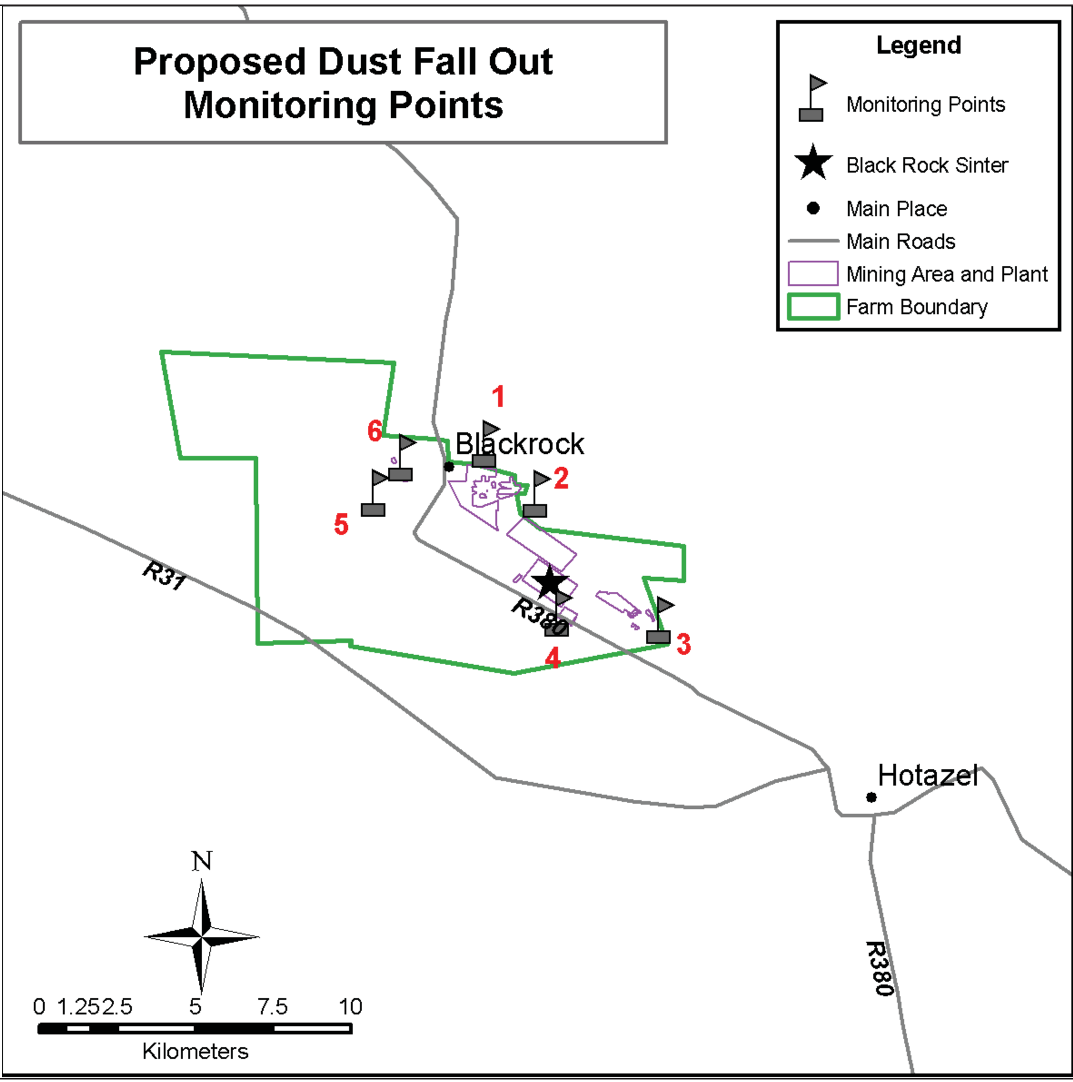


Figure 5-1: Dust fallout monitoring locations

Table 5-1: Co-ordinates of the dust emissions monitoring

Name	No.	Latitude	Longitude
North boundary point	1	-27.1225	22.8649
East boundary point	2	-27.1368	22.87949
Far East boundary point	3	-27.1735	22.9153
South boundary	4	-27.171301	22.88858
Mokala Guest Lodge	5	-27.1367	22.8328

Black Rock School	6	-27.1265	22.8406

Monitoring must be undertaken as per the requirements of ASTM D1739: Standard Test Method for 'Collection and Measurement of Dustfall'. Monthly monitoring must be undertaken, with quarterly reports relating thereto being issued to mine management, such that any necessary remedial actions can be timeously actioned.

6. ENVIRONMENTAL REHABILITATION

This rehabilitation plan provides details as to how site rehabilitation should be undertaken, with step by step break-down of disturbed areas to be rehabilitated, when those areas should be rehabilitated, as well as a description of the actual rehabilitation measures to be implemented. The decommissioning and rehabilitation of the housing facility would hinge on the closure of the BRMO itself; unless an alternative use for the housing can be agreed upon with the local authority and the DMR. These rehabilitation provisions are written under the auspices that the housing will be demolished at the end of life of mine and the disturbed footprint rehabilitated; where the provisions are commensurate with the rehabilitation requirements of the greater BRMO.

6.1 PRINCIPLES OF REHABILITATION

The following principles should be followed during the planning, implementation and post-implementation phases of the rehabilitation process:

- Define and agree upon end-goals for the rehabilitation process, such as land-use, rehabilitation objectives, areas to be rehabilitated, etc.;
- Prevent and continually manage the propagation and establishment of alien and invasive species;
- As far as is practical, implement concurrent rehabilitation in order to limit degradation of soil biota;
- Limit the footprint area of the disturbing activity in order to minimise environmental damage;
- Rehabilitation earthworks should aim to reshape the disturbed areas to represent the area prior to disturbance and to present a safe, functional and sustainable environment;
- Visual impacts of rehabilitated areas must be minimised by recreating natural landforms and ensuring that reshaped areas are visually suited to surrounding landscapes;
- Natural landforms such as drainage lines, undulating areas and ridges, which have been damaged during activities, must be restored.
- Implement erosion control measures to prevent the loss of topsoil during and after construction activities;
- Rip and aerate all compacted soils in order to allow for plant establishment and growth;
- Re-vegetate all disturbed areas with suitable floral cover and methods;
- After completion of activities ensure that the site is safe for use by the intended land users and remove all activity equipment; and
- Implement a monitoring plan to determine the efficacy of the rehabilitation exercise (This should be a long-term monitoring program).

6.2 REHABILITATION OBJECTIVES

Before any rehabilitation measures are implemented, it is of vital importance to define goals and objectives for the rehabilitation procedures. These objectives include:

- Defining an end-use for the area in question and returning the area to as-close-as-possible to the pre-mining environment;
- Ascertain whether the proposed end-use is compatible with the land capability of the area;
- Resources allocated to rehabilitation procedures must be sufficient to ensure effective rehabilitation;

- Contractors entrusted with rehabilitation operations must be suitably qualified and experienced;
- Planning of rehabilitation should ideally be implemented as part of the planning and pre-construction phase of any proposed project;
- Continual record-keeping must be implemented in order to ensure effective and responsible rehabilitation; and
- Monitoring and after-care must be implemented in order to ensure efficacy of rehabilitation.

6.2.1 LAND-USE OBJECTIVES

The remote and arid nature of the site, in combination with the low average annual rainfall (approximately 325mm/annum) of the region and poor agricultural potential of the site soils (i.e. 'poor' in respect of planted crop production), limits the range of potentially feasible end land-use alternatives available to the Assmang BRMO. To this end, the end land-use for the BRMO mine site is proposed as extensive grazing land; where according to the draft JTGDM EMF, stocking rates in the Northern Cape are 14 - 30ha/LSU. The Agricultural Research Council's Institute for Soil, Climate and Water (ARC-ISCW), put this figure at closer to 20-25ha / LSU for the region in question.

It is proposed, therefore, that the most feasible end land-use of the aforementioned option would be as follows; where closure of the BRMO would be conditional to –

The rehabilitated land should be capable of sustainably supporting an extensive livestock production system of at least 25ha / large stock unit (LSU).

The proposed end land-use is commensurate with pre-mining land use, and typical of the surrounding, non-mining, land uses in the area; where it would be the choice of any party who ultimately wishes to purchase the subject land (as would be the case with any farm purchased in the area) to further invest in establishing any land use other than that defined as part of these closure objectives for the BRMO.

6.2.2 ECOLOGICAL OBJECTIVES

Apart from ensuring that mine rehabilitation at the BRMO yields outcomes supportive of sustainable economic activity(ies), a further critical objective of mine rehabilitation is to achieve a stable, climax state, representative of the pre-mining vegetation types; where the ecological system functioning of the plant community(ies) is tolerant of the prevailing environmental conditions of the region.

The 'ecological' objective of mine rehabilitation at the BRMO is thus to -

Ultimately ensure that efforts by the BRMO to re-establish Kathu Bushveld (Figure 6-1) over disturbed development footprints yields stable, climax state, floral communities with ecosystem functioning and biological diversity at least resembling pre-development conditions to the extent that reasonable and feasible rehabilitation efforts allow.

6.2.3 GENERAL OBJECTIVES

Apart from the land use and 'ecological' objectives stated in the preceding sections, the closure and rehabilitation of the BRMO's operations would need to see the subject areas made safe, to the extent that –

The rehabilitated areas should not pose any significant direct, indirect or residual risks to either human health and livelihoods, or environmental quality, over the short-, medium- or long-term post closure and rehabilitation thereof.

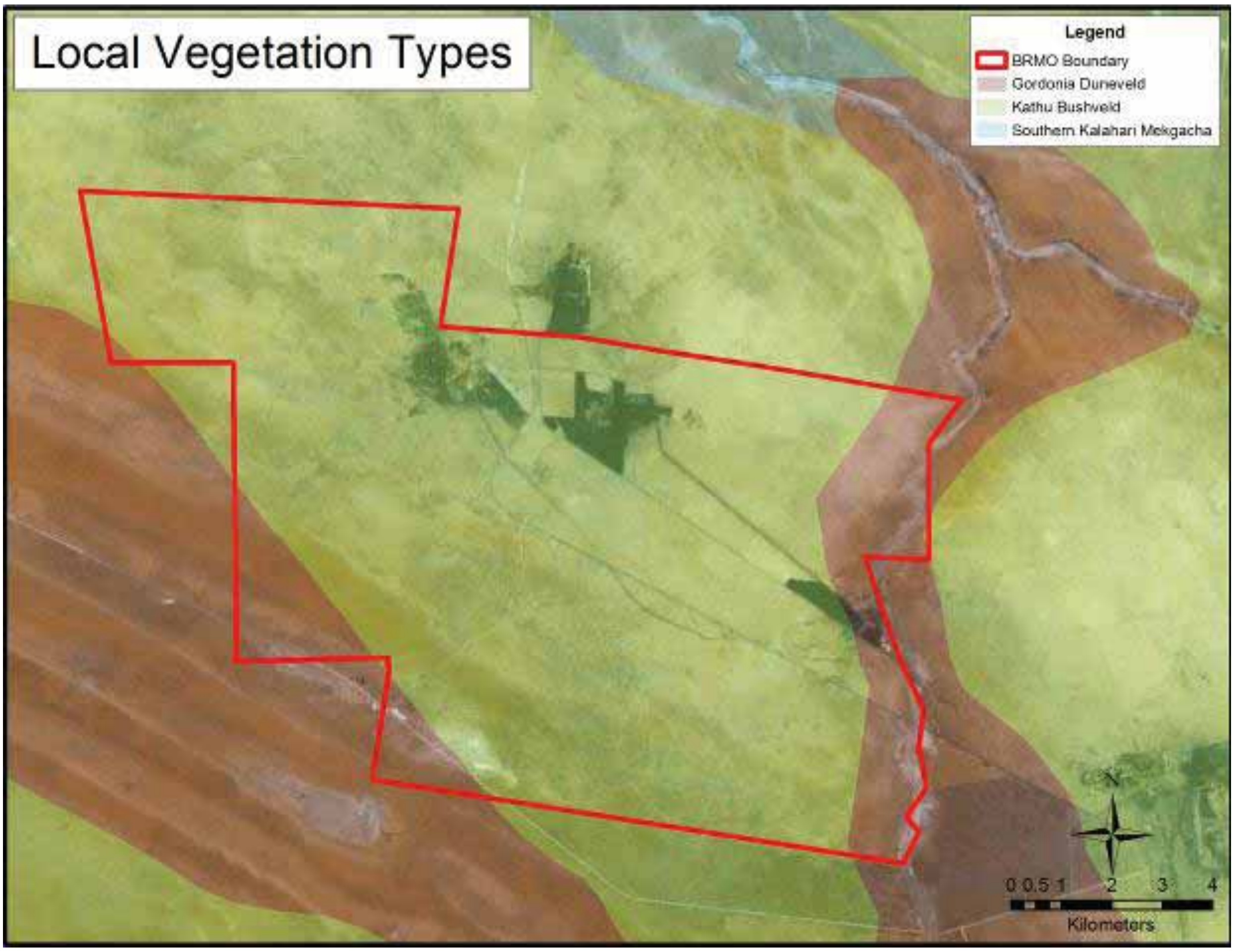


Figure 6-1: Target vegetation types for final phase BRMO surface rehabilitation

6.2.4 EXTENT OF REQUIRED 'GENERAL SURFACE REHABILITATION'

The relevant extent of required 'general surface rehabilitation' relevant to the project is as per the approved development layout (Appendix 1). The requisite requirements for 'general surface rehabilitation' are discussed in Section 6.3 to follow.

6.3 GENERAL SURFACE REHABILITATION

The 'general surface rehabilitation' of the development footprint to meet the stated end land-use and ecological objectives, must comply with the following broad sequentially implemented phases of rehabilitation:

Phase 1: Removal of all surface structures and infrastructure, as well as buried service infrastructure that may act to impede subsequent phases of rehabilitation;

Phase 2: Preparation and amelioration of structural and infrastructural development footprints for further rehabilitation;

Phase 3: Replacement of stockpiled topsoil to a depth of at least 30cm;

Phase 4: Initial hydro-seeding of prepared areas to establish basal cover for subsequent of rehabilitation;

Phase 5: Initial maintenance and monitoring of basal cover;
Phase 6: Establishment of Kathu Bushveld once sufficient basal cover is achieved; and
Phase 7: On-going monitoring and maintenance

Table 6-1 to **Error! Reference source not found.** that follow provide further detail as to the actions that need to be taken by the BRMO for each of the respective phases of surface rehabilitation.

Table 6-1: Requirements for General Surface Rehabilitation

No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
PHASE 1: Removal of Surface Structures and Infrastructure				
1.1	All surface structures, infrastructure and 'hard surfaces' (*inter alia*, redundant surfaced roads, parking and paved areas) are to be demolished and removed from the disturbed development footprint; unless an alternative/continued use for any such items is agreed upon, in writing, with the Department of Mineral Resources (DMR) and the local authority. (Refer Section 8.4.1)	Development footprint cleared of all housing units and related structures and infrastructure.	Assmang, contractor	Once-off
1.2	The foundations of removed structures and infrastructure are to be removed to a depth of at least 0.5m below ground level.	No remaining sub-surface structures that may impede further phases of rehabilitation, or the ultimate root penetration of re-introduced plant species.	Assmang, contractor	Once-off
1.3	Care should be taken in implementing 1.1 and 1.2above to ensure nominal losses of underlying soils.	No evidence of significant sub-surface soil loss	Assmang, contractor	On-going
1.4	On-going alien and invasive floral species control, in accordance with the provisions of the *BRMO Alien and Invasive Species Control Programme* (attached), is required through all phases of rehabilitation.	No establishment and propagation of 'undesirable' plant species over rehabilitation sites.	Assmang, contractor	On-going. Weekly inspections; unless otherwise expressly stated for subsequent phases of rehabilitation
PHASE 2: Preparation of underlying soils for further phases of rehabilitation				
2.1	Exposed, compacted, soil surfaces must be ripped to a depth of at least 0.5m to allow for adequate aeration and plant root penetration.	No topsoil replacement to compacted underlying soil horizons.	Assmang, contractor	Once-off

Table 6-1: Requirements for General Surface Rehabilitation

No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
2.2	The pre-development site topography should be reasonably restored through shaping, such that the topography of rehabilitated areas will ultimately be commensurate with that of adjacent, non-disturbed areas.	No evidence of significant alteration to 'natural', pre-development, surface drainage and topographical regime.	Assmang, contractor	On-going
2.3	A 'post-rehabilitation' surface contour plan should be developed by the BRMO in consultation with a specialist surface water hydrologist, such that would then inform implementation of 2.3 above.	Post-rehabilitation contour plan on record. Said plan mitigates potentially significant impacts on surface hydrology.	Assmang, Specialist hydrologist	Once-off, within 12 months of EMP approval
2.4	Care should be taken in choosing a method/machinery to implement 2.2 above, such that ripped soils are not re-compacted through efforts to appropriately shape the disturbed sites.	No topsoil replacement to compacted underlying soil horizons.	Assmang, contractor	Once-off
2.5	Vehicular access to rehabilitation sites from this phase of rehabilitation onward should be limited to vehicles/machinery expressly required for the sound implementation of this plan.	No *ad hoc*, unauthorised, vehicular movements over rehabilitation sites.	Assmang, contractor	On-going
	PHASE 3: Topsoil / growth substrate replacement/preparation			
3.1	As far as available stockpile volumes allow, topsoil should be replaced to a consistent depth of at least 30cm across areas prepared in terms of phase 2.	Topsoil replacement implemented prior to further efforts to re-introduce basal cover. Even surface, free from surface ponding of water.	Assmang, contractor	Once-off
3.2	Topsoil should be screened, as necessary, to remove any foreign objects, rocks, etc., prior to the replacement thereof.	Replacement of topsoil that is fit for purpose, and which does not impede Assmang from achieving the stated end-use objectives for the site.	Assmang, contractor	On-going
3.3	Topsoil should at least meet the following physical and chemical profile before the replacement thereof is	Replacement of topsoil that is fit for purpose, and which does not	Assmang, contractor, soil	Once-off

<table>
<tr><th colspan="5">Table 6-1: Requirements for General Surface Rehabilitation</th></tr>
<tr><th>No.</th><th>Management/Monitoring Measures</th><th>Target</th><th>Responsible party(ies)</th><th>* Time-frames</th></tr>
<tr><td></td><td>implemented as part of rehabilitation:
<table>
<tr><th colspan="2">Topsoil Analytical Data for BRMO Reference Soil</th></tr>
<tr><td>Depth (cm)</td><td>0-20</td></tr>
<tr><td>pH (H_20)</td><td>7.3</td></tr>
<tr><td>Clay %</td><td>1.5</td></tr>
<tr><td>Silt%</td><td>0.2</td></tr>
<tr><td>Very fine sand%</td><td>16.4</td></tr>
<tr><td>Fine sand</td><td>60.2</td></tr>
<tr><td>Medium sand</td><td>15.5</td></tr>
<tr><td>Texture</td><td>Sand</td></tr>
<tr><td>Exch. Ca ($mgkg^{-1}$)</td><td>106</td></tr>
<tr><td>Exch. Mg ($mgkg^{-1}$)</td><td>51</td></tr>
<tr><td>Exch. K ($mgkg^{-1}$)</td><td>31</td></tr>
<tr><td>Exch. Na ($mgkg^{-1}$)</td><td>0.2</td></tr>
<tr><td>P (Bray 1)</td><td>2.8</td></tr>
</table></td><td>impede Assmang from achieving the stated end-use objectives for the site.</td><td>scientist</td><td></td></tr>
<tr><td>3.4</td><td>Any areas with slope >3° should be inspected weekly for signs of topsoil erosion following the replacement thereof, and appropriate action taken to curb any problematic areas.</td><td>Records of weekly ‘erosion inspections’. No topsoil erosion following replacement.</td><td>Assmang, contractor</td><td>Monitor weekly, address erosion within 48 hours</td></tr>
<tr><td>3.5</td><td>Care should be taken during topsoil replacement to minimise the extent to which vehicle movement over replaced topsoil may act to compact these surfaces.</td><td>No significant compaction of soil surfaces prior to commencement of re-seeding (phase 4)</td><td>Assmang, contractor</td><td>On-going</td></tr>
<tr><td colspan="5">PHASE 4: Re-seeding for basal cover establishment</td></tr>
<tr><td>4.1</td><td>A grass mixture of endemic grasses known to be non-invasive within the area, such as, inter alia, Aristida meridionalis, Centropodia glauca, Stipagrostis ciliata, Eragrostis lehmanniana and Schmidtia pappophoroides, should be utilised in the re-seeding process for the re-introduction of basal cover over rehabilitation sites.</td><td>Establishment of basal cover commensurate with the indigenous floral communities of the pre-mining site, such that would also allow Assmang to meet the stated land-use objectives for the site.</td><td>Assmang, contractor</td><td>Once-off</td></tr>
</table>

Table 6-1: Requirements for General Surface Rehabilitation

No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
4.2	The BRMO should investigate the commercial availability of seed stocks of the aforementioned grass species; and if not commercially available, Assmang must implement a seed harvesting programme from undisturbed areas of the BRMO surface rights area (in conjunction with a competent specialist).	Sufficient available seed stock on hand to effect rehabilitation that meets the stated land-use objective for the site.	Assmang, specialist	Proof of commercial availability within 3 months of the EMP approval, or seed harvesting programme commencement within 12 months.
4.3	Hydro-seeding, or any other suitable means of re-introducing basal cover, should be planned and implemented in conjunction with the professional inputs and services of a competent contractor, with experience in such undertakings (proven track record in the Northern Cape preferable).	Optimal establishment of basal cover that will that Assmang achieves the stated end-use objectives for the site.	Assmang	Once-off appointment with on-going management thereafter
4.4	Re-seeding should commence within 30 days of topsoil replacement, and areas should be free of alien and invasive plants.	Records kept of topsoil replacement and re-seeding dates for all rehabilitation sites.	Assmang, contractor	Within 30 days of topsoil replacement
4.5	The potential requirements for the irrigation and fertilisation of seeded areas, is to be done according to the recommendations and specifications of the specialist contractor appointed for this work.	Optimised efficacy of efforts to establish appropriate basal cover over rehabilitated areas.	Assmang, contractor	Once-off
4.6	No grazing on rehabilitated areas is to occur within three years of phase 4 completion.	• Documented records of dates upon which re-seeding was effected; • Establishment of robust basal cover prior to introducing grazing herbivores; and • Assmang to meet stated end land-use objectives for the site	Assmang	3 years from re-seeding

Table 6-1: Requirements for General Surface Rehabilitation

No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
	PHASE 5: Intermediary monitoring and maintenance of basal cover			
5.1	Weekly monitoring should take place in order to ascertain the efficacy of the seeding, and to repair any areas where gullies or rills are forming. Appropriate interventions to be adopted where basal cover establishment fails.	Documented records of weekly inspections. Basal cover establishment commensurate with adjacent undisturbed areas over the BRMO surface rights areas (i.e. % cover relative to exposed soil surfaces).	Assmang, contractor	Weekly monitoring until adequate basal cover establishment has been confirmed by ecological specialist
5.2	Regular application of fertiliser, under the guidance of a suitably qualified soil scientist, should take place in order to ensure efficient establishment of vegetation cover until such time as sufficient organic matter is being produced by the established grasses to allow for self-sustaining growth.	Basal cover establishment commensurate with adjacent undisturbed areas over the BRMO surface rights areas (i.e. % cover relative to exposed soil surfaces).	Assmang, soil scientist	On-going, as per specialist recommendations
5.3	If re-seeding for basal cover establishment was not effective during 1st application, a second application of hydro-seed mixture may have to be applied in certain areas. The application of hydro-seed should be at the discretion of the specialist contractor.	Basal cover establishment commensurate with adjacent undisturbed areas over the BRMO surface rights areas (i.e. % cover relative to exposed soil surfaces).	Assmang, contractor	As necessary, per specialist recommendations
	PHASE 6: Establishment of Kathu Bushveld			
6.1	Once sufficient basal cover has been established, the introduction of species representative of the applicable vegetation types over the site may commence.	Establishment of stable, climax state, plant communities on rehabilitated areas.	Assmang, contractor	On-going
6.2	Introduction of these species should commence through the stages of natural succession (i.e. Pioneer species (grasses, herbaceous species), Secondary species (grasses, small shrubs, and small trees) and Climax state (larger shrubs, large trees).	Establishment of stable, climax-state, plant communities on rehabilitated areas.	Assmang, contractor	On-going
6.3	The BRMO indigenous tree and plant nursery (as per the BRMO Indigenous Nursery Implementation Plan) should be retained	Functional indigenous nursery on-site until all necessary phase 6	Assmang	On-going.

Table 6-1: Requirements for General Surface Rehabilitation

No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
	on-site for as long as it is necessary to propagate species for active re-introduction thereof to rehabilitation sites.	undertakings are completed over the BRMO surface rights area.		
6.4	The potential requirements for the irrigation and fertilisation of re-introduced floral species, is to be done according to the recommendations and specifications of the specialist contractor appointed for this work.	Effective establishment and growth of introduced floral species.	Assmang, contractor	On-going.
PHASE 7: On-going monitoring, maintenance and aftercare				
7.1	Monitoring and maintenance (as necessary) of phase 6 implementation is to be effected for at least five years following the completion of active species re-introduction to the site.	• At least 90%, sustainable, establishment of re-introduced plants/trees; and • 'Ecological' objectives for site closure met.	Assmang	On-going, Monthly inspections for at least two years; every 6 months thereafter if efforts to rehabilitate are proving effective.
GENERAL PROVISIONS				
8.1	External, independent, 'BRMO Rehabilitation' compliance audits must be undertaken by a competent auditor for all areas where rehabilitation is being implemented at the BRMO. Audit to at least document compliance with this plan.	Full compliance with the provisions for BRMO site rehabilitation.	Assmang, External Auditor	Every 6 months for as long as any rehabilitation (concurrent and/or closure) is being undertaken at the BRMO
8.2	The BRMO should undertake monthly internal compliance audits for all areas where rehabilitation is being implemented at the BRMO. Audit to at least document compliance with this plan, as well as any other relevant provisions of the EMP revision approval by the DMR.	Full compliance with the provisions for BRMO site rehabilitation.	Assmang	Monthly
8.3	Assmang should comply with all relevant enviro-legal provisions concerning protected floral species, in executing	Full legal compliance for the duration of rehabilitation efforts.	Assmang	On-going

Table 6-1: Requirements for General Surface Rehabilitation

No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
	any relevant provision of this plan.			

* All required actions to be implemented and completed within reasonable, practical, time-frames; unless time-frames otherwise expressly stated.

7. PROCEDURES FOR ENVIRONMENTAL RELATED EMERGENCIES AND REMEDIATION

An effective, comprehensive, well-considered and tested environmental emergency preparedness and response plan has the potential to save lives, prevent unnecessary damage to the company and other property, as well as to manage environmental risk in the event of a large chemical spill, oil spill, fuel spill or explosion.

The MPRDA requires in the Regulations Section 51(b) iii that the mine implement procedures to environmental related emergencies and remediation [Refer to the Black Rock Mine (BRMO) Emergency Preparedness and Response Plan included in Appendix 2].

Some specific legal requirements were identified for the emergency response activities in the mining industry. A number of SABS standards apply, such as the SANS10232 - the minimum requirements for emergency responses. Legislation requires that relevant government departments are kept informed of incidents and accidents that occur within the mining area in terms of the following acts:

- Regulation 51 of Regulations under the MPRDA - PROCEDURE FOR ENVIRONMENTAL RELATED EMERGENCY AND REMEDIATION;
- Mine Health & Safety Act (Act 29 of 1996) - MANNER OF REPORTING AND KEEPING OF INFORMATION REGARDING INCIDENTS & EMERGENCIES; and
- Occupational Health & Safety Act (Act 85 of 1993) - EMPLOYEE REQUIREMENTS TO REPORT INCIDENTS WHERE ACTIVITY HAS OCCURRED.

7.1 OBJECTIVES OF AN ENVIRONMENTAL EMERGENCY RESPONSE PLAN

Environmental emergencies occur over the short-term and require an immediate response. A mine, as part of its management tools, especially if it is ISO 9000 and ISO 14001 compliant, should have an Emergency Response Plan. If one does not exist then one should be compiled and disseminated to all employees and contractors and in the event of an emergency, the emergency response plan should be consulted.

This plan should be placed around the mine where it will be easily viewed. The plan should contain a list of procedures, evacuation routes and a list of emergency contact numbers. It is advisable that the mine tests the emergency response plan in order to identify any areas for improvement.

If the emergency has the potential to affect surrounding communities, they should be alerted *via* alarm signals or contacted in person. The surrounding community will be informed, prior to mining taking place, of the potential dangers and emergencies that exist, and the actions to be taken in such emergencies.

Communication is vital in an emergency and thus communication devices, such as mobile phones, two-way radios or telephones, must be placed around the mine. A checklist of emergency response units must be consulted and the relevant units notified.

The checklist includes:

- Fire department;
- Police;

- Emergency health services, such as ambulances, paramedic teams, poisons centres;
- Hospitals, both local and further afield, for specialist care;
- Public health authorities;
- Environmental agencies, especially those responsible for air, water and waste issues;
- Other industrial facilities in the vicinity with emergency response facilities;
- Public works and highways departments; and
- Public information authorities and media organisations.

7.2 EMERGENCIES, PROCEDURES AND REMEDIAL ACTION

The relevant provisions of the BRMO's existing emergency preparedness and response plan must be made relevant to the proposed housing development (Appendix 2).

8. ENVIRONMENTAL AWARENESS PLAN

8.1 INTRODUCTION

An environmental awareness plan must:

- Outline how employees will be informed of environmental risks; and
- State how employees will be able to prevent, reduce or remediate risks.

8.1.1 SCOPE

This environmental awareness plan sets out the mine's training procedures and objectives regarding environmental awareness. It is a stand-alone procedure, which serves to improve awareness, training and competency in the environmental field. It contains no detail on the actual training initiatives but rather serves to ensure that a responsible person is appointed to deal with and increase environmental awareness on the mine.

8.1.2 OBJECTIVES

The objectives as defined by ISO14001 are as follows:

Competence, Training and Awareness:

1. The organisation shall ensure that any person(s) performing tasks for it or on its behalf that have the potential to cause a significant environmental impact(s) identified by the organisation is (are) competent on the basis of appropriate education, training or experience, and shall retain associated records.

2. The organisation shall identify training needs associated with its environmental aspects and its environmental management system. It shall provide training or take other action to meet these needs, and shall retain associated records.

3. The organisation shall establish, implement and maintain a procedure(s) to make persons working for it or on its behalf aware of:

- *The importance of conformity with the environmental policy and procedures and with the requirements of the environmental management system.*
- *The significant environmental aspects and related actual or potential impacts associated with their work, and the environmental benefits of improved personal performance.*
- *Their roles and responsibilities in achieving conformity with the requirements of the environmental management system.*
- *The potential consequences of departure from specified procedures.*

8.1.3 REVISION

The responsible person will revise these environmental awareness procedures from time to time. The date of commencement of the revised procedure will always be indicated to prevent confusion.

8.2 ENVIRONMENTAL RISKS AND PRIORITIES

8.2.1 OBJECTIVES

The following requirements of ISO14001 have bearing:

1. The organisation shall establish, implement and maintain a procedure(s) to identify potential emergency situations and potential accidents that can have an impact(s) on the environment and how it will respond to them.

2. The organisation shall respond to actual emergency situations and accidents and prevent of mitigate associated adverse environmental impacts.

3. The organisation shall periodically review and, where necessary, revise its emergency preparedness and response procedures, in particular, after the occurrence of accidents or emergency situations.

4. The organisation shall also periodically test such procedures where practicable.

8.2.2 IDENTIFYING ENVIRONMENTAL RISKS

Environmental risks must be identified and procedures must be set in place to deal with risks, which could include:

- Fires;
- Spills of hazardous substances, including explosions;
- Leaks or breaks of pipes or vessels, including dam overflows;
- Accidents, especially during adverse weather;
- Slow environmental degradation related to continuous poor housekeeping;
- Damage to heritage or environment; and
- Social issues, either complaints about poor environmental management, or direct employment type issues.

Many of these environmental risks have been identified in the Basic Assessment Report associated with the development of this EMP and therefore the risk assessment exercise will not be repeated here. Once the mitigation measures have been read in the EMP chapter, it will be clear what training will assist with the prevention or reduction of each environmental risk.

8.3 INCREASING ENVIRONMENTAL AWARENESS

8.3.1 TRAINING NEEDS

These shall typically be identified by:

- Management or staff through performance appraisal;
- At time of recruitment;
- In-task observation of performance;
- Additions to scope of work; and
- Changes to working procedures.

Training programmes and environmental awareness programmes should typically include:

- Environmental legislation and the BRMO EMS;
- Resource conservation, including recycling and cleaner production methods;
- Pollution prevention, including emergency procedures;
- General good house-keeping, storage and handling of chemicals;
- Spill prevention, clean-up and remediation;
- Ecological protection and nature conservation, including alien vegetation, protected trees; and
- Administrative procedures, such as reporting, data collection and input, sampling, etc.

The level of detail on these topics will depend upon the exposure of that person to the natural environment and the nature of their job. Contractors that are employed at BRMO must, prior to starting any work, complete the contractor's package. This package requires the contractor to perform SHERQ procedures, which include BRMO's SHERQ Policy, existing operational procedures and Incident Reporting. The contractor is required to brief and train all its employees on the BRMO SHERQ procedures prior to commencing with work. Training records must be available and auditable for auditing purposes.

Several different types of training programme can be developed, as follows:

- Induction training: for all new employees, aimed to acquaint the employee with the company, its rules and their new job; no employee may start work until they have completed the induction training;
- On-the-Job training: offered as needs be, but particularly as part of mentoring junior staff; to be largely conducted by supervisors and other senior staff;
- Internal training: may be similar to On-the-Job training, for topics such as machinery operation, but will be conducted as a discrete training event; other courses may also be offered such as First Aid. Outside service providers may be used, but training will take place on site;
- External training: can cover any topic, including leadership, life skills, management, etc. and should be aligned with the National Skills Strategy of the Department of Labour and the Mining Qualifications Authority;
- Educational assistance: this will encourage staff to study further, by possibly paying tuition and towards study materials, or allowing study leave; some payback system may be used for staff who fail, in order to provide motivation to pass and excel;
- Once training needs have been established it is up to the supervisor to notify the training department of the requirements. The training department will then identify pertinent and relevant courses (if not already done so by employee/supervisor) and schedule training accordingly. Identified and agreed training needs shall be included in budgets and processed as described below. Course attendance (other than at the internal induction courses) shall be scheduled on the basis of the scale of environmental risk; and
- Training expenses, including conferences and symposia should be checked and approved by the mine management. The training department shall complete a course authorisation form and ensure that the procedures are followed regarding course bookings, confirmations and payments. Planning of training for job specific training (done through training needs analysis) will be coordinated between the Training Superintendent and the relevant section heads. This will result in a training schedule for job specific training on the mine.

8.3.2 EMS TRAINING

All employees, current and new, and contractors will undergo induction, a part of which is environmental awareness training and includes the environmental policy of the Mine. All personnel performing tasks, which can cause significant or major environmental impacts, shall be competent on the basis of training, education and/or experience. This applies to, but is not limited to, supervisor level and above - i.e. operators, artisans.

Type

Awareness training should typically include the potential consequences of departure from specified operating procedures as well as significant environmental impacts, actual or potential, of their work activities. Training should be appropriate to the actual activity of individual employees.

Evaluation

Evaluation of awareness and competency training (implementation of training in the work place) can be carried out by the environmental officers, section managers and staff in the training department. Senior management if required can also supplement the evaluation.

Records

The following records should typically be maintained by the Training, or designated such, Department when relevant:

- Personnel qualifications;
- Training needs;
- Certificates;
- Licences;
- Training programmes/courses attended;
- Staff induction; and
- Performance appraisals (confidential).

8.4 ENVIRONMENTAL NON-COMPLIANCE

Non-conformance is a term used for the ISO14001 EMS, whilst non-compliance typically relates to environmental law. Either way, these situations do occur and need to be dealt with suitably.

8.4.1 RESPONSE TO ENVIRONMENTAL NON-COMPLIANCE

ISO14001 states that:

> "The organisation shall establish, implement and maintain a procedure(s) for dealing with actual and potential non-conformity(ies) and for taking corrective action and preventative action".

All employees and contractors must report non-compliances according to the EMS, which generally involves:

- Reporting to the supervisor of that area;
- Investigating the cause of the incident;
- Recording the incident;
- Reporting to authorities, if necessary;
- Ensuring remediation is done;
- Identifying corrective actions;
- Follow-up on corrective actions; and
- Drafting progress reports and keeping all records.

The BRMO have existing, well established and trialled, '*competence, training and awareness*' procedure (EP02-2) which they will continue to implement in respect of environmental awareness training requirements at their operations (Appendix 13).

9. CONCLUSION

This EMP and associated Environmental Impact Assessment has been compiled in terms of the provisions of the National Environmental Management Act (Act No. 107 of 1998)[NEMA] and its associated 2010 EIA Regulations. The EMP provides for management and mitigation measures relevant to all phases of the project life cycle. It is the EAP's opinion the implementation of the EMP will reduce the potential significance of identified impacts to within acceptable levels.

10. UNDERTAKING

I, ____

the undersigned, and duly authorised thereto by Assmang Black Rock Mine Operations, have studied and understand the contents of this document in its entirety and hereby duly undertake to adhere to the conditions as set out therein.

Signed at ____

this ________ day of __________________________, 2013

Applicant's name:

Designation:

APPENDIX 1: DEVELOPMENT LAYOUT PLAN

APPENDIX 2: BRMO EMERGENCY PREPAREDNESS AND RESPONSE PLAN

ASSMANG LIMITED

EMERGENCY PREPAREDNESS AND RESPONSE

PROCEDURE

BLACK ROCK

DOCUMENT REF : 02-07-01

MANAGEMENT REPRESENTATIVE	SENIOR GENERAL MANAGER	ISSUE STAMP / REF.
		14/04/2008

PROCEDURE REVISIONS

NO	CLAUSE (S) AMENDED	PAGES RE-ISSUED	REVISION DETAILS
1.	Not Applicable	1 - 11	Assmang Iron and Manganese logo substituted by Manganese logo
2.	Not Applicable	1 - 11	General Mine Manger W.S. Grobbelaar changed to General Mine Manager Manganese A.J. Nel
3.	Not Applicable	1 - 11	General Mine Manager Manganese A.J. Nel changed to Senior General Manager A.P. Hamman
4.	No 1 below	2 - 15	Revised text to be in red. Change to correct contact numbers
5.			
6.			
7.			
8.			
9.			
10.			

NOTES:

1. Revised areas to have the revision number opposite them. Revised text to be in red. (Except in the case of a complete revision of entire document).

2. This Procedure to Be Completely Re-Issued after a maximum of 10 revisions.

3. Title Sheet and Revision Sheet to be re-issued with every revision.

MANAGEMENT REPRESENTATIVE	SENIOR GENERAL MANAGER	ISSUE STAMP / REF.
		14/04/2008

LIST OF CONTENTS

1. OBJECTIVE

To provide guidance to deal with emergencies efficiently and to:

- Ensure the safety of all personnel
- Recover to normal operation as soon as possible
- Co-ordinate orderly evacuation
- Minimize damage to equipment and production loss
- Minimize damage to the environment

2. SCOPE

This procedure is applicable to all Assmang Mine personnel, visitors and contractors permanently or temporarily on site.

3. DEFINITIONS

3.1 Emergency Control Centre

This location will be a suitable room from where the emergency co-ordinator can control the emergency by telephone.

3.2 Emergency Co-ordinator

After hours, it will be the nearest most senior person in charge of the area most affected by an emergency. During office hours it will be the ISO Co-ordinator or the most senior person in charge of the area most affected by an emergency.

3.3 *Fire Emergency Team*

This will be Mine personnel on each shift or Proto team, trained to do the first line fire fighting.

3.4 *Fire Department*

This will be the surface fire-fighting department. They will
take charge of all fire fighting on surface on their arrival at an emergency.

3.5 *Area co-ordinator*

This will be a person selected to take charge of evacuation process at each department/Unit.

3.6 *Emergency assembly point*

This will be an identified place where all personnel must assemble for roll call after evacuation.

- Black Rock - Emergency assembly points as identified per MSMS at each office.
- Nchwaning - Emergency assembly points as identified per MSMS at each office.
- Gloria - Emergency assembly points as identified per MSMS at each office.

4. *POTENTIAL EMERGENCIES*

4.1 *Fires*

4.2 *Spillage of potentially contaminated water (Surface Pipelines).*

4.3 *Diesel Spill*

4.4 *Petrol Spill*

4.5 *Leakage of underground or surface oil storage tank*

4.6 *Explosives truck (overturning)*

5. ACTIONS TO BE TAKEN

5.1 Fires

5.1.1 All fires are to be reported to the control room.

5.1.2 Procedure as per fire manual to be followed.

5.2 Spillage of potentially contaminated water

5.2.1 The person detecting the emergency notifies control room.

a) Notify the nearest most senior official

b) Notify the safety and environmental departments

c) Mobilise possible equipment that can be used to contain spillage

ASSMANG LIMITED

5.3 IN CASE OF : DIESEL TANK FAILURE

STEPS

If possible stop the source of spillage and switch of all sources of ignition.

Evacuate area.

Demarcate affected area with red and white barrier tape.

Display no smoking open flame signs.

Initiate steps to prevent spilt diesel from entering drain water systems.

Contain spillage to smallest possible area.

Notify fire brigade or emergency services of the incident.

Initiate plan of action to clean up contaminated area.

Return to workplace after area has been declared safe.

Rehabilitate contaminated area to its original form.

In case of water pollution notifies DWAF.

ASSMANG LIMITED

5.4 IN CASE OF: PETROL TANK FAILURE

STEPS

If possible stop the source of spillage and switch of all sources of ignition.

Evacuate area.

Demarcate affected area with red and white barrier tape.

Display no smoking open flame signs.

Initiate steps to prevent spilt petrol from entering drain water systems.

Contain spillage to smallest possible area.

Notify fire brigade or emergency services of the incident.

Initiate plan of action to clean up contaminated area.

Return to workplace after area has been declared safe.

Rehabilitate contaminated area to its original form.

In case of water pollution notifies DWAF.

ASSMANG LIMITED

5.5 IN CASE OF: OIL STORAGE TANKS FAILURE

STEPS

If possible stop the source of spillage and switch of all sources of ignition.

Evacuate area.

Demarcate affected area with red and white barrier tape.

Display no smoking open flame signs if on surface.

Initiate steps to prevent spilt oil from entering drain water systems.

Contain spillage to smallest possible area.

Notify Manager or emergency services of the incident.

Initiate plan of action to clean up contaminated area.

Return to workplace after area has been declared safe.

Rehabilitate contaminated area to its original form.

ASSMANG LIMITED

5.6 IN CASE OF: FLAMMABLE STORES FAILURE

STEPS

If possible stop the source of spillage and switch of all sources of ignition.

Evacuate area.

Demarcate affected area with red and white barrier tape.

Display no smoking and open flame signs if on surface.

Initiate steps to prevent spilt substance from entering drain water systems.

Contain spillage to smallest possible area.

Notify Manager or emergency services of the incident.

Initiate plan of action to clean up contaminated area.

Return to workplace after area has been declared safe.

Rehabilitate contaminated area to its original form.

ASSMANG LIMITED

5.7 IN CASE OF: EXPLOSIVE TRUCK

STEPS

Demarcate affected area with red and white barrier tape.

Display no smoking and open flame signs.

Contain spillage to smallest possible area.

Notify Manager brigade or emergency services of the incident.

Initiate plan of action to clean up contaminated area.

Rehabilitate contaminated area to its original form.

ASSMANG LIMITED

6. MANAGEMENT TEAM CONTACT NUMBERS

S. LETABA	Tel:	(053) 751 5299
Senior General Manager	Fax:	(053) 751 5252
	Home:	(053) 751 1688
	Cell:	(082) 498 1452
J.J.P NEL	Tel:	(053) 751 5229
Mine Manager	Fax:	(053) 751 5251
	Home:	(053) 712 0774
	Cell:	(083) 701 8008
D. MANS	Tel	(053) 751 5405
Engineering Manager	Fax	(053) 751 5404
	Cell:	(083) 809 0540

7. OTHER CONTACT NUMBERS

SAFETY DEPARTMENT	**053 751 5419**
ENVIRONMENTAL DEPARTMENT	**053 751 5227**
SECURITY DEPARTMENT	**053 751 5209**
SAPD	**053 7791 0222**

EMERGENCY TELEPHONE NUMBERS

AMBULANCE	**053 751 5218**
FIRE BRIGADE	**053 751 5214**

DR HTE BOHNEN

All hours emergency number **(082) 859 7617**

DR J MOSTERT

All hours emergency number **(083) 269 5977**

APPENDIX 3: CV OF EAP

CURRICULUM VITAE — Bradley Thorpe

Full Name:	Bradley Kevin Thorpe
Date of Birth:	27 March 1980
Nationality:	South African
Identity Number:	8003275043087
Sex:	Male
Marital Status:	Married
Language:	English, Afrikaans

QUALIFICATIONS & PROFESSIONAL MEMBERSHIP

- Bachelor of Science – Animal Sciences: University of Pretoria, 2002;
- Bachelor of Science (Honours) in Wildlife Management: University of the Pretoria, 2003;
- Master of Science – Environmental Management: University of Johannesburg, in progress;
- Member: Institute of Waste Management, South Africa (IWMSA); and
- Member: International Association of Impact Assessors (IAIA), South Africa branch.

KEY EXPERIENCE

Six (6) years experience in Integrated Environmental Management (Strategic planning, legislation, Waste Management, EIA's, EMP's, monitoring, auditing, pollution abatement, rehabilitation etc.), including:

- **Integrated environmental management for the establishment, expansion, upgrade, rehabilitation and optimisation of light and heavy industrial processes** including the metallurgical, paper, mining and power generation industries
- **Integrated environmental management studies for the establishment, operation, auditing, closure and rehabilitation** of general waste landfills and transfer stations, industrial/hazardous waste landfills, incinerators, and hazardous effluent dams
- **Mining / prospecting permit and licence applications,** in terms of the Mineral and Petroleum Resources Development Act (MPRDA) –as amended, 2002
- **Environmental impact assessments, environmental management plans and public participation programmes** for small, medium and large linear and site specific infrastructure and land developments
- **Environmental management plans (EMP)** for the construction, operational and decommissioning/closure phases of infrastructure and land developments, waste management facilities and heavy industrial processes
- **Environmental advisory services,** including policy and procedures development, legal enforcement and compliance management, strategic planning, enviro-legal procedures and peer reviews
- **Specialist training,** including training of Provincial Environmental Authorities / EIA administrators in the review and administration of EIA's and Basic Assessments.
- **Project management** of numerous environmental and strategic projects

EMPLOYMENT HISTORY & PROJECT EXPERIENCE

EScience Associates (Pty) Ltd. January 2010 - Current
Senior Environmental Project Manager

Key Projects:

Waste Management:
- Interwaste: Scoping and EIA process for the establishment of an integrated waste management/treatment and transfer facility, Germiston, Gauteng (current);
- Reclamation Group (Reclam): Development of industry norm and standards for the operation of scrap metal recovery and processing facilities;
- Department of Environmental Affairs & Tourism (DEAT): Development of a Revised Hazardous Waste Classification System for South Africa;
- ClinX Waste Management: Scoping and EIA process relating to Waste License application for proposed Healthcare Risk Waste Incinerator, Wadeville, Gauteng;
- SE Solutions, on behalf of Reclamation Group: Specialist Waste Impact Assessment for a proposed ferrous scrap metal shredder facility in Waltloo, Pretoria, Gauteng; and
- Rand Water, Panfontein Water Treatment Residue Disposal Facility: Environmental risk assessment, rehabilitation planning and associated determination of closure and rehabilitation costs, Vereeniging, Gauteng (current).

I*ndustry*:
- ArcelorMittal, Vanderbijlpark Works: EIA and Environmental Management Plan for decommissioning of coke oven effluent maturation ponds, Vanderbijlpark, Gauteng;
- Assmang Chrome: Environmental Control Officer (ECO) for implementation and operational phases of ferromanganese production switch ('swing capacity') at Assmang Machadodorp-Ferroalloy Works, Machadodorp, Mpumalanga; and
- Assmang Chrome: Development of an Integrated Water and Waste Management Plan for the Machadodorp-Ferroalloy Works, Machadodorp, Mpumalanga.

Mining:
- Assmang Black Rock Mine Operations (BRMO): EIA and EMPR addendum for Sinter Plant and Mine Expansion, Hotazel, Northern Cape (current);
- Assmang Black Rock Mining Operations (BRMO): Development and subsequent implementation of the BRMO Environmental Management Master Plan, Hotazel, Northern Cape (inclusive of total revision to the Mine's EMPR);
- Assmang Chrome, Machadodorp: Waste Licensing EIA process for the proposed establishment of a proposed Reverse Osmosis Plant at Assmang, Machadadorp operations, Machadodorp, Mpumalanga; and
- Assmang Chrome, Dwarsriver Mine: Waste Licensing EIA process for the proposed establishment of a proposed Reverse Osmosis Plant at Assmang, as well as total revision to EMPR, Dwarsriver Mine, Steelpoort valley, Limpopo.

Specialist Training Course Development & Presentation:
- 2010: Training of Government Officials in the Review of EIAs and applications for environmental authorisation - Responsible for training of Government Officials responsible for EIA Review at the Gauteng, Eastern Cape, Western Cape and KZN Provincial Environmental Authorities.

COURSES

- Practical Training and Capacity Building Workshop on the Globally Harmonised System of Classification and Labelling of Chemicals (GHS): Presented by Orange House Partnership, with assistance from UNITAR (March 2011). Certificate received;
- Introduction to Integrated Waste Management: Centre for Environmental Management, Potchefstroom University (April 2009). Certificate received;
- Waste Reduction and Management: Melrose Advanced Training, Glenhove Conference Centre (September 2008);
- Integrated Environmental Management and Reporting: SEF internal training offered by Andrew Woghiren / Reuben Heydenrych (July 2008); and
- EIA Report Writing: Strategic Environmental Focus (2007).

APPENDIX 4: LIST OF POTENTIAL DUST PALLIATIVES

Road Palliation Options (Efficiencies from Bashian and Strauss, 2002)				
Type (efficiency %)	***Mechanism***	***Advantages***	***Limitations***	***Environmental considerations***
Freshwater (87%)	Moisture wets particles, increasing their mass and binding them together.	Usually readily available, low material cost, easy to apply.	BRMO within a water scarce area. Frequent light applications may be necessary during hot, dry, weather; potentially labour intensive. Over application may result in loss of traction, erosion, or points of road failure.	Minimal environmental impact provided water is not scarce. If applied excessively, may result in erosion and sediment runoff. Supply may be limited in some areas.
Calcium chloride	Deliquescent and hygroscopic at a relative humidity equal to or greater than 29 % (25°C).	Reduces evaporation rate of surface moisture 3.4 times; increases compacted density of road material.	Effectiveness in arid and semi-arid regions may be limited due to low relative humidity; very corrosive to aluminium alloys; slightly corrosive to steel. Solubility results in leaching during heavy precipitation. Releases heat when mixed in water.	Repeated applications and long-term use may harm vegetation, and contamination of groundwater.
Magnesium chloride (98%)	Deliquescent and hygroscopic at a relative humidity equal to or greater than 29 % (25°C).	Reduces evaporation rate of surface moisture 3.1 times; increases compacted density of road material, more so than $CaCl_2$.	Effectiveness in arid and semi-arid regions may be limited due to low relative humidity; very corrosive to steel, though inhibitors can be added. Solubility results in leaching during heavy precipitation.	Repeated applications and long-term use may harm vegetation, and contamination of groundwater.
Lignin derivatives (99%)	Act as adhesives, binding soil particles together.	Greatly increases dry strength of soil; not humidity-dependent; imparts some plasticity to road surfaces; lowers freezing point of road surface and base.	High solubility results in leaching during heavy precipitation; corrosive to aluminium alloys due to acidity ($CaC0_3$ added ingredient, can neutralize acidity). Proper aggregate mix (4-8% fines) important to performance. Becomes slippery when wet, brittle when dry.	Lignin products have a high BOD in aquatic systems. Spills or runoff into surface or groundwater may create low dissolved oxygen conditions or increases in groundwater concentrations of iron, sulphur com pounds, and other pollutants.
Tree Resin Emulsions	Act as adhesives, binding soil particles together.	Low solubility after curing minimizes leaching and provides degree of surface waterproofing. Imparts some plasticity to road surfaces. High bonding strength; non-corrosive.	Require proper weather and time to cure. No residual effectiveness after re-blading. Equipment requires prompt clean up avoiding curing of resin in hoses and pipes.	

Road Palliation Options (Efficiencies from Bashian and Strauss, 2002)

Type (efficiency %)	***Mechanism***	***Advantages***	***Limitations***	***Environmental considerations***
Synthetic Polymer Emulsions	Bind soil particles together by forming a polymerizing matrix, function similar to adhesives.	Applicable to a range of emission sources; function well in sandy soil conditions. Some types allow seeded vegetation to grow through the polymer matrix.	Require proper weather conditions and time to cure; may be subject to UV (sunlight) degradation; application equipment requires timely cleaning; no residual effectiveness after re-blading.	
Bituments, Tars, and Resins	Asphalt and resinous products are adhesive, binding soil particles together. Petroleum oil products coat soil particles, increasing their mass.	Water insoluble when dry; provide a degree of surface waterproofing. Good residual effectiveness.	Surface crusting, fracturing and potholing may develop; long-term application may cause road to become too hard for re-blading; won't lower freezing point; petroleum oil products lack adhesive characteristics.	Use of used oils is prohibited. See MTCA discussion on page 6. Some petroleum-based products may contain carcinogenic polycyclic aromatic hydrocarbons (PAHs).
Geo-textiles	Provide and maintain drainage; improve load supporting properties; prevent upward migration of sub-grade fines; separate road layer materials.	Flexible, durable, water per me able, and resists soil chemicals; reduces amount of aggregate required during initial construction; lower maintenance.	High material cost; material degrades in sunlight, if exposed.	

APPENDIX 5: BRMO ALIEN INVASIVE SPECIES MANAGEMENT PROGRAMME

ALIEN VEGETATION CONTROL PLAN FOR THE ASSMANG MANGANESE BLACK ROCK MINE

PREPARED FOR

Environmental Science Associates

Prepared by:	Scientific Aquatic Services
Report Authors:	Stephen van Staden (Pr. Sci. Nat)
	Natasha van de Haar (Pr. Sci. Nat)
Report Reference:	SAS 211022
Date:	May 2011

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Glossary of Terms & Acronyms

Alien vegetation – Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally.

Biomass – The total mass of living material in a specific area.

Biome – A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.

Bush encroachment – A state where undesirable woody elements gain dominance within grassland, leading to depletion of the grass component. Typically due to disturbances and transformations as a consequence of veld mismanagement (overgrazing, incorrect burning, etc.).

Decreaser grass – Grass abundant in veld in good condition, which decreases when veld is under- or over-utilized.

°C – Degrees Celsius.

Endangered – Organisms in danger of extinction if causal factors continue to operate.

Endemic species – Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.

Exotic vegetation – Vegetation species that originate from outside of the borders of the biome. Usually international in origin.

Ex situ conservation – Where a plant (or community) cannot be allowed to remain in its original habitat and is removed and cultivated to allow for its ongoing survival.

Extrinsic – Factors that have their origin outside of the system.

ha – Hectares.

Indigenous vegetation – Vegetation occurring naturally within a defined area.

Increaser 1 grass – Grass species that increase in density when veld is under-utilized.

Increaser 2 grass – Grass species that increase in density in over-utilized, trampled or disturbed veld.

Increaser 3 grass – Grass species that increase in density in over and under-utilized veld.

In situ conservation – Where a plant (or community) is allowed to remain in its natural habitat with an allocated buffer zone to allow for its ongoing survival.

Karoid vegetation – A shrub-type vegetation that dominates in grasslands that have seen historical disturbances. Mainly due to over-grazing and mismanaged burning regimes. The shrubby vegetation eventually becomes dominant and out-competes the grassy layer.

m – Metres.

mm – Millimetres.

MAMSL – Metres above mean sea level.

MAP – Mean annual precipitation.

MAPE – Mean annual potential for evaporation.

MASMS – Mean annual soil moisture stress.

MAT – Mean annual temperature.

PES – Present Ecological State.

POC – Probability of occurrence.

Pre - emergence herbicide – Is applied to the soil before the weeds emerge. Uptake is usually by growing coleoptiles (shoot) or by the developing roots.

Post - emergence herbicide – Applied after emergence of the weeds and usually have high degree of leaf uptake. To a large degree this term is used to describe products applied to mature plants.

PRECIS – Pretoria Computer Information Systems.

Pioneer species – A plant species that is stimulated to grow after a disturbance has taken place. This is the first step in natural veld succession after a disturbance has taken place.

QDS – Quarter degree square (1:50,000 topographical mapping references).

SANBI – South African National Biodiversity Institute.

Veld retrogression – The ongoing and worsening ecological integrity state of a veld

1 INTRODUCTION

Alien invaders are plants that are of exotic origin and are invading previously pristine areas or ecological niches (Bromilow, 2001). Not all weeds are exotic in origin but, as these exotic plant species have very limited natural “check” mechanisms within the natural environment, they are often the most opportunistic and aggressively growing species within the ecosystem. Therefore, they are often the most dominant and noticeable within an area. Disturbances of the ground through trampling, excavations or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area. Under natural conditions, these pioneer species are overtaken by sub-climax and climax species through natural veld succession. This process, however, takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition as would have been present prior to the disturbance. There are many species of indigenous pioneer plants, but very few indigenous species can out-compete their more aggressively growing exotic counterparts.

Alien vegetation invasion causes degradation of the ecological integrity of an area, causing (Bromilow, 2001):

- A decline in species diversity;
- Local extinction of indigenous species;
- Ecological imbalance;
- Decreased productivity of grazing pastures and
- Increased agricultural input costs.

All floral species that can be regarded as problem plants within a certain area are not necessarily included within the categories as stipulated by the Conservation of Agricultural Resources Act, 1983 (CARA). It is however important to note that each study area is unique and each floral species encountered should be considered with regards to extent and dominance. If any species are identified within the study area which can be regarded as a threat to natural vegetation, or its dominance is as a result of anthropogenic activity, an appropriate mitigation plan should be developed. According to DWAF all alien invasive eradication programs should consist of three phases (www.dwaf.gov.za):

1 Initial control: drastic reduction of existing population.
2 Follow-up control: control of seedlings.
3 Maintenance control: sustain low alien plant numbers with annual control.

Presently dominant alien floral species can be divided into three categories as stipulated by CARA (see section below). The definitions of category 1, 2 and 3 plants as well as the definition of bush encroachment as given by the Agricultural Research Council (www.arc.agric.za) are stipulated below.

- **Category 1** These are prohibited plants that will no longer be tolerated, neither in rural nor urban areas, except with the written permission of the executive officer or in an approved biocontrol reserve. These plants may no longer be planted or propagated, and all trade in their seeds, cuttings or other propagative material is prohibited. They may not be transported or be allowed to disperse.

Plant species were included in this list for one or more of the following reasons: they might pose a serious health risk to humans or livestock, cause serious financial losses to land users, be able to invade undisturbed environments and transform or degrade natural plant communities, use more water than the plant communities they replace or be particularly difficult to control. Most of the plants in this category produce copious numbers of seeds, are wind or bird dispersed or have highly efficient means of vegetative reproduction. Whereas some of these plants were introduced inadvertently, have no obvious function to fulfil in South Africa and are generally regarded as undesirable, many of them are popular garden or landscaping plants. What they all have in common, however, is the fact that their harmfulness outweighs any useful properties they might have. Care was taken not to include a plant in this category if part of the population of South Africa would suffer because of its absence. The ornamentals in this category ought to be reasonably easy to replace with less invasive substitutes (Agricultural Research Council; www.arc.agric.za).

- **Category 2** These are plants with the proven potential of becoming invasive, but which nevertheless have certain beneficial properties that warrant their continued presence in certain circumstances. CARA makes provision for Category 2 plants to be retained in special areas demarcated for that purpose, but those occurring outside demarcated areas have to be controlled. The exception is that Category 2 plants may also be retained or cultivated in biological control reserves, where the plants will serve as host plants for the breeding of biological control agents. The growing of Category 2 plants in a demarcated area qualifies as a water use, and is subject to the requirements of section 21 of the National Water Act, 1998 (Act No. 36 of 1998).

An area can only demarcated for the growing of Category 2 plants by the Executive Officer of the department of Water and Environmental Affairs. The land user needs to obtain a water use license; the plants have to primarily serve a commercial or utility purpose, such as a woodlot, shelter belt, building material, animal fodder, soil stabilisation, medicinal or own consumption; the conditions under which they are cultivated, have to be controlled; all reasonable steps have to be taken to curtail the spreading of seeds or vegetatively reproducing material outside the demarcated area, and all specimens outside the demarcated area have to be controlled. The Executive Officer of the department of Water and Environmental Affairs. has the power to impose additional conditions to ensure the adequate control of Category 2 plants in demarcated areas. Seed or other propagative material of Category 2 plants may only be sold to, and acquired by, land users of areas demarcated for the growing of that species, or for the establishment of a biocontrol reserve. Category 2 plants may not occur within 30 m from the 1:50 year flood line of watercourses or wetlands, unless authorisation has been obtained in terms of the National Water Act. The Executive Officer of the department of Water and Environmental Affairs has the power to grant exemption from some of the above requirements (Agricultural Research Council; www.arc.agric.za).

- **Category 3** These plants are undesirable because they have the proven potential of becoming invasive, but most of them are nevertheless popular ornamentals or shade trees that will take a long time to replace. A few of them were placed into this category instead of into category 1 because they do not cause problems in all situations. In terms of Regulation 15 of CARA, Category 3 plants will not be allowed to occur anywhere except in biological control reserves, unless they were already in existence when these regulations went into effect. The conditions on which these already existing plants may be retained are that they do not grow within 30 m from the 1:50 year flood line of watercourses or wetlands, that all reasonable steps are taken to keep the plant from spreading, and that the Executive Officer of the department of Water and Environmental Affairs has the power to impose additional conditions or even prohibit the growing of Category 3 plants in any area where he has reason to believe that these plants will pose a threat to the agricultural resources. Propagative material of these plants, such as seeds or cuttings, may no longer be planted, propagated, imported, bought, sold or traded in any way. It will, however, be legal to trade in the wood of Category 3 plants, or in other products that do not have the potential to grow or multiply. The Executive Officer of the department of Water and Environmental Affairs will have the power to grant exemption from some of the above requirements (Agricultural Research Council; www.arc.agric.za).

- **Bush encroachment** Declared indicators of bush encroachment concern only landowners in rural areas and are covered in Regulation 16 of CARA. Bush encroachment is a condition where specific individual plant species are closer to each other than three times the mean crown diameter. Plants in this group are not alien plants, but indigenous plants that tend to become abnormally abundant when the area is degraded by e.g. overgrazing or injudicious fires (Agricultural Research Council; www.arc.agric.za).

2 LEGISLATION

The Conservation of Agricultural Resources Act (CARA) and the National Environmental Management: Biodiversity Act (NEMBA), and their Regulations, gives significant powers to hold land-owners accountable for invasions of alien plants on their land.

The present Legislation forms part of the Conservation of Agricultural Resources Act, 1983 (CARA). Regulations 15 and 16 under this Act are of specific concern to problem plants. In the past CARA classified problem plants in two groups namely declared weeds and plant invaders. As a result of accelerating deterioration of the country's natural resources as well as heightened public awareness with regards to environmental affairs, this Act was amended in 2001. Thereafter problem plants are dealt with in four Categories:

Regulation 15

- Declared weeds (Category 1)
- Plant invaders (Category 2 and 3).

Regulation 16

- Indicators of bush encroachment.

3 ASSUMPTIONS AND LIMITATIONS OF THE STUDY

The following assumptions and limitations are applicable to this report:

- The assessment is confined to the subject property and does not include the neighbouring and adjacent properties.
- Sampling by its nature, means that not all individuals are assessed and identified. Some species on the subject property may therefore been missed during the assessment.

4 METHODOLOGY

The alien vegetation study and assessment of the study area will include the following:

- Literature study of both the regional and localised area which will include relevant geology, soil types and species likely to be encountered in the area.
- A site visit will take place for the consultants to obtain an understanding of the site and to observe the various alien vegetation types and their locations and extent.
- Further assessment of the alien vegetation stands will include:
  - Dominance by biomass.
  - Dominance by recruitment.
  - Assessment of spatial significance.

- Reports will include:
  - Mapping of alien communities.
  - Legal overview and obligations.
  - Alien species inventory.
  - Control methods.
  - Management methods.
  - Discussions of priority species.
  - Discussions on priority areas.

5 RESULTS OF INVESTIGATION

5.1 Surrounding properties/land uses

Four mining entities form part of the Black Rock surface rights area namely Black Rock, Gloria, Nchwaning II and Nchwaning III. Black Rock, Gloria, and Nchwaning II and III Mines are situated in the Northern Cape Province approximately 80km north-west of the town of Kuruman. Black Rock, Nchwaning II and III are situated 16km north-west of Hotazel and Gloria Mine is situated 12km north-west of Hotazel. As depicted in the figure below the Black Rock Mine is bordered by the Belgravia Game Farm to the west which also falls under management of the mine. The Gloria and Nchwaning III mines are located east of the Black Rock Mine and Nchwaning II is located within the Black Rock Mine footprint area. All the above mentioned mining facilities are presently still in use, with the exception of the Black Rock koppie operations which ceased in 1992. Two decommissioned mine sites are located to the south of the Black Rock surface rights area, located on the farms Perth 276 and Devon 277. The mining footprint within the farm Perth 276 constitutes approximately 160ha of the total farm surface area and Devon 277 approximately 105ha.

Historically the subject property was utilised primarily for livestock grazing. Some portions within the surface rights area are presently rented to farmers which currently still use the open veld for grazing of cattle. The portion of the Balgravia farm presently managed as a game farm was historically also utilized for grazing however from the time of the establishment of the game farm this area has seen little anthropogenic activity and has largely returned to a more natural ecological state. Land in the immediate vicinity of the Black Rock Mine not used for mining purposes is used for extensive livestock farming.

5.2 Site descriptions

A site visit was undertaken during March 2011 to obtain an understanding of the site and to observe the various alien vegetation communities, their locations and extent. After an initial reconnaissance drive around, more thorough investigations of the study area were undertaken on foot to identify the dominant alien vegetation species.

Current mining activity, game farming with specific reference to the Belgravia game farm as well as cattle grazing are the dominant land uses encountered during the assessment. As a result of these anthropogenic activities, less natural vegetation than what is expected occurs within the surface rights area.

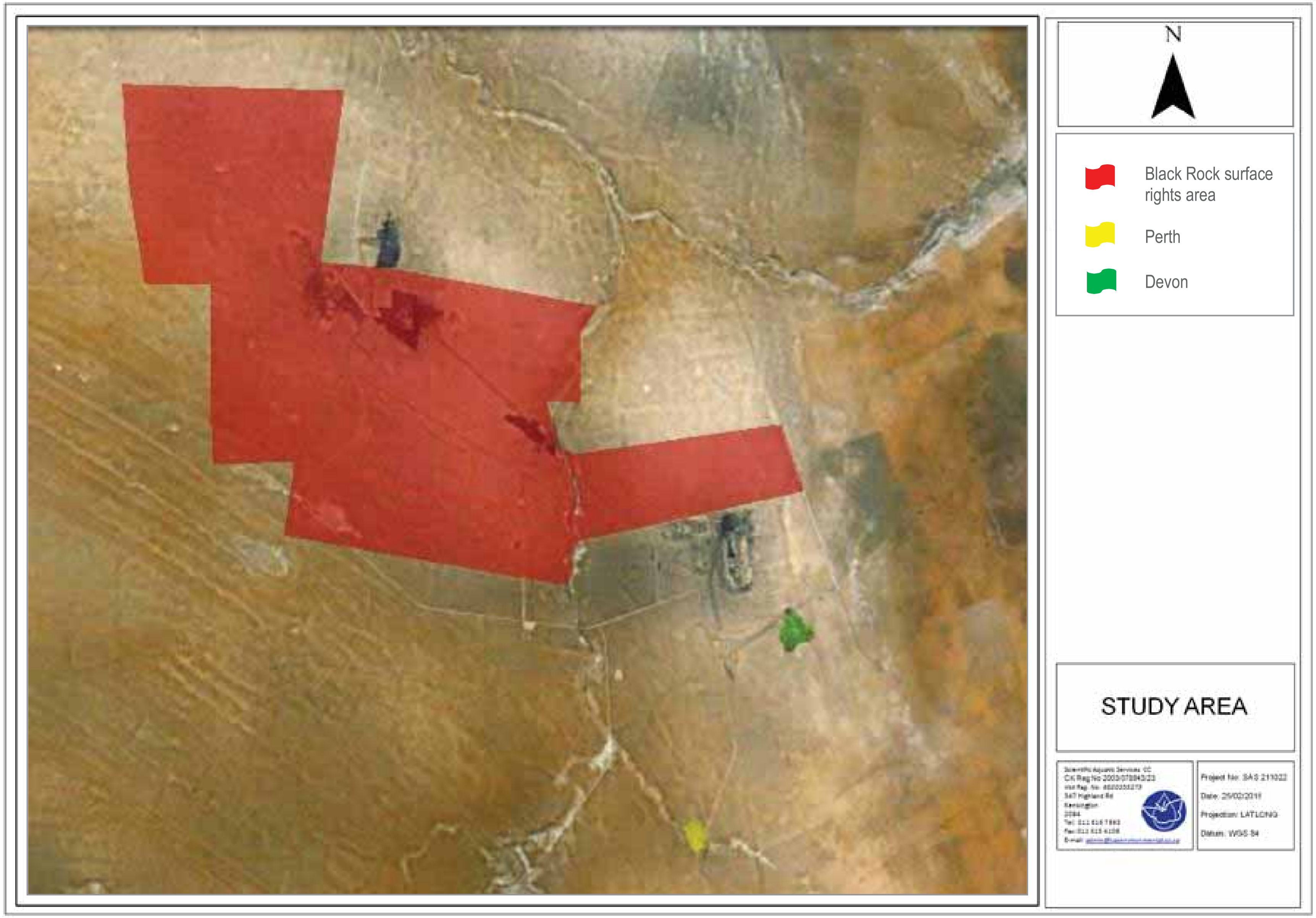

Figure 1: Aerial photograph depicting locality of the subject property within the larger area.

5.3 Regional floral life context

5.3.1 Biome and bioregion

Biomes are broad ecological units that represent major life zones extending over large natural areas (Rutherford 1997). This assessment site falls within the *Savanna biome* (Figure 2) (Rutherford & Westfall, 1994). Biomes are further divided into bioregions, which are spatial terrestrial units possessing similar biotic and physical features, and processes at a regional scale. The majority of the assessment site is situated within the *Eastern Kalahari Bushveld Bioregion* however some smaller portions are located within the *Kalahari Duneveld Bioregion* (Figure 3) (Musina & Rutherford, 2006).

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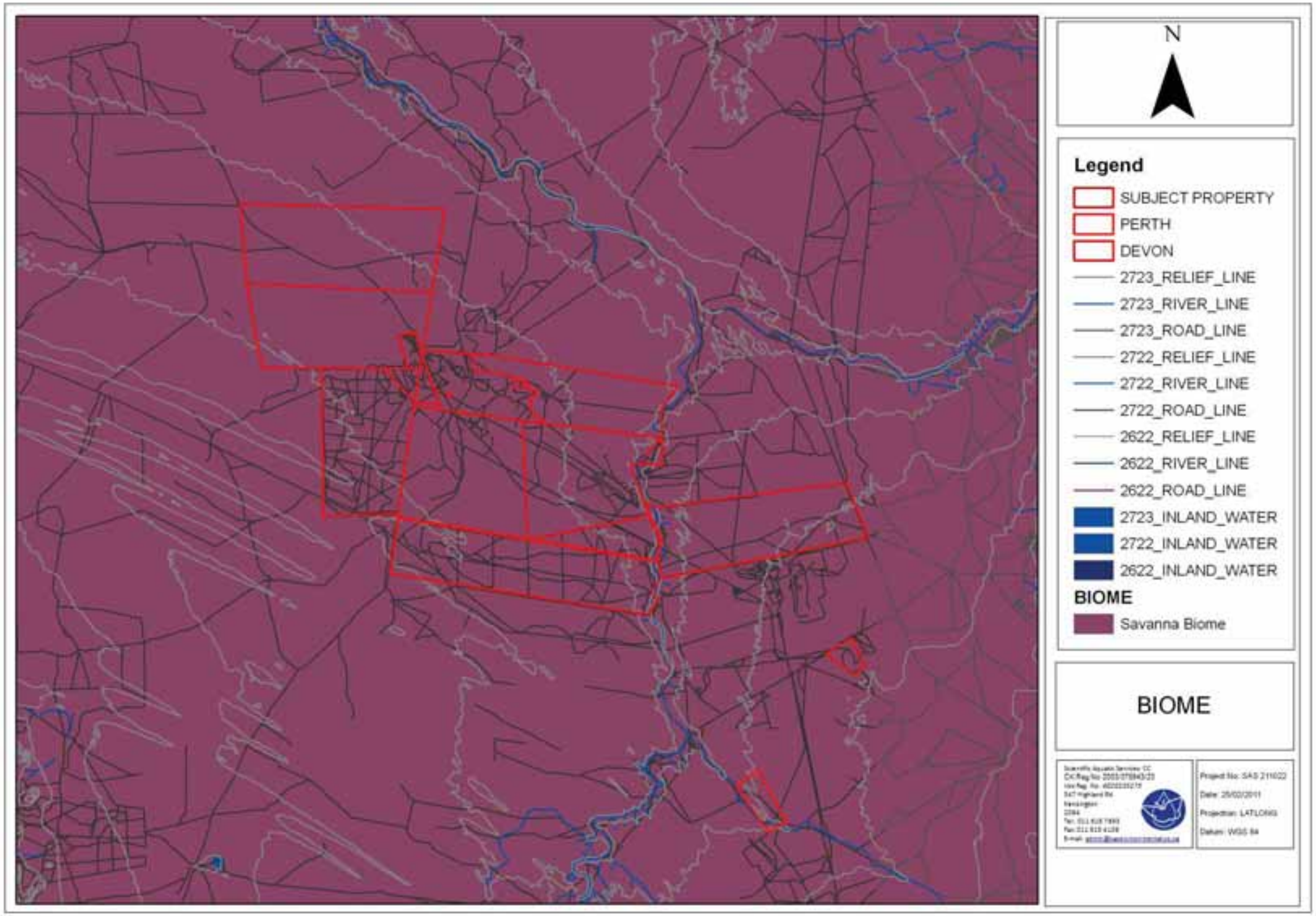

Figure 2: Biomes associated with the study area *(Mucina & Rutherford, 2006)*.

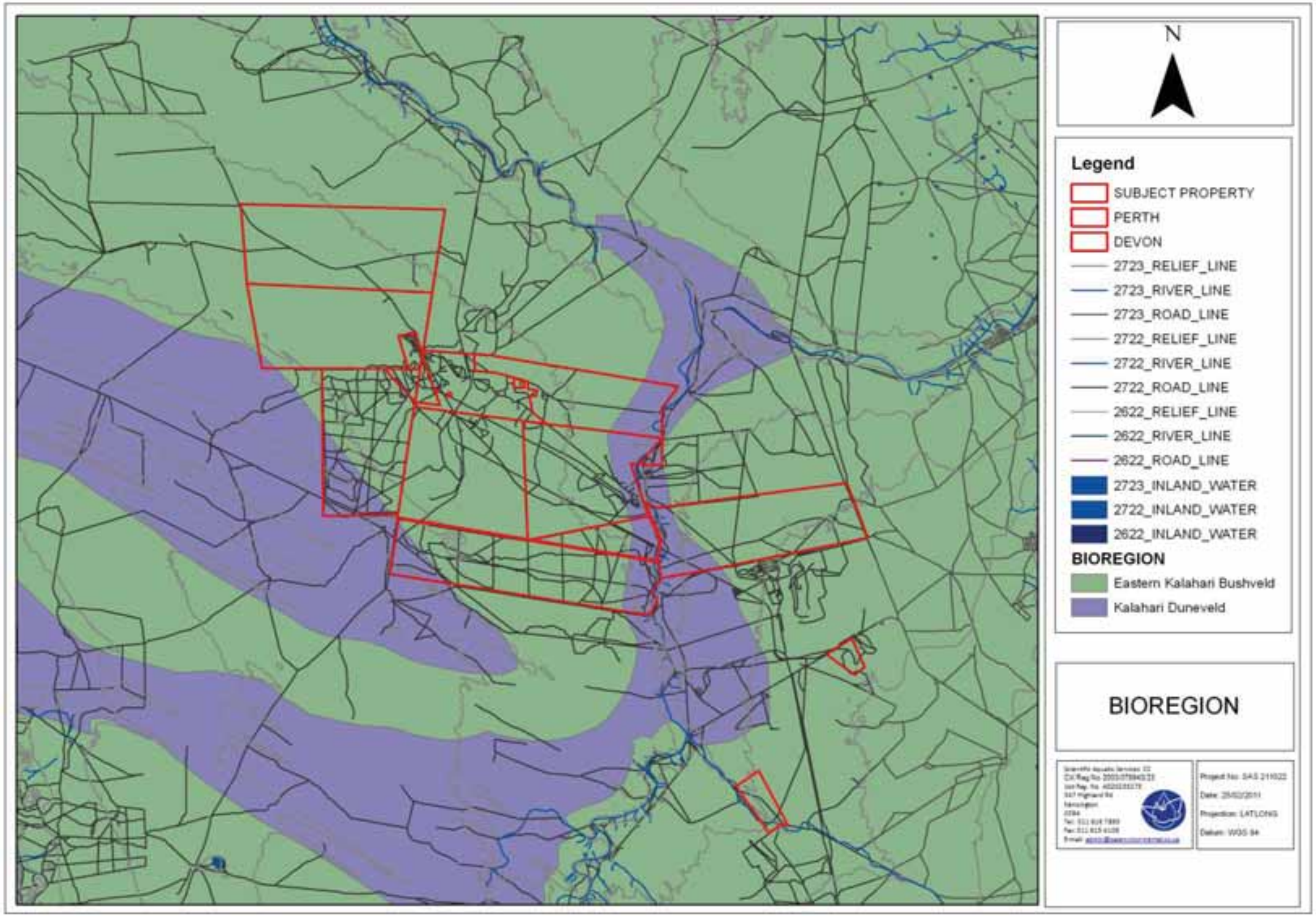

Figure 3: Bioregions associated with the study area *(Mucina & Rutherford, 2006)*.

5.3.2 Vegetation type

While biomes and bioregions are valuable as they describe broad ecological patterns, they provide limited information on the actual species that are expected to be found in an area. Knowing which vegetation type an area belongs to provides an indication of the floral composition that would be found if the assessment site was in a pristine condition. When the boundary of the assessment site is superimposed on the vegetation types of the surrounding area, it is evident that the subject property falls within the *Kalahari Thornveld and Shrub Bushveld* veld type; Figure 4 (Acock's, 1990) and *Kathu Bushveld* vegetation type and partly in the *Gordonia Duneveld* vegetation type; Figure 5 (Musina & Rutherford, 2006).

These species are what one would expect to find in the natural state of the vegetation types, not necessarily for the study area. Factors such as veld mismanagement in the form of incorrect burning regimes, cultivation and infrastructure development, bush encroachment, historical ploughing, landscaping, exotic vegetation encroachment and other forms of transformation all lead to a generally transformed veld where there is no, or little, representation of the floral species associated with the expected vegetation types.

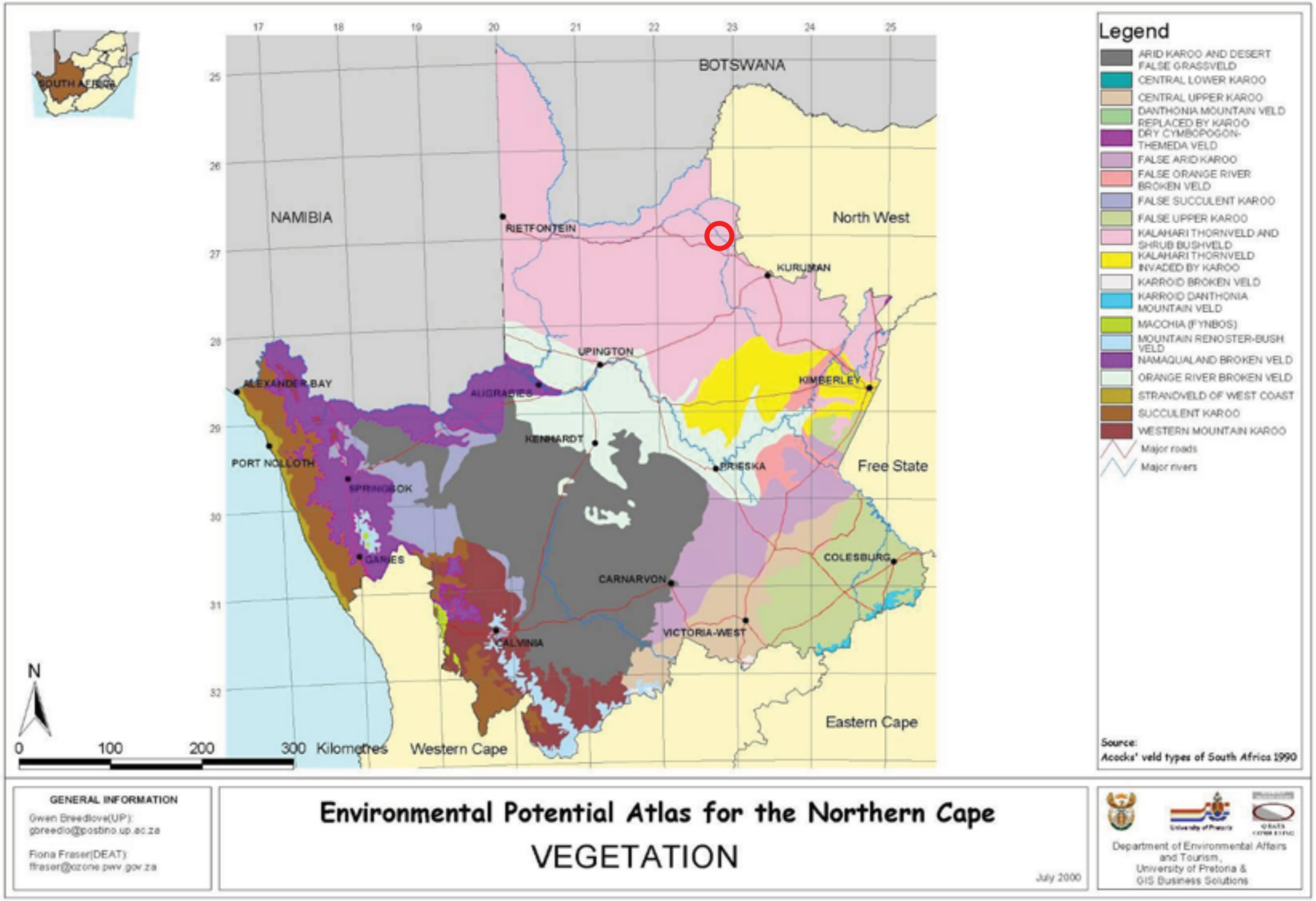

Figure 4: Veld types of the Northern Cape (www.environment.gov.za) subject property is depicted in red.

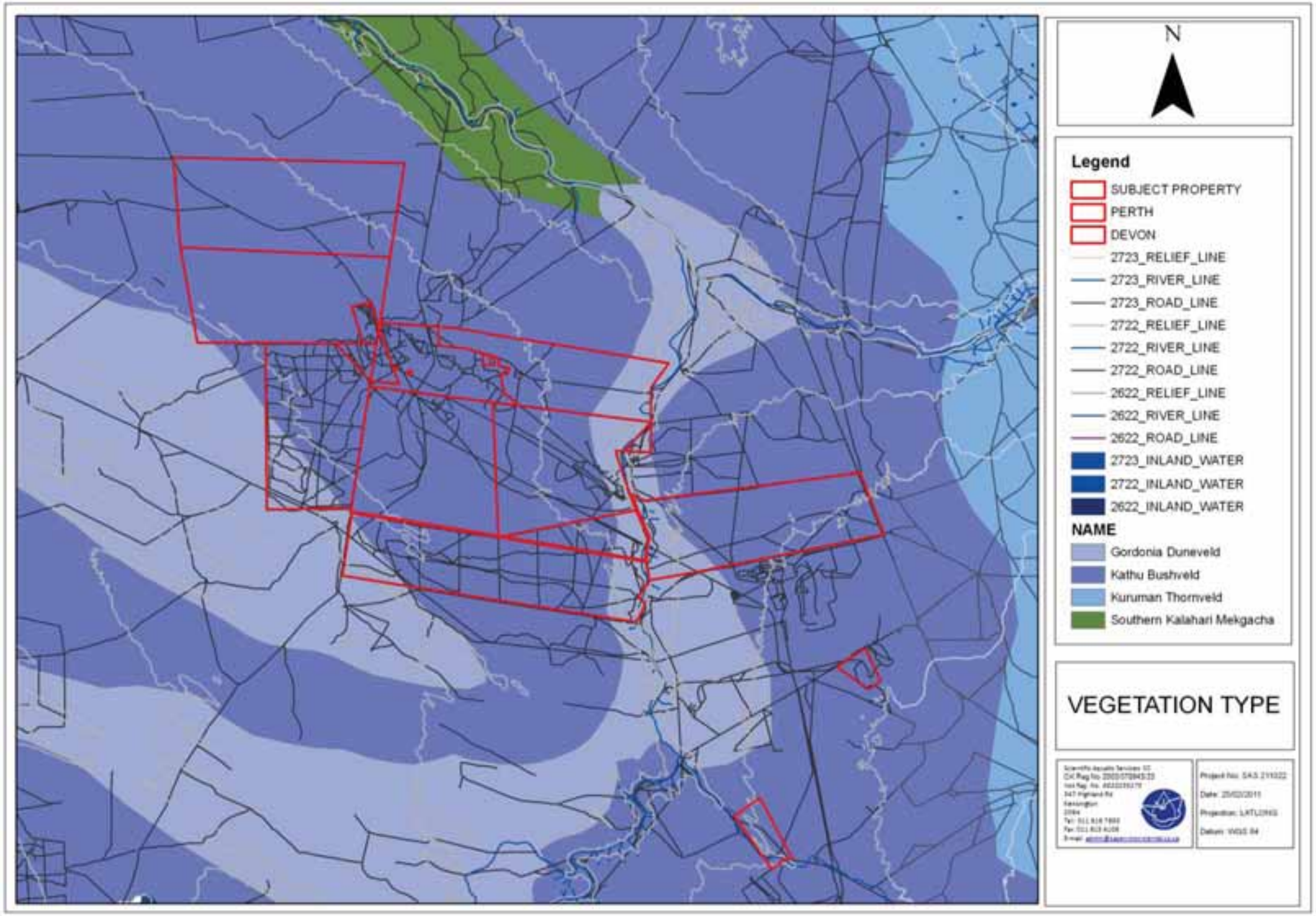

Figure 5: The boundary of the assessment site and the vegetation types of the surroundings areas.

5.3.3 Geology and soils

5.3.3.1 Kathu Bushveld

Aeolian red sand and surface calcrete, deep (>1.2m) sandy soils of Hutton and Clovelly soil forms. Land types mainly Ah and Ae, with some Ag (Mucina & Rutherford, 2006).

5.3.3.2 Gordonia Duneveld

Aeolian sand, underlay by calcrete of the kalahari group, deep, loose, sandy soils of the namib soil form on the flat plains. Land types mainly Ah, and Af with little Ae (Mucina & Rutherford, 2006).

5.3.4 Climate

5.3.4.1 Kathu Bushveld

Summer and autumn rainfall with very dry winters. MAP about 220-380mm. Frost frequently in winter. Mean monthly maximum and minimum temperatures for Sishen 37.0°C and -2.2°C for December and July, respectively (Mucina & Rutherford, 2006).

5.3.4.2 Gordonia Duneveld

Summer and autumn rainfall with very dry winters. MAP about 180-280mm. Frost frequent in winter (Mucina & Rutherford, 2006).

5.3.5 Conservation

5.3.5.1 Kathu Bushveld

Least concern with a target of 16%. None conserved in statutory conservation areas. More than 1% already transformed, including the manganese ore mining locality at Sishen, one of the biggest open-cast mines in the world. Erosion is very low (Mucina & Rutherford, 2006).

5.3.5.2 Gordonia Duneveld

Least threatened with a target of 16%. Some 14% statutorily conserved in the Kgalagadi Transfrontier Park. Very little transformed. Generally low erosion, but some areas with spectacular destabilisation of normally vegetated dues (through local overstocking) favoured by Photographers. Erosion is normally very low (Mucina & Rutherford, 2006).

6 FLORAL ALIEN & INVADER COMMUNITIES

The study area can be broadly divided into four alien floral communities. These communities were identified using to dominance by biomass and recruitment of individual species identified. Definitions given below:

- Recruitment - the arrival/establishment of new individuals into the floral community.
- Biomass - the combined weight of a specific species within the alien floral community.

After the initial site assessment as well as determination of recruitment and biomass, areas with uniform vegetation characteristics were mapped and grouped together. An aerial photograph depicting the locations of these alien communities are conceptually presented in the figure below and discussed in detail in the sections that follow.

It is recommended that species listed as category 1 be considered first priority followed by category 2 and 3 invaders. During the assessment of the study area very low alien and weed species diversity were noted (see table below). It is however evident within the region that grass species known to thrive in disturbed places, is the species noted to quickly establish if areas are disturbed. As a result the natural species diversity declines and grass species known to thrive in disturbed places dominates instead of shrub/forb weed species. An exception to this is overgrazed areas where it was noted that *Acacia mellifera* is the species to quickly establish. The establishment of *A. mellifera* ultimately leads to bush encroachment with little or no establishment of grass species.

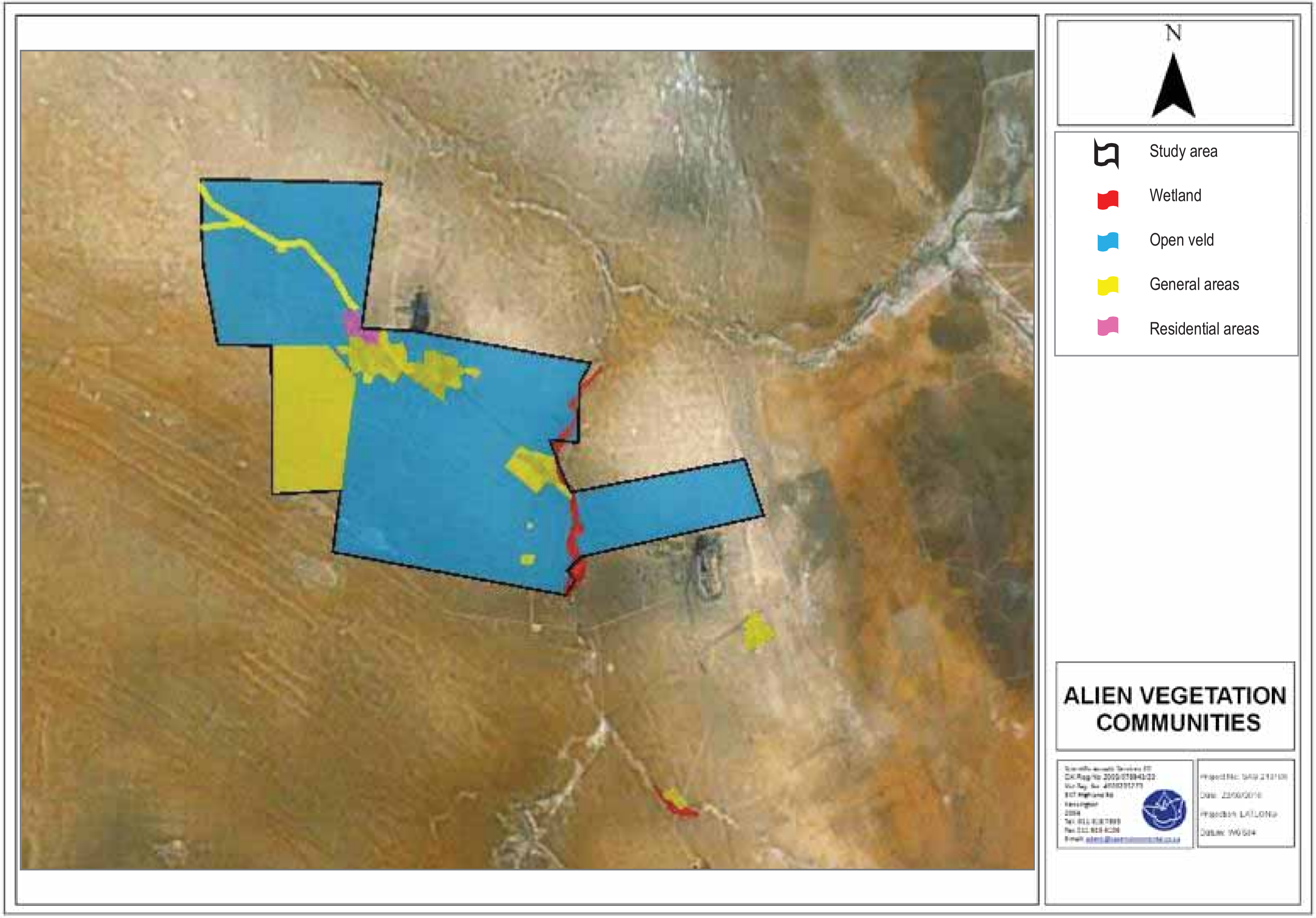

Figure 6: Conceptual mapping of alien floral communities within the study area

6.1 Community 1-Riparian zones and artificial wetland features

Figure 7: Ga Magara River habitat.

Areas included within community 1 are habitat associated with the Ga Magara River as well as the Witleegte River near Perth. This community has remained largely free from alien and invasive species (see figure above); however, invader grass known to thrive in disturbed places such as *Aristida congesta* subsp *congesta* and *Setaria verticillata* was noted. The dominant exotic species identified within community 1 during the time of the assessment was *Prosopis glandulosa,* listed as a category 2 invader. Evidence was encountered during the assessment of *Prosopis glandulosa* eradication within these habitat units. Individuals of this species were also noted along the banks of the open cast quarries located within the decommissioned Perth and Devon mines. It is deemed important that individuals of this species also be eradicated within these areas to prevent increase in the community size. It is however important to note that both these quarries presently hold water and creates habitat for various faunal wetland inhabitants and therefore eradication methods should be done in such a way to prevent to the loss of habitat of the wetland faunal species.

The Conservation of Agricultural Resources Act concerning category 2 invader species specify that category 2 plants may not occur within 30 m from the 1:50 year flood line of watercourses or wetlands, unless authorisation has been obtained in terms of the National Water Act. Therefore it is deemed important that eradication of this species continue in conjunction with rehabilitation of the decommissioned areas as well as previously disturbed areas within the Ga Magara River. All the appropriate eradication measures are stipulated within Appendix A. However, management of these species within riparian areas will prove to be difficult and therefore proper planning should coincide with the management to limit any further damage to the riparian features.

Other invasive floral species identified within the community include *Acacia mellifera, Acacia hebeclada* and *Setaria verticillata.* Management of these species should form a part of all river rehabilitation plans, because they have the potential to proliferate as a result of disturbance, which in turn will prevent establishment of natural climax vegetation.

Recommendations for mitigation of Prosopis glandulosa[1]:

- The eradication methods are stipulated within appendix A. It is deemed that the cut-stump method will be the most effective with the least harm to the wetland, riparian and drainage line habitats. Due to the overall sensitivity of wetland systems, the herbicide chosen should specifically cater for wetland and riverine habitats.
- The plant is known to re-sprout if eradication was not effective; therefore, ongoing monitoring after eradication is necessary.
- All action plans pertaining to wetlands as stipulated within the BAP, should be adhered too. Therefore, the area disturbed during the removal of trees should be kept as small as possible, with no vehicles allowed within wetland zones and all work should be done manually in these areas.

[1] Bromilow, C. Problem plants of South Africa, 2001

Table 1: Summary of alien community 1: Riparian zone.

	Species	Common name	Category if applicable
Dominance by biomass	*Prosopis glandulosa*	Mesquite	2
	Acacia mellifera	Black Thorn	Bush encroachment indicator
	Acacia hebeclada	Candle-pod thorn	Bush encroachment indicator
	Setaria verticillata	Sticky bristle grass	N/A
Dominance by recruitment	*Prosopis glandulosa*	Mesquite	2
	Acacia mellifera	Black Thorn	Bush encroachment indicator
	Acacia hebeclada	Candle-pod thorn	Bush encroachment indicator
	Setaria verticillata	Sticky bristle grass	N/A

6.2 Community 2 – Open veld

Figure 8: *Acacia mellifera* encroachment.

All areas presently utilised for cattle grazing were included within this community. Significant amounts of *Acacia mellifera* which formed impenetrable thickets in some areas within the subject property was considered the dominant invasive species within the community, which ultimately resulted in a significant decrease in natural floral species diversity and abundance within these areas. Smaller areas were also noted within the open veld habitat unit with the potential of extensive *Acacia hebeclada* encroachment in the future.

Although *Acacia mellifera* is considered an indicator species of the *Gordonia Duneveld* vegetation type this species is known to become invasive in previously disturbed areas. Both *Acacia mellifera* and *Acacia hebeclada* are listed within the CARA, (regulation 16) as declared indicators of bush encroachment. This regulation states that a land user of an area in which natural vegetation occurs and which contains communities of indicator plants should follow practices to prevent the deterioration of natural resources and to combat bush encroachment where it occurs. Bush encroachment is a result of a process known as plant succession that entails transformation of a grass-dominated ecosystem to a tree or shrub-dominated ecosystem. The key difference is that bush encroachers are mainly indigenous woody plants. Bush encroachment also poses problems for those who graze cattle on their land, as valuable grazing is lost[2]. Although the tree is known to be grazed by goats the tree is too spiny for cattle and the fallen leaves too small and therefore does not hold any grazing potential.

Eradication and control of *Acacia mellifera* should be planned according to post as well as future land use. To prevent unnecessary expenditure within areas earmarked as future mining expansion areas. No eradication within these areas are deemed necessary, however

[2] http://www.hartebeestfonteinconservancy.org.za/index.php?option=com_content&view=article&id=140:bush-encroachment&catid=43:projects&Itemid=59

the spread of these trees should be monitored. It is also recommended that a combined effort between farmers currently renting the areas within the Black Rock surface rights area and Black Rock Mining operations be established to eradicate extensive *A. mellifera* stands.

Recommendations for mitigation of Acacia mellifera within open veld areas:

- *A. mellifera* is killed by stumping and cutting, with the use of Bromacil and Tebuthiuron, or other herbicides as recommended by chemical agencies.
- Repeated burning exerts a good deal of control, however it is doubtful that burning will be efficient within the subject property mainly due to very little grass cover left in the majority of the highly infected areas. Burning may also result in destruction of seedlings of protected tree species found within the subject property such as *Acacia erioloba* and *Acacia haematoxylon.*
- Ongoing monitoring is essential within areas rehabilitated, which is earmarked for cattle grazing in the future. A sufficient grass layer should be established prior to the introduction of grazing as to prevent proliferation of *A. mellifera*. Future land use should be managed in such a way as to prevent overgrazing which will lead to *A. mellifera* encroachment.
- Regular inspection after eradication is deemed necessary to ensure the eradication method is effective.
- Protected tree species (*Acacia erioloba, Acacia heamatoxylon* and *Boscia albitrunca*) were identified close to areas with *Acacia mellifera* encroachment therefore care should be taken with the identification of the trees.
- Where total removal of *A. mellifera* communities has taken place, reseeding with indigenous grass is required. It is important to use pioneer species such as *Centropodia glauca, Stipagrostis ciliata, Eragrostis lehmanniana* and *Schmidtia pappophoroides,* which are expected within the vegetation type, that will establish quickly and lead to a natural vegetation community in the future.

Cuscuta campestris is listed as a Category 1 invader, therefore all individuals within the Black Rock Mine surface rights area should be eradicate. One other floral species considered invasive at the time of the assessment namely *Verbesina encelioides* was identified. Although *V. encelioides* is not listed within the CARA act it is deemed important that individuals be eradicated and controlled to prevent spread to surrounding areas. Two other species namely *Melinis repens* and *Ziziphus mucronata* also not listed within CARA were identified. Both species have the potential to become invasive if not controlled, therefore these species are not considered priority at present but needs to be monitored to prevent excessive propagation in the future.

Table 2: Summary of alien community 2: Open veld.

	Species	Common name	Category if applicable
Dominance by biomass	*Acacia mellifera*	Black Thorn	Bush encroachment indicator
	Acacia hebeclada	Candle-pod thorn	Bush encroachment indicator
	Melinis repens	Natal red top	N/A
	Verbesina encelioides	Wild sunflower	N/A
	Cuscuta campestris	Dodder	1
	Ziziphus mucronata	Buffalo thorn	N/A
Dominance by recruitment	*Acacia mellifera*	Black Thorn	Bush encroachment indicator
	Acacia hebeclada	Candle-pod thorn	Bush encroachment indicator
	Melinis repens	Natal red top	N/A
	Verbesina encelioides	Wild sunflower	N/A
	Cuscuta campestris	Dodder	1
	Ziziphus mucronata	Buffalo thorn	N/A

6.3 Community 3 – Residential areas

Figure 9: *Melia azedarach* trees within residential areas.

Due to urban development within the Black Rock village and areas such as the hostel and office buildings various exotic species were introduced within urban gardens. Category 3 species identified within these areas include *Melia azedarach, Morus nigra* and *Schinus molle*. Although these species are considered exotics they still offer habitat for faunal species known to reside close to human activity and also form part of established gardens. It is therefore not deemed necessary to remove larger trees, however all exotic seedlings should be removed to prevent spread of these species into open veld areas. It is recommended that a replacement process of large exotic tree species with indigenous species be done over 5 year period.

Nerium oleander is listed as a Category 1 species and should therefore be eradicated regardless of size. The only Category 2 species identified at the time of the assessment was *Agave americana*. It is recommended that the majority of *Agave americana* individuals be eradicated; exception can be made of larger individuals within established gardens; provided that all seedlings are removed.

Table 3: Summary of alien community 3: Residential areas.

	Species	Common name	Category if applicable
Dominance by biomass	*Melia azedarach*	Syringa	3
	Morus nigra	Black mulberry	3
	Schinus molle	Pepper tree	3
	Nerium oleander	Oleander	1
	Agave americana	Sisal	2

	Species	Common name	Category if applicable
	Verbesina encelioides	Wild sunflower	N/A
Dominance by recruitment	*Melia azedarach*	Syringa	3
	Verbesina encelioides	Wild sunflower	N/A
	Morus nigra	Black mulberry	3
	Nerium oleander	Oleander	1
	Agave americana	Sisal	2
	Schinus molle	Pepper tree	3

6.4 Community 4 – General areas

Figure 10: Disturbed areas dominated by one grass species namely *Schmidtia kalihariensis* with *Verbesina encelioides* encroachment visible.

All remaining areas within the Black Rock Mine surface rights area are included within this community and species listed within this community were encountered throughout these areas, with only *Verbesina encelioides* noted as significantly invasive in some areas. Although not listed as an invader within the CARA act, this weed is adapted to arid sandy soil conditions and therefore eradication and future management is needed to prevent it from spreading to nearby open veld habitat.

Opuntia ficus-indica, Spartium junceum, Lantana camara and *Cuscuta campestris* are species identified within this community and listed as Category 1 species. All individuals of these species should be eradicated and controlled. *Eucalyptus* sp. was the only Category 2 species identified within this community. Category 2 plants may not occur within 30 meters from the 1:50 year flood line of watercourses or wetlands, unless authorisation has been obtained in terms of the National Water Act*. Melia azedarach, Schinus molle* and *Ipomoea indica* are Category 3 species identified. It is recommended that these species be removed and replaced with species representative of the relevant vegetation type such as *Acacia erioloba, Boscia albitrunca* and *Acacia haematoxylon.* The remainder of the species were not considered a significant threat to natural vegetation, however it is deemed important that they be appropriately monitored to ensure they do not proliferate excessively.

Table 4: Summary of alien community 4: General areas.

	Species	Common name	Category if applicable
Dominance by biomass	*Eucalyptus sp.*	Gum trees	2
	Melia azedarach	Syringa	3
	Schinus molle	Pepper tree	3
	Opuntia ficus-indica	Sweet prickly pear	1
	Cortaderia selloana	Pampas grass	1
	Verbesina encelioides	Wild sunflower	N/A
	Pennisetum setaceum	Fountain grass	1
	Sesamum triphyllum	Wild sesame	N/A
	Spartium junceum	Spanish broom	1
	Lantana camara	Lantana	1
	Cuscuta campestris	Dodder	1
	Ipomoea indica	Morning glory	3
	Melinis repens	Natal red top	N/A
Dominance by recruitment	*Verbesina encelioides*	Wild sunflower	N/A
	Pennisetum setaceum	Fountain grass	1
	Sesamum triphyllum	Wild sesame	N/A
	Eucalyptus sp.	Gum trees	2
	Melia azedarach	Syringa	3
	Lantana camara	Lantana	1
	Ipomoea indica	Morning glory	3
	Cortaderia selloana	Pampas grass	1
	Melinis repens	Natal red top	N/A
	Spartium junceum	Spanish broom	1
	Cuscuta campestris	Dodder	1
	Schinus molle	Pepper tree	3
	Opuntia ficus-indica	Sweet prickly pear	1

7 CONTROL METHODS

After identification of the different alien floral communities within the study area, control methods specifically pertaining to each floral community could be ascertained (listed in Appendix A). The control methods can be divided into four basic methods of weed control, listed below (definitions compiled by using Bromilow, 2001 and www.dwaf.gov.za).

1. Physical/manual (chopping and slashing; digging and bulldozing; cultivation or hoeing).
2. Cultural (crop rotation; the use of catch crops; winter ploughing; irrigation management; fire).
3. Biological (insects and diseases).
4. Chemical (herbicides).

It should be noted that the category of each species as indicated within the CARA, 2001 legislation is indicated within the control methods table and where the species is not considered in one of the categories, but control methods is deemed necessary, it is indicated with N/A.

- **Ring barking**: Bark must be removed from the bottom of the stem to a height of 0.75-1.0 m. All bark must be removed to below ground level for good results. Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out. Bush knives or hatchets should be used for debarking.
- **Frill:** Using an axe or bush knife. Make angled cuts downward into the cambium layer through the bark in a ring. Ensure to affect the cuts around the entire stem and apply herbicide into the cuts.
- **Cut stump treatment**: Stems should be cut as low as possible. Herbicides are applied in diesel or water as recommended for the herbicide. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label
- **Stem injection**: Punch downward slanting holes into the main stem using a sharpened metal spike. Space holes around entire circumference of lower stems. Inject the herbicide directly into the plant – ensuring to inject around the stem. Follow label recommendations - For invasive cactus species.

General guidelines to take into consideration during alien and invasive control strategies [3]:

- Do not leave herbicide mixed and "ready-to-use" - use it all on the day that it is mixed.
- Use a crop oil with the herbicide; this assists the herbicide to "cling" to the leaves; where applicable it is noted within Appendix A.
- To prevent confusion use a dye in the sprayer so that field workers can see individuals already sprayed; where applicable it is noted within Appendix A.
- Do not spray in the heat of the day. The plant protects itself from water loss, and this reduces the take-up of the herbicide.
- Use all herbicides in the recommended dosages.
- Do not use herbicide in a watercourse. If the use of an herbicide is deemed necessary, the herbicide chosen should specifically cater for wetland habitat.
- If it is a flowering plant, remove flower heads before seeds are dispersed. Care should be taken not to disperse seeds while picking and transporting of flowers. It is recommended that all flower heads be placed directly into a plastic bag where after suitably discarded off.

8 DISPOSAL OF PLANT MATERIAL

- Care should be taken that all alien/weed vegetation is removed prior to seed production. This typically occurs in the early summer.
- All plant material removed should be taken to an area isolated from surrounding natural areas with a bunded surface. This should be designated as a burning area and burning should only be allowed within this area. The plant material should be burnt at the highest temperature possible to ensure alien floral seeds are destroyed. After which all ash should be taken to a registered landfill site.
- All plant material should be covered with a sail during transportation by road to prevent any blow-off from the vehicle.
- The landfill site as well as the place were burning is carried out and the immediate surrounding areas should be monitored for any species that may germinate.
- It is not recommended that any plant material be disposed of within a landfill site or buried prior to burning. This is mainly due to the possible presence of seeds which will germinate and result in the further spread of the problem species.

[3] http://rnc.za.net/index.php?option=com_content&view=article&id=49:guide-to-invader-species-weeds&catid=7:conservation&Itemid=21

- It is not recommended that any species be chipped and used as mulch as there may be seeds present within the mulch that will spread to areas beyond the present alien/weed floral communities.
- Wood from large trees can be made available to the public for firewood.

9 MANAGEMENT OBJECTIVES

The following objectives and principles should be followed to ensure adequate management.

- Priority invasive species within each community identified during the assessment should be addressed first. These include *Prosopis glandulosa* for Community 1; *Acacia mellifera* for Community 2; *Nerium oleander* for community 3 and *Vebesina encelioides* as well as all Category 1 species for community 4. Followed by other species as listed within the various communities.
- After initial control methods the relevant areas should be assessed at quarterly intervals after initial treatment to control any species that may sprout. Thereafter an annual assessment of the alien vegetation stands should take place after the spring flush of each year but prior to seed formation. The annual assessment should include:
    - Determination of effectiveness of mitigation measures within each community.
    - Determination of dominance by biomass and recruitment within each alien vegetation community. To identify any dominant species that may become a threat to the natural vegetation.
- Where total removal of alien communities has taken place, reseeding with indigenous grass is required with special mention of areas where *Acacia mellifera* eradication is deemed necessary. It is important to use pioneer species, which are expected within the vegetation type, that will establish quickly and lead to a natural vegetation community in the future.
- Liaison with surrounding stakeholders, and the local municipality to control surrounding nodes of seed production.
- Re-assessment of the area to determine success of the action and any follow-up measures required.
- Where extensive rehabilitation is needed and areas prone to erosion have been left bare as a result of alien removal a rehabilitation plan should be compiled and implemented.
- Various plant species of concern (*Acacia erioloba, Acacia haematoxylon, Ammocaris coranica, Boophone disticha, Babiana hypogaea* and *Harpagophytum procumbens)* were noted throughout the Black Rock surface rights area. Therefore extra care should be taken with the identification of species before removal of alien or invasive species as well as keeping impact from eradication methods as well as footprint areas to a minimum.

10 REFERENCES

Agricultural Research Council (www.arc.agric.za)

Bromilow, C. (2001). Revised Edition, First Impression. *Problem Plants of South Africa.* Briza Publications, Pretoria, RSA.

Department of Water Affairs and Forestry (www.dwaf.co.za)

Mucina, L. & Rutherford, M. C. (Eds). (2006). *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria, RSA.

Rutherford, M. C. & Westfall, R. H. (1994). *Biomes of Southern Africa: An Objective Categorization.* National Botanical Institute, Pretoria, RSA.

APPENDIX A

Table 5: Control methods as given by Bromilow, 2001 and T.Bold, WfW, Nat.Off.CT retrieved from www.dwaf.gov.za.

Species	Category if applicable	Eradication method
Ipomoea indica	3	Not very susceptible to herbicides. Removal by hand recommended before seed production.
Lantana camara	1	**Foliar spray - Fluroxypyr / picloram**; 80 / 80 g/L ME Plenum 160 ME (L7702); 150ml / 10 Litres water and 0.5% Wetter & Dye **Foliar spray - Glyphosate (ammonium)**; 680 g/kg WG Roundup Max 680 WG; (L6790); 160gr / 10 Litres water and 0.1% Dye **Foliar spray - Glyphosate (isopropylamine)**; 240 g/L SL Tumbleweed 240 SL; (L4781); 300ml / 10 Litres water and 0.1% Dye **Foliar spray - Glyphosate (isopropylamine)**; 360 g/L SL Glyph 360 SL (L4767), Mamba 360 SL (L4817), Roundup 360 SL (L407), 300ml / 10 Litres water and 0.1% Wetter & Dye **Foliar spray - Glyphosate (isopropylamine)**; 450 g/L SL RoundUp Turbo 450 SL (L7166); 240ml / 10 Litres water and 0.1% Dye **Foliar spray - Glyphosate (isopropylamine);** 480 g/L SL Mamba Max 480 SL (L7714); 220ml / 10 Litres water and 0.1% Dye **Foliar spray - Glyphosate (potassium)**; 500 g/L SL Touchdown Forte Hitech 500 SL adjuvant incl.(L7305); 200ml / 10 Litres water and 0.1% Dye **Foliar spray - Glyphosate (sodium)**; 500 g/kg WG Kilo 500 WSG (L7431); 220gr / 10 Litres water and 0.5% Wetter & Dye **Foliar spray - Imazapyr;** 100 g/L SL Chopper 100 SL (L3444), Hatchet 100 SL (L7409); 200ml / 10 Litres Water **Foliar spray - Picloram** (potassium salt) 240 g/L SL; Access 240 SL (L4920), Browser 240 SL (L7357); 100ml / 10 Litres Water and 0.5% Wetter & Dye
Melia azedarach	3	Seedlings need to be hand pulled no herbicide recommended. Adults can be eradicated by the cut stump method or frilling using the herbicides indicated below. • **Clopyralid / triclopyr**; (-amine salt); 90 / 270 g/L SL; Confront 360 SL (L7314); 300ml / 10 Litres water and 0.5% Wetter & Dye • **Fluroxypyr / picloram**; 80 / 80 g/L ME Plenum 160 ME (L7702); 150ml / 10 Litres water and 0.5% Wetter & Dye • **Imazapyr** 100 g/L SL Chopper 100 SL (L3444), Hatchet 100 SL (L7409); 300ml / 10 Litres Water • **Picloram** (potassium salt) 240 g/L SL; Access 240 SL (L4920); 200ml / 10 Litres Water and 0.5% Wetter & Dye • **Triclopyr** (-amine salt); 360 g/L SL Timbrel 360 SL

Species	Category if applicable	Eradication method
		(L4917); 300ml / 10 Litres Water and 0.5% Wetter & Dye
Opuntia ficus indica	1	Injection by any of the following: • **Glyphosate (Ammonium);** 680 g/kg WG **;** Roundup Max 680 WG; (L6790) 3,300ml / 10 Litres water and 0.1% Dye • **Glyphosate (ammonium**); 680 g/kg WG Roundup Max 680 WG (L6790); 3,300ml / 10 Litres water and 0.1% Dye • **Glyphosate (ammonium**); 680 g/kg WG Roundup Max 680 WG (L6790;) 1,800ml / 10 Litres water and 0.1% Dye • **Glyphosate (ammonium);** 680 g/kg WG Roundup Max 680 WG (L6790); 2,200ml / 10 Litres water and 0.1% Dye • **Glyphosate (ammonium**); 680 g/kg WG Roundup Max 680 WG (L6790) 1,000ml / 2 Litres water
Cuscuta campestris	1	Cut and burn infected plants.
Pinus pinaster	2	Mature trees can be frilled: • glyphosate (sodium) 500 g/kg WG Kilo 500 WSG (L7431) Seedlings can be uprooted.
Asclepias fruticosa	N/A	Controlled by physical means when still young. No herbicide registrations.
Melinis repens	N/A	Pre-immergence herbicides
Eucalyptus camaldulensis	2	Seedlings can be hand pulled. Cut stump method can be applied to mature trees: • fluroxypyr / picloram 80 / 80 g/L ME Plenum 160 ME (L7702)
Prosopis spp.	2	Seedlings can be hand pulled. **Foliar spray:** clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL Confront 360 SL (L7314) 150ml / 10 Litres water and 0.5% Wetter & Dye **Foliar spray:** glyphosate (potassium) 500 g/L SL Touchdown Forte Hitech 500 SL adjuvant incl.(L7305) 500ml / 10 Litres water and 0.1% Dye **Cut stump/frilled with:** clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL Confront 360 SL (L7314) 400ml / 10 Litres water and 0.5% Wetter & Dye **Cut stump/frilled with**: triclopyr (butoxy ethyl ester) 240 g/L EC Ranger 240 EC adjuvant incl. (L6179) 800ml / 10 Litres water and 0.1% Dye **Cut stump/frilled with:** triclopyr (butoxy ethyl ester) 480 g/L EC Garlon 480 EC (L4916) 400ml / 10 Litres water and 0.5% Wetter & Dye **Cut stump/frilled with:** triclopyr (-amine salt) 360 g/L SL Lumberjack

Species	Category if applicable	Eradication method
		360 SL (L7295), Timbrel 360 SL (L4917) 500ml / 10 Litres Water and 2% Wetter & Dye
Agave americana & sisalana	2	**Direct inject:** MSMA 720g/L SL MSMA 720 SL (L7279) 2 ml / plant undiluted
Spartium junceum	1	The entire plant needs to be physically removed.
Pennisetum setaceum	1	Isolated plants can be removed manually. Industrial herbicides can be used for large stands.
Sesamum triphyllum	N/A	Preferably plants need to be controlled when still seedlings when they can be removed manually. Isoksaflutool is registered for the control of this species.
Verbesina encelioides	N/A	Mechanical control methods such as removal of flower heads or of the entire plant with taproot, mowing, etc. are suggested. Repetition of efforts is needed.
Morus nigra	3	Seedlings can be hand pulled. Cut stump treated with an herbicide.
Schinus molle	3	Cut stump treated with Triklopir - registered for the control of this species.
Nerium oleander	1	Chemical control is deemed the most effective. Cut stump method with suitable herbicide.
Cortaderia selloana	1	This invader is very difficult to control. Burning does not aid in eradication. Systemic herbicide is deemed the most effective, however follow-up treatment is necessary.

APPENDIX B

Table 6: Photographs of all identified alien and invader species.

Scientific name	**Common name**	**Photograph**
Melia azedarach	Syringa/Maksering	
Lantana camara	Common lantana/Lantana	
Pennisetum setaceum	Fountain grass/Pronkgras	
Melinis repens	Natal Red-top Natalse rooipluim	
Cuscuta campestris	Dodder	 v

Scientific name	Common name	Photograph
Pinus pinaster	Cluster pine Trosden	
Spartium junceum	Spanish broom	 en.wikipedia.org
Sesamum triphyllum	Wild sesame	 zimbabweflora.co.zw
Verbesina encelioides	Wild sunflower	
Morus nigra	Black mulberry	 trees-online.co.uk

Scientific name	Common name	Photograph
Eucalyptus camaldulensis	Red River gum	
Schinus molle	Pepper tree	 biologie.uni-regensburg.de
Prosopis glandulosa	Mesquite	 laspilitas.com
Agave americana	Sisal	 ag.arizona.edu
Opuntia ficus-indica	Sweet prickly pear	 digilander.libero.it

Scientific name	Common name	Photograph
Nerium oleander	Oleander	 en.wikipedia.org
Ipomoea indica	Morning glory	 st-andrews.ac.uk
Cortaderia selloana	Pampas grass	 en.wikipedia.org

APPENDIX 6: BRMO SALVAGE YARD – ENVIRONMENTAL OPERATIONAL PROCEDURE (ENV-S/UG-GN-005)

Salvage Yard – Environmental Operational Procedure

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Ensure that the Salvage Yard at Black Rock Mine Operations is controlled and operated in a manner that is not detrimental to the environment.

2. Related Documents and Forms

2.1. Occupational Health, Safety and Environmental Policy

2.2. SANS ISO 14001: 2004 (4.4.6)

2.3. Hazardous Substances Act, 1973 (Act No. 15 of 1973)

2.4. Environmental Conservation Act, 1989 (Act No. 73 of 1989)

2.5. DWAF Minimum Requirements for Waste Disposal by Landfill

2.6. DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste

2.7. DWAF Minimum Requirements for Monitoring at Waste Management Facilities

2.8. National Environmental Management Act (Act No. 107 of 1998)

2.9. National Water Act (Act 36 of 1998)

2.10. Access Control Forms

2.11. Waste Manifests

2.12. Safe Disposal Certificate

2.13. Waste Monitoring Reports

2.14. Environmental Incident/Non-conformance Reports

2.15. PROCEDURE: Salvage Yard - GEN-S-GN-002

2.16. Salvage Commercial Forms as per Salvage Procedure

3. General

3.1. This procedure is applicable to the Black Rock Mine Operations Salvage Yard, which includes the area designated for temporary storage of hazardous waste. This procedure applies to the management, sorting, stacking and piling of recyclable materials as well as the separation of Hazardous and Non Hazardous waste

3.2. The responsibility for the implementation and compliance to this procedure lies with the following all the sections and individuals utilizing the Salvage Yard.

3.3. DEFINITIONS

- **Hazardous Waste:** is waste which can, even in low concentrations, have a significant adverse effect on public health and/or the environment. This is on account of its' inherent chemical and physical characteristics such as toxicity, ignitibility, corrosiveness, carcinogenic, and other properties.
- **General Waste:** is the generic term for waste that, because of its composition and characteristics, does not pose a significant threat to public health or the environment if properly managed.
- **Recyclable Material:** is material that maybe offered on tender to interested parties, which is deemed not to be hazardous.

4. Description of Procedure

4.1. The different sections will deliver recyclable/salvageable material and hazardous waste to the Salvage Yard during normal working hours.

4.2. As access to the Salvage Yard is strictly controlled, a register is to be completed upon entry.

4.3. The Salvage Yard Supervisor/designate will indicate the area where hazardous waste or recyclable/salvageable material is to be off-loaded.

4.4. The Salvage Yard Supervisor/designate will report all non-compliances and incidents of environmental nature to the Environmental Management Section.

4.5. The Salvage Yard Supervisor/designate will ensure that the non-hazardous waste is separated into recyclable material and waste that must leave the mine. The recyclable material must be stacked neatly so that the tender process may follow.

4.6. The Salvage Yard Supervisor/designate will label all the hazardous waste, indicating the date of receipt, type and volume.

4.7. The Salvage Yard Supervisor/designate will ensure that the hazardous waste is sent to a H:H registered waste disposal site within a period of 90-days.

4.8. The Salvage Yard Supervisor/designate will inform the Environmental Officer when the hazardous waste is due for off-site disposal, the Environmental Officer will contact the outsourced Waste Contractor, and have the hazardous waste removed and disposed at a registered H:H Waste disposal facility, and ensure that the Waste Manifest and Certificate of Safe Disposal are received by the mine.

APPENDIX 7: BRMO ENVIRONMENTAL OPERATIONAL PROCEDURE FOR THE USE OF HERBICIDES AND PESTICIDES (ENV-S/UG-GN-003)

The Use of Herbicides and Pesticides

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Ensure safe handling, application and disposal of pesticides at Black Rock Mine Operations.

2. Related Documents and Forms

2.1. Department of Water Affairs Working for Water Policy on the use of herbicides for the control of alien vegetation

2.2. Conservation of Agricultural Resources Act, CARA 1983 (Act 43 of 1983)

2.3. National Environmental Management Act (Act 107 of 1998)

2.4. PROCEDURE: Waste Management – ISO-14001-WastD-01-1-2

2.5. PROCEDURE: Hazardous Substances Handling – Env-S/UG-GN-004

2.6. Black Rock Emergency Telephone List

2.7. Black Rock Emergency Telephone Numbers and Addresses

3. General

3.1. This procedure applies to all areas on the mine, including mine perimeter and plant areas, where pesticides are applied.

3.2. It is the responsibility of the Environmental Specialist/Designate to ensure adherence to this procedure where pesticides are used, handled, stored and/or disposed of.

3.3. DEFINITIONS

Pesticides: Pesticides is a collective term for Herbicides, Insecticides, Fungicides, etc.

Herbicides: Herbicides is a chemical mixture, which contains an active ingredient to eradicate weeds.

4. Description of Procedure

4.1. Selection of pesticides to be used

- Determine the type of pest or weeds that needs to be controlled, and the specific pesticide to be used for control.
- The pesticide must be registered under Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No.36 of 1947).
- Obtain a Material Safety Data Sheet for the pesticide.

4.2. Operator Safety

- All measures must be taken to ensure operators safety and label recommendations regarding safety are strictly observed. The following gives the toxicity rating according to the label colour band:
  - Green — Acute hazard unlikely in normal
  - Blue — Slightly hazard – caution
  - Yellow — Moderately hazardous – harmful
  - Red — Toxic to very toxic

4.3. Operators Training

- Basic pesticide awareness
- Safe handling of concentrates and spray mixtures, toxicity of the pesticides, protective clothing and safe disposal
- Application techniques to prevent waste
- Care of equipment – cleaning and disposal of washings.

4.4. Personal Protective Equipment (PPE)

- Always read the product label to determine what specific protective equipment is required for handling and application of a product.
- The minimum requirements when handling pesticides are:
  - Adequate eye protection, goggles or a full-face shield.
  - Rubber gloves and boots
  - Aprons to protect working clothes
  - Head protection
  - Respirator or face-mask

4.5. Environmental Safety

- Only pesticides with least environmental impact should be used.
- Precaution should be taken to ensure that these products are safely stored, handled, applied and disposed.

- During the application, damage to indigenous or other desirable vegetation product should be observed.
- Care must be taken to prevent contamination of water bodies.

4.6. Handling

- Strict precautions should be applied when handling pesticides and the personnel handling the product must be fully aware of the precautions observed.

4.7. Spillages

- Absorbent materials must be available during the process to handle accidental spillages.
- In case of spillage, the spill must be contained immediately with absorbent.
- The contaminated material should then be disposed of as hazardous waste
- Concentrates and mixtures should never be decanted into or be mixed in drinking bottles or other food containers.
- All containers into which pesticides are decanted must be clearly marked and a copy of the original label secured to the container.

4.8. Disposal

- Pesticides empty containers should be treated as hazardous waste and correctly and safely disposed (see waste management procedure)
- All contaminated material must be paled in a sealable container marked with the following words e.g. “Pesticide/Toxic”.
- Contaminated soil must be dug up and placed into a suitable container and sealed.
- The container must be stored in a designated area, along with all other hazardous waste (See: Waste Management Procedure)

APPENDIX 8: BRMO BUND WALL PROCEDURE (ENV-S/UG-GN-002)

Bund Walls

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Ensure that all bund walls are constructed to a specific standard in order to prevent pollution of soil and water resources.

2. Related Documents and Forms

2.1. National Environmental Management: Waste Act (Act 59 of 2008)

2.2. Mineral and Petroleum Resources Development Act (Act 28 of 2002)

2.3. National Environmental Management Act (Act 107 of 1998)

2.4. National Water Act, 1998 (Act 36, 1998)

2.5. Hazardous Substances Act, 1973 (Act 15, 1973)

2.6. Hazardous Chemical Substances Regulations, 1995

3. General

3.1. This procedure applies to all areas on the mine, where bund walls may be deemed necessary

3.2. It is the responsibility of the Section Supervisors to ensure adherence to this procedure in their area(s) of responsibility.

3.3. DEFINITIONS

- Environment: the surroundings in which the mine operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation.

- Environmental Aspects: components of the mine's activities or products or services that can interact with the environment.
- Environmental Impact: any change to the environment, whether adverse or beneficial, wholly or partially resulting from the mines environmental aspects.
- Environmental Management Systems(EMS): the part of the overall management system that includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy.

3.4. SPECIFICATIONS FOR BUND WALLS

All Bund walls will have the following specifications:

- The bund walls must be able to contain at least the volume of the largest container and an additional 10% of the largest container in the bunded area.
- The total capacity of the bund wall must be displayed on the bund wall or on the fence if the bunded area is fenced.
- It must be constructed from cast concrete with pinning steel, or from bricks (plastered inside) or made from an impermeable material.
- It must have a draining valve at the lowest point of the bunded area; the draining valve must be closed and if lockable, be locked at all times.
- An emergency container and pump must be readily available at a commonly-known location.
- Where practical/ necessary, the bund wall must have protective barriers to prevent vehicles from colliding with the walls and damaging it.
- No pipes or cables should run through the bund walls, except drainage pipes. As far as possible, all flanges, pipe fittings, valves and pumps etc. of the tank and the dispensing system should be situated well within the bund wall.
- Storage areas that must be accessible with forklifts must be constructed in such a way that a ramp will allow access and still contain spillage.
- Only galvanized steel pipes may be used for drainage. No rubber, plastic or PVC pipes will be allowed.

4. Description of Procedure

4.1. Demarcation of Bund Walls

Responsible Person:

- ➢ Calculate the volume of the bund wall.
- ➢ Prepare a conspicuous display mechanism i.e. a metal/ plastic plate, laminated sheet or painted on the bund wall
- ➢ Attach the display mechanism in such a manner that the integrity of the bund wall will not be jeopardised.
- ➢ Ensure that only the volume of liquid that the bund wall is designed for is kept in the bund wall.

4.2. Cleaning of Bunded Areas

Responsible Persons:

- ➢ Pumps or drains contaminated water from bunded areas into a container.
- ➢ Cleans the contaminated area with the appropriated absorbent in the case of spillage.

- Disposes contaminated water at a wash bay where an oil separator is functional.
- Salvage and recycles any oil / fuel spilled inside the bund wall as far as possible.
- Disposes any absorbent material or polluted soil as hazardous waste.
- Empties drip trays regularly and stores them inside the bunded area.
- Ensures that no chemical, oil or fuel is present in the water before releases rain water from the bund wall.
- Ensures that the valves on the bund walls are closed/locked at all times.

4.3. Inspection of Bund Walls

Responsible Person:

- Checks on permeability, cracks and pollution of adjacent areas during regular inspection of bund walls.
- Schedules inspections on Maximo.
- All newly constructed bund walls are to be inspected and signed off in terms of the integrity and capacity of the installation by the responsible Engineer.

APPENDIX 9: BRMO WASTE OIL ENVIRONMENTAL PROCEDURE (ENV-S/UG-GN-001)

Old Oil Management

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Provide guidelines for correct handling and disposal of used oil at Black Rock Mine Operations.
- Identify the roles and responsibilities for the transportation and maintenance of the used oil disposal facilities.
- Prevent the pollution of land and water with oil.

2. Related Documents and Forms

2.1. National Environmental Management Act

2.2. National Environmental Management: Waste Act

2.3. Hazardous Substances Act

2.4. SANS 10131:2004 Standard

2.5. ARM Corporate Standard on Waste Management

2.6. FORM: Old Oil Management

2.7. PROCEDURE: Non-conformance, Corrective and Preventative Actions – ISO-14001-PRO-03-2

2.8. PROCEDURE: Waste Management – ISO-14001-WasteD-01-1-2

2.9. PROCEDURE: Bund Wall – Env-S/UG-GN-002

3. General

3.1. Used oil may only be disposed of in the following manner:-

3.1.1. Used oil “in transit” will be conveyed in the following containers:

Surface

- In 210 litre drums between the collection point and the Workshops.
- In containers carried from the Shaft to the old oil storage tank at Nchwaning 2.

Underground

- In used oil containers such as 210litre drums between the collection points and Surface.

NOTE: All lubricant containers and storage areas for lubricants must comply with the following standards:

- Storage areas must be bunded according to the SANS specification to contain 110 % of the volume of the storage capacity of containers and must be impervious to fuel and oil.
- The storage area must not present a fire hazard to other facilities or structures.
- Oil drums must not leak and caps must be securely fitted.
- Measures must be taken to prevent the overfilling of containers.

3.2. RESPONSIBILITY

3.2.1. Areas for Maintenance and Persons Responsible

Underground Workshops

- The Engineering Foreman of each Underground Workshop must ensure that the oil separators and the sumps of oily water separators are always in good working order and that all used oil is pumped to the designated used oil containers.

4. Description of Procedure

4.1. Surface

4.1.1. Used oil disposal on Surface

- All the used oil on surface is to be drained into a container and emptied into 210 litre drums posted at various locations and clearly marked for this purpose.
- All the used oil collected at the oil traps and sumps is to be pumped into 210 litre drums marked for this purpose.
- When these drums are full, the responsible Artisan is to ensure that they are taken to the old oil bay at Nchwaning 2 and placed at the designated storage area to be pumped out.
- Empty drums must replace the full drums that are removed from the oil disposal points.
- All personnel must be familiar with the old/used oil disposal system and must know where the disposal points are situated.
- Empty drums that are not in use may be stored at the hazardous storage area at the Salvage Yard.

4.2. Underground

4.2.1. Used oil removal procedures for Underground Workshops

- No oil shall be allowed to run into any water drain. The responsible Foreman and Artisans are to ensure that all oil drained from machines during maintenance is to be disposed of into 210 litre drums which eventually report to surface. Oil spillage occurring during machine repairs and breakdowns in service bays must be absorbed with fibre and the workshop floor cleaned with a biological degreaser where possible. Under no circumstances must oil be deposited on the footwall or poured into the drains or water passes underground. Any vessel that contains old oil must be sealed so that accidental spillage cannot occur if the container is disturbed.

- Old oil must be taken to the old oil storage tank at Nchwaning 2.
- At this facility oil must then be transferred into the used oil storage tank. Spillage must be caught in a drip tray.

4.3. Transformer Oil

4.3.1. As a standard, no PCB containing insulating oil is to be used in transformers and as a rule, should not contain PCBs. If transformer oil has to be disposed of, a sample will be taken for PCB testing. If the results indicate that the oil is PCB free it will be taken for testing. If the results indicate that the oil is PCB free it will be taken in 210litre drums to a designated area at the Nchwaning2 where it will be pumped into the used oil storage.

4.3.2. If the transformer oil contains PCBs, i.e. if the levels exceed 50 ppm it cannot be disposed of through the old oil system. PCB contaminated oil must be securely contained in labeled 210litre drums and taken by the Electrical Foreman to the hazardous waste storage area at the Salvage Yard. The Environmental Officer must be informed so that arrangements can be made for its safe, off-site disposal.

4.4. Oil Disposal Facility Procedure

4.4.1. Old oil must be sent to an old oil facility at Nchwaning 2.

4.4.2. The oil must then be transferred from the used oil storage tank into the used oil cassette. Spillage must be caught in a drip tray.

4.5. Oil Spill Clean-up Procedure

4.5.1. All spills must be reported to the Environmental Management Section. The method used to clean up an oil spill depends on the type of surface that has been contaminated. The main objective is to prevent the spreading of the oil, recovery of oil where possible, clean up and if necessary rehabilitation of the area.

4.5.2. Personnel handling oil must use gloves and eye protection. Personnel must have training in spill management.

4.5.3. Method used to contain and clean up oil spills on a concrete surface.

- Absorbent Booms should be used to contain a large spill and excess oil must be pumped or scooped up into old oil containers. Loose Fibre should be used on any concrete floor where a small-uncontained spill has occurred. The used fibre or booms should be stored in a 210 litre drum marked for this purpose and reused where possible. Avoid the use of chemicals to absorb/emulsify oil.
- The used fibre and fibre booms, together with oily rags may be disposed of in a drum marked for this purpose and sent to the Salvage Yard. Do not mix oil-contaminated fibre or other oil contaminated materials with any other wastes.
- Concrete floors should be washed with a Biological Degreaser to remove the oil stains.

4.6. Clean-up of Oil Spills on Land

4.6.1. Spills on land should be contained as quickly as possible with earth walls or absorbent booms. Excess oil can be deflected onto plastic sheeting to minimise infiltration into the ground. Contaminated soil should be removed and placed in 210litre drums and removed to the designated area at the Salvage Yard.

4.6.2. On site bioremediation can be carried out in an approved manner. Bioremediation Powders are powders containing microbes, and are used to bio-remediate contaminated soil.

4.7. Records

4.7.1. Records of used oil disposal must to be kept by Materials Manager and by each Section that makes use of the old oil disposal system.

14. APPENDIX 10: BRMO SPILL MANAGEMENT ENVIRONMENTAL PROCEDURE (ENV-S/UG-GN-016)

Spill Management

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Ensure that spills are handled in an appropriate manner in order to minimise the environmental impact and rectify the damage done to the environment.

2. Related Documents and Forms

2.1. SHE Incident/Accident Reporting Booklet

2.2. Black Rock Mine Operations' Occupational Health, Safety & Environmental Policy

2.3. Hazardous Substances Act, 1973 (Act No. 36 of 1973).

2.4. National Water Act, 1998 (Act No. 36 of 1998)

2.5. PROCEDURE: Hazardous Substances Handling Procedure - PRO-SHERQ-Env-S/UG-GN-004

2.6. PROCEDURE: Non-conformance, Corrective and Preventative Actions – ISO14001-PRO-03-2

2.7. PROCEDURE: Waste Management - PRO-SHERQ-Env-S/UG-GN-0012

3. General

3.1. This procedure applies to all areas Black Rock Mine Operations which are considered to have been disturbed by the mining activities.

3.2. RESPONSIBILITY

- It is the responsibility of all employees working at Black Rock Mine Operations to handle spills that may cause environmental impacts in accordance with this procedure and report via the prescribed incidents/non-conformance form or Electronic Management System.

- It is the responsibility of all supervisors to ensure that remedial steps are taken to rectify the damage caused to the environment in their area of responsibility and to report back on the Electronic Management System.
- The supervisors responsible in that area must in conjunction with the Environmental Specialist formulate sustainable solutions to prevent re-occurrences of such incidents.
- It is the responsibility of the Environmental Specialist to evaluate the success of the remedial action taken on significant spills and to record the results on the Electronic Management System.

3.3. DEFINITIONS

Environment: the surroundings in which the mine operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation.

Environmental aspects: components of the mine's activities or products or services that can interact with the environment.

Environmental impact: any change to the environment, whether adverse or beneficial, wholly or partially resulting from the mines environmental aspects.

Environmental Management System (EMS): the part of the overall management system that includes the organisation structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy.

4. Description of Procedure

4.1. All spillages must be reported and attended to.

4.2. Should a spill occur, the person responsible/ discovering the spill should take the necessary step to contain the spill in order to minimise the area that will be affected.

4.3. Once contained, the spill should be cleaned up in a manner appropriate to the spill, if uncertain refer to the Safety Data Sheet for the fluid spilled.

4.4. Spills on an impermeable surface can be mopped up with a suitable absorbent material e.g. organic fibre; reusable absorbent pads or any other suitable absorbent material. If a reusable absorbent material is used this should be stored in a drum kept for this purpose until its life is exhausted. Once the absorbent material has reached the end of its life it should be disposed of in the hazardous waste bins and not discarded with general waste. It is important that the used absorbent is placed in a box/packet/container before placed into the hazardous waste drum.

4.5. Should an oil, fuel or lubricant spill occur on a permeable surface (i.e. ground/soil) the area is to be remediated on site by the person responsible for the spill. If is not practical to remediate the site, as much of the contaminated soil as possible must be lifted and removed to the Salvage Yard hazardous waste temporary storage for disposal. The site of the spill should be treated with suitable bioremediation product in accordance with the manufacturer's instructions. The principle of "polluter pays" will be adopted with regard to the clean-up and disposal costs incurred.

4.6. Should any other spill occur the spill must be cleaned up and the polluted waste and/or soil deposited in a hazardous waste bin or suitable container clearly labeled with contents. This container must be sent to the hazardous waste transfer site for correct disposal according to the substance spilled.

4.7. Oil spills which occur on water may be contained with fibre booms and mopped up with a suitable product (e.g. absorbent cushions) that float on top of the water and absorbs the oil. The used fibre booms and pillows should be disposed of at demarcated contamination site.

4.8. If harmful substances, other than oil, fuel or lubricant, are spilled into water the contaminated water must be contained and pumped to where it can either rectify or disposed correctly.

4.9. Spill kits are provided in the various sections of the mine to assist with the cleaning of spillages.

4.10. The re-filling of spill kits is the responsibility of the employee who uses the kit.

4.11. Purchase Requisitions must be completed and the absorbent must then be fetched from stores.

4.12. Each section/department is responsible for the care of their spill kits.

15. APPENDIX 11: BRMO WASTE MANAGEMENT ENVIRONMENTAL PROCEDURE (ENV-S/UG-GN-0012)

Waste Management

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Establish minimum control measures to be implemented to ensure waste management complies with the applicable environmental laws from inception of the waste stream to final disposal. The procedure provides for control measures for the handling, storage and disposal of waste on and off site, as well as for the operation of the general waste landfill site.

2. Related Documents and Forms

2.1. Occupational Health and Safety Act (Act No. 85 of 1993, as amended)

2.2. National Water Act (Act No. 36 of 1998, as amended)

2.3. Minerals Petroleum Resources Development Act, (Act 28 of 2002)

2.4. Mine Health and Safety Act (Act 29 of 1996)

2.5. National Environmental Management Act (Act 107 of 1998)

2.6. National Environmental Management: Waste Act (Act 59 of 2008)

2.7. The Constitution (Act 108 of 1996)

2.8. Environment Conservation Act Transitional Provisions (Repealed, but mine has a s.20 permit)

2.9. Assmang Black Rock Mine Operations Occupational Health, Safety and Environmental Policy

2.10. FORM: Landfill Site Register

2.11. FORM: Old Oil Management

2.12. PROCEDURE: Old Oil Management – Env-S/UG-GN-0001

2.13. PROCEDURE: Safe handling and processing of products containing Asbestos – Env--S/UG-GN-0011

2.14. PROCEDURE: Disposal of Empty Containers and Storage of Full Containers – Env-S/UG-GN-0013

2.15. Department of Water Affairs & Forestry, 1994. Waste Management Series. Minimum Requirements for the Handling and Disposal of Hazardous Waste.

2.16. Department of Water Affairs & Forestry, 1994. Waste Management Series. Minimum Requirements for Waste Disposal by Landfill.

2.17. Department of Water Affairs & Forestry, 1994. Waste Management Series. Minimum Requirements for the Monitoring at Waste management Facilities.

2.18. PERMIT: Black Rock Landfill Site Permit, issued in terms of Section 20 of the Environmental Conservation Act

3. General

3.1. This procedure covers the disposal of all waste as defined and it applies to all parties using any of the waste handling or waste disposal facilities described in the procedure.

3.2. DEFINITIONS

3.2.1. Operator

The person / party responsible for operating the disposal area and where enquiries may be made about the acceptability of waste at that site.

3.2.2. Waste (Definition based on National Environmental Management: Waste Act (Act 59 of 2008)

"waste" means any substance, whether or not that substance can be reduced, re-used, recycled and recovered—

(a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of; 30

(b) which the generator has no further use of for (he purposes of production;

(c) that must be treated or disposed of; or

(d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but—

(i) a by-product is not considered waste; and 35

(ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste;

3.2.3. Waste Producer

The legally appointed person for the area is responsible for the waste produced in the area and the responsible handling and / or disposal thereof.

3.2.4. Waste Transporter /Collector

The contractor contracted to collect, transport and dispose the waste at the designated site

3.2.5. Waste Disposal facility

It means any site or premise used for the accumulation of waste with the purpose of disposing of that waste at that site or on that premise.

3.2.6. Waste Management Activity

It means any activity listed in Schedule 1 or 40 published by notice in the Gazette under section 19, and includes:

- the importation and exportation of waste
- the generation of waste, including the undertaking of any activity or process that is likely to result in the generation of waste
- the accumulation and storage of waste
- the collection and handling of waste
- the reduction, re-use, recycling and recovery of waste
- the trading in waste
- the transportation of waste
- the transfer of waste
- the treatment of waste
- the disposal of waste

4. Description of Procedure

4.1. Minimum Requirements

Waste management for Black Rock Mine Operations is divided into various sections for the application of this procedure. This division is based on the state of the waste (re-cyclable or not), the hazard classification as well as the available disposal areas.

The division may be summarised as follows (please contact the Black Rock Mine Operations Environmental Specialist if the waste is not described below):

Waste description	Waste classification	Disposal area
Aluminium oxide	Non hazardous	Landfill Site
Asbestos waste	Hazardous	As per Asbestos procedure.
Batteries: lead Acid (big), battery acids / electrolytes	Recyclable	As per Battery Disposal work instruction
Batteries: NiCad and lead acid	Hazardous	Special container at Strip and Quote workshop - Final destination class H-H site
Building rubble and cement	General	Landfill Site
Bulk paint containers, aerosol cans	Hazardous	Salvage yard - Final destination class H-H site
Carton / cardboard	General	Landfill Site
Computer equipment	Recyclable	Salvage Yard
Conveyor belting (big and small pieces)	Recyclable	Salvage Yard
Domestic, household, office and garden waste	General	Landfill Site
Drums containing used oil	Recyclable	Drums to be emptied at Black Rock Workshop storage tank. Drums to Salvage yard.
Electrical cables	Recyclable	Salvage Yard
Empty containers and Drums	Possibly hazardous / Recyclable	Salvage Yard as per Disposal of Empty Containers and Storage of Full Containers work instruction
Fluorescent lights	Hazardous	Special container – Final destination class H-H site
Instrumentation and related equipment	Recyclable	Salvage Yard
Insulation material (excluding asbestos containing material)		Landfill Site
Manganese Dust	Non hazardous	Landfill Site
Medical waste (All related waste e.g. bandages)	Hazardous	As per Medical Waste procedure EP 01-1-4
Mercury containing waste	Hazardous	Encapsulation at a class H-H site
Metals: reclaimable precious and base metals and	Recyclable	Salvage Yard

Waste description	Waste classification	Disposal area
material		
Metals: Scrap metal	Recyclable	Salvage Yard
Obsolete operating material and assets	Recyclable	Salvage Yard
Oil - used	Recyclable	
Paint – “wet” paint(can be in containers) and bulk paint (can be paint containers)	Hazardous	Salvage yard Final destination Class H-H site
Paint – empty and dry in small quantities		Landfill Site
Plastics	Recyclable	Landfill Site
Putrescible organic waste from hostel and single quarters	Hazardous	Sill storage area at hostel
Reclaimable oil	Recyclable	Black rock Workshop storage tank
Slimes	Non-Hazardous	Slimes dams
Sludge: sewerage or activated	Non-Hazardous	Landfill Site
Soil: natural excavated material and top soil		Rehabilitation area
Toxic, ignitable, corrosive, carcinogenic and poisonous process waste and heavy metals (Cobalt, Nickel, Mercury, Vanadium, Lead, etc – un recyclable), chemical waste	Hazardous	Salvage yard Final destination Class H-H site
Tyres: motor vehicles	Recyclable	Salvage yard
Wood	Recyclable	Salvage Yard
Wood	General	Landfill Site

The types of waste indicated give a broad synopsis of the types of acceptable waste at various disposal areas. See Annexures A to C for more details as well as guidelines for the use of the disposal areas. This list is not static owing to changing needs and products e.g. lubricants, flocculent, etc. Assmang Black Rock Mine Operations does not have a Class H-H dumping sites and shall make use of a licensed class H-H site where required.

4.1.1. Waste must be dumped at the applicable identified site. Sites for final disposal may not be used without the required permits. As all bins for general waste are taken to the Landfill Site the waste producer must ensure that only waste permitted at the Landfill Site is in the general waste bin.

4.1.2. The Assmang Black Rock Mine Operations Environmental Specialist shall monitor and report on subterranean water and the surface water.

4.1.3. Records must be kept in accordance with the conditions of the permit(s) for the waste site, and in cases where the site is not operated by Assmang, Black Rock Mine Operations such records must be furnished to the Assmang Black Rock Mine Operations Environmental Specialist six-monthly.

4.1.4. Should a waste producer be in doubt regarding the classification or suitable practices for the dumping of any specific waste material, it remains the responsibility of the waste producer to ensure that the waste is dealt with correctly. Information regarding handling and dumping facilities is available from the Environmental Specialist.

4.1.5. No person may remove any item from any disposal area, unless the responsible Engineer has given written approval for such removal. Contracts will be awarded according to normal commercial procedures for recycling at the disposal area. The Salvage Yard Supervisor must keep records of the volume and nature of the recycled waste in accordance to the permit conditions.

4.1.6. Records of all safe disposal certificates from a Class H-H disposal site will be kept by the Environmental Specialist.

4.1.7. Waste bins from the different sections should be clearly marked with the section name and number to ensure gate control at the Landfill Site.

4.1.8. The Landfill Site operational times are from 06h30 to 15h30 during weekdays (Mondays to Thursdays), from 06h30 to 12h45 (Fridays) and from 06h30 to 14h00. The site will be closed on Sundays.

4.1.9. Requests to re-use/recycle materials dumped in the Landfill Site will be lodged to the Environmental Specialist. The Landfill Site Operator will be notified by the Environmental Specialist of such request and a Logbook will be kept (detailing all materials removed from the Landfill Site).

4.1.10. A documented waste inventory shall be compiled and kept. Such an inventory shall reflect each waste stream, the source/location, volume, hazardous nature, temporary storage requirements, waste minimisation measures considered (e.g. re-used/recycling), disposal option (e.g. landfill, incineration), contractor disposal and other special requirement, e.g. transportation or treatment. The inventory shall include all/any waste generated by contractors or service providers.

4.1.11. Authorisations for waste management activities shall be obtained.

4.1.12. Reasonable measures shall be implemented to avoid the generation of waste and if not possible, minimise the quantity and any toxicity. Steps will be undertaken to reduce, re-use, recycle and recover waste. Records of the investigations into the avoidance or minimisation of the landfill options shall be kept.

4.1.13. Employees shall be trained on the basic principles of waste management to ensure effective implementation of the principles contained in this procedure.

ANNEXURE C

Salvage Yard

1. **LOCATION**
   Black Rock Salvage Yard
2. **OPERATOR**
   Black Rock Mine Operations Engineering Department
3. **TYPES OF WASTE**

Accepted Types of Waste	Types of Waste not Accepted
All types of metal Conveyor belting Empty steel and plastic drums/containers Motor vehicle tyres Computer equipment Instrumentation and related equipment Electrical cables Plastics Woo*d* Precious metals (see Annexure D) Obsolete operating material, such as: Furniture, Housing units, Operating machinery Vehicles Lead acid and Ni Cad batteries Fluorescent tubes	Building materials Household, office and general waste Drums containing used oil As listed in paragraph 3's table

4 PROCEDURE

The procedure should be fully supported by a commercial work instruction. The procedure can be summarised as follows.

4.1 It is the responsibility of the waste producer to declare the material as scrap.

4.2 Material declared as scrap must be pre-classified in the waste producer's area of responsibility. The classification is quoted in 4.5 below for convenience sake.

4.3 Empty drums must be cleaned in the waste producer’s area of responsibility in accordance with Disposal of Empty containers and Storage of Full Containers work instruction before being presented to the Scrap Reclamation Yard.

4.4 If the requirements of paragraphs 4.2 and 4.3 are not adhered to, the official in charge of the Salvage Yard has the right to return the waste to the waste producer at his cost.

4.5 Classification of scrap

- Aluminium
- Brass
- Copper
- Electrical cables
- Empty 210 litre drums (plastic)
- Empty 210 litre drums (steel)
- Instruments
- Steel, grades A to E (solid)
- Steel, subgrade
- Steel, stainless

ANNEXURE D

Precious Metals

1 Assmang Black Rock Mine Operations has no facilities for reclaiming precious metals. This type of waste is, therefore, sold under contract. Waste precious metals are collected at the Salvage Yard and sold.

2 Line managers must create internal procedures and control measures to ensure that the company does not lose precious metals in their areas of responsibility when such metals have served their purpose. The Salvage Yard must create procedures and control systems to ensure that waste precious metals delivered at the Salvage Yard will be stored safely until it is sold. Safety risks for the storage of for example magnesium must be taken into account.

3 TYPES OF WASTE

Accepted Types of Waste	Types of Waste not Accepted
Gold (e.g. printed circuit boards) Platinum wire and rods Silver (e.g. old X ray photos and photographic films. Tungsten (fine or pieces, e.g. from machining and from broken machine tool bits) Fine magnesium or blocks of magnesium (e.g. cuttings and spent anodes) Stainless or mild steel Copper, Brass, Bronze and Aluminium	As listed in the table under paragraph 3

4 PROCEDURE

4.1 The waste producer must declare precious metals as scrap.

4.2 Scrapped precious metals must be placed in suitable containers in accordance with the accepted control method. Producers of magnesium waste must adhere to the directives of the magnesium code on the packaging of magnesium waste.

4.3 The official in charge of the Salvage Yard shall acknowledge receipt of the consignment.

ANNEXURE E

Class H-H Dumping Sites

1 LOCATION

Assmang Black Rock Mine Operations does not have a Class H-H dumping site at its disposal. These sites are normally used for hazardous waste only and are subject to very strict control.

2 OPERATOR

Class H-H dumping sites are operated by companies who have been screened by the Department of Environmental Affairs on the basis of proven control methods.

3. TYPES OF WASTE

Accepted Types of Waste	Types of Waste not Accepted
Toxic, hazardous and poisonous process, laboratory and medical waste Contaminating waste	Household, office and general waste Re workable waste Reclaimable waste Precious metals

4 PROCEDURE

4.1 Each line manager / waste producer is responsible to be conversant with the grade of the waste that is generated in his area of responsibility and, with the assistance of knowledgeable persons, to prescribe procedures for the handling of hazardous, poisonous and toxic waste.

4.3 Since Assmang Black Rock Mine Operations does not have the facilities for dumping this type of waste, the Environmental Specialist must enter into a contract with the operator of a Class H-H dumping site for the removal and disposal of the waste referred to.

4.3 Line managers must take care that waste that is acceptable at the Landfill Site is not dispatched to a Class H-H site, as the operators of Class H-H sites charge a high rate for the use of their sites.

4.4 Assmang Black Rock Mine Operations shall negotiate a contract to remove and dispose **fluorescent tubes**. These lamps contain mercury and must, therefore, be dumped on a Class H-H site.

4.4.1 Each area replacing fluorescent tubes must collect the old tubes and place them in supplied containers. All the pieces of broken fluorescent tubes must be swept up and placed into a strong plastic bag and the bag must be sealed tightly. Persons handling fluorescent tubes must wear a suitable dust mask, plastic gloves and overalls as preventive protection from exposure to mercury and mercury vapours in case the tubes break.

4.4.2 The areas collecting used tubes as mentioned above, must dispose the tubes as regularly as good housekeeping requires in the container belonging to the operator of a Class H-H site. The Environmental Management Section will keep records of the number of containers, as well as of the waste producer and arrangement for removal of these containers by the operator of the Class H-H site.

ANNEXURE E

Waste Disposal Guide

AREA	WASTE GENERATED	COLLECTION METHOD	DISPOSAL METHOD	RESPONSIBLE PERSON
Black Rock Hostel	Domestic	Waste Bins	Weekly (Approved site)	Hostel Manager
	Cooking Oil	Drums	As per Man. Instruction	Hostel Manager
Security Dept	Domestic	Waste Bins	Weekly (Approved site)	Security Officer
Clinic	Needles	Sealed container	Collected by approved contractor	Nurse in charge
	Swabs	Sealed container	Collected by approved contractor	Nurse in charge
	Syringes	Sealed container	Collected by approved contractor	Nurse in charge
	Bandages	Sealed container	Collected by approved contractor	Nurse in charge
	Plastic	Waste Bins	Weekly (Approved site)	Nurse in charge
	Radio Active waste	Waste Bins	Annually (Approved site)	Nurse in charge
	Domestic	Waste Bins	Weekly (Approved site)	Nurse in charge
Administration Offices (Gloria, Nchwaning and Black Rock)	Domestic	Waste Bins	Weekly (Approved site)	Foreman
Mechanical Workshops	Domestic	Waste Bins	Weekly (Approved site)	Foreman
	Cable	Salvage yard	As per existing contract	Foreman
Mechanical Workshops	Slings	Salvage yard	As per existing contract	Foreman
	Chains	Salvage yard	As per existing contract	Foreman
	Motors	Salvage yard	As per existing contract	Foreman
	Scrap metal	Salvage yard	As per existing contract	Foreman
	Plastic/cardboard packaging	Waste Bins as for domestic	As per existing contract	

AREA	WASTE GENERATED	COLLECTION METHOD	DISPOSAL METHOD	RESPONSIBLE PERSON
	Wooden packaging	Salvage yard	As per existing contract	Foreman
	Drums	Salvage yard	As per existing contract	Foreman
	Used oil	Transfer to marked container	Approved contractor (OILKOR)	Foreman
	Used oil and petrol/diesel filters	Transfer to marked container	As per existing contract	Foreman
	Used air filters	Domestic waste	As per existing contract	Foreman
Electrical workshops	Domestic	Waste Bins	Weekly (Approved site)	Foreman
	Scrap cable	Salvage yard	As per existing contract	Foreman
Electrical workshops	Electrical motors/Air conditioners	Salvage yard	Sell to successful tenderer	Foreman
	Cable plastic/rubber/plastic and cardboard packaging	Weekly (Approved site)l	As per existing contract	Foreman
	Motors	Salvage yard	Sell to successful tenderer	Foreman
	Scrap metal	Salvage yard	As per existing contract	Foreman
	Fluorescent tubes	Crushed and drummed. Marked as such	As per existing contract	
	Sodium/mercury vapour lamps	Crushed and drummed. Marked as such	As per existing contract	Foreman
Sewage plant – Nchwaning/Black Rock	Effluent water	Pump to water recovery dams	Utilise on sports grounds	Engineering Foreman
	Dried sludge	Collect in drying beds	To be disposed as Hazardous Waste	Environmental Specialist
Sewage Plant - Gloria	Effluent water	Pump to storage dams	Utilise in plant and on roads for dust allaying purposes	Environmental Specialist
	Dried sludge	Collect in drying beds	to be disposed as Hazardous Waste	Environmental Specialist

AREA	WASTE GENERATED	COLLECTION METHOD	DISPOSAL METHOD	RESPONSIBLE PERSON
Villages- Nchwaning, Schoonspuit and District Six	Domestic	Waste Bins as for domestic	Weekly(Approved site)	Foreman
	Garden	Waste Bins as for domestic	Weekly(Approved site)	Foreman

Appendix G: Other information

IMPACT ASSESSMENT METHODOLOGY

The following criteria and methodology is proposed to determine the significance of environmental impacts caused by the proposed project.

TYPE OF IMPACTS

Potential environmental impacts may either have a positive or negative effect on the environment, and can in general be categorised as follows:

a) Direct / Primary Impacts

Primary impacts are caused directly due to the activity and generally occur at the same time and at the place of the activity.

b) Indirect / Secondary Impacts

Secondary impacts induce changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken.

c) Cumulative Impacts

Cumulative impacts are those that result from the incremental impact of the proposed activity on common resources when added to the impacts of the other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time, and can include both direct and indirect impacts.

DETERMINING SIGNIFICANCE

The following criteria will be used to determine the significance of an impact. The scores associated with each of the levels within each criterion are indicated in brackets after each description [like this].

Nature

Nature (N) considers whether the impact is:

- positive [- ¼]
- negative [+1].

Extent

- Extent (E) considers whether the impact will occur:
- on site [1]
- locally: within the vicinity of the site [2]
- regionally: within the local municipality [3]
- provincially: across the province [4]
- nationally or internationally [5].

Duration

Duration (D) considers whether the impact will be:

- very short term: a matter of days or less [1]
- short term: a matter of weeks to months [2]
- medium term: up to a year or two [3]
- long term: up to 10 years [4]
- very long term, or permanent: 10 years or longer [5].

Intensity

Intensity (I) considers whether the impact will be:

- negligible: there is an impact on the environment, but it is negligible, having no discernable effect [1]
- minor: the impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts [2]
- moderate: the environment is altered, but function and process continue, albeit in a modified way; the system is stressed but manages to continue, although not with the same strength as before [3]
- major: the disturbance to the environment is enough to disrupt functions or processes, resulting in reduced diversity; the system has been damaged and is no longer what it used to be, but there are still remaining functions; the system will probably decline further without positive intervention [4]
- severe: the disturbance to the environment destroys certain aspects and damages all others; the system is totally out of balance and will collapse without major intervention or rehabilitation [5].

Probability

Probability (P) considers whether the impact will be:

- unlikely: the possibility of the impact occurring is very low, due either to the circumstances, design or experience [1]
- likely: there is a possibility that the impact will occur, to the extent that provisions must be made for it [2]
- very likely: the impact will probably occur, but it is not certain [3]
- definite: the impact will occur regardless of any prevention plans, and only mitigation can be used to manage the impact [4].

Mitigation or Enhancement

Mitigation (M) is about eliminating, minimising or compensating for negative impacts, whereas enhancement (H) magnifies project benefits. This factor considers whether –

A negative impact can be mitigated:

- unmitigated: no mitigation is possible or planned [1]
- slightly mitigated: a small reduction in the impact is likely [2]
- moderately mitigated: the impact can be substantially mitigated, but the residual impact is still noticeable or significant (relative to the original impact) [3]
- well mitigated: the impact can be mostly mitigated and the residual impact is negligible or minor [4]

A positive impact can be enhanced:

un-enhanced: no enhancement is possible or planned [1]

- slightly enhanced: a small enhancement in the benefit is possible [2]
- moderately enhanced: a noticeable enhancement is possible, which will increase the quantity or quality of the benefit in a significant way [3]
- well enhanced: the benefit can be substantially enhanced to reach a far greater number of receptors or recipients and/or be of a much higher quality than the original benefit [4].

Reversibility

Reversibility (R) considers whether an impact is:

- irreversible: no amount of time or money will allow the impact to be substantially reversed [1]
- slightly reversible: the impact is not easy to reverse and will require much effort, taken immediately after the impact, and even then, the final result will not match the original environment prior to the impact [2]
- moderately reversible: much of the impact can be reversed, but action will have to be taken within a certain time and the amount of effort will be significant in order to achieve a fair degree of rehabilitation [3]
- mostly reversible: the impact can mostly be reversed, although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily [4].

CALCULATING IMPACT SIGNIFICANCE

The table below summarises the scoring for all the criteria.

Table **Error! No text of specified style in document.**-1: Scoring for Significance Criteria

CRITERION	**SCORES**					
	- ¼	**1**	**2**	**3**	**4**	**5**
N-nature	positive	negative	-	-	-	-
E-extent	-	site	local	regional	provincial	national
D-duration	-	very short	short	moderate	long	very long
I-intensity	-	negligible	minor	moderate	major	severe
P-probability	-	very unlikely	unlikely	likely	very likely	-
M-mitigation	-	none	slight	moderate	good	-
H-enhancement	-	none	slight	moderate	good	-
R-reversibility	-	none	slight	moderate	good	-

Impact significance is a net result of all the above criteria. The formula proposed to calculate impact significance (S) is:

For a negative impact: $S = N \times (E+D) \times I \times P \div ½(M+R)$; and
For a positive impact: $S = N \times (E+D) \times I \times P \times (H)$.

Negative impacts score from 2 to 200. Positive impacts score from – ½ to -200.

UNDERSTANDING IMPACT SIGNIFICANCE

The following is a guide to interpreting the final scores of an impact (for negative impacts):

Table **Error! No text of specified style in document.**-2: Final Significance Scoring

Final score (S)	**Impact significance**	
0 – 10	Negligible	the impact should cause no real damage to the environment, except where it has the opportunity to contribute to cumulative impacts

Table **Error! No text of specified style in document.**-2: Final Significance Scoring		
Final score (S)	**Impact significance**	
10 – 20	Low	the impact will be noticeable but should be localized or occur over a limited time period and not cause permanent or unacceptable changes; it should be addressed in an EMP and managed appropriately
20 – 50	Moderate	the impact is significant and will affect the integrity of the environment; effort must be made to mitigate and reverse this impact; in addition the project benefits must be shown to outweigh the impact
50 – 100	High	the impact will affect the environment to such an extent that permanent damage is likely and recovery will be slow and difficult; the impact is unacceptable without real mitigation or reversal plans; project benefits must be proven to be very substantial; the approval of the project will be in jeopardy if this impact cannot be addressed
100 – 200	Severe	the impact will result in large, permanent and severe impacts, such as local species extinctions, minor human migrations or local economic collapses; even projects with major benefits may not go ahead with this level of impact; project alternatives that are substantially different should be looked at, otherwise the project should not be approved

Two examples will help illustrate this system:

SCENARIO 1 – An industrial facility proposes discharging effluent containing a high salt content into a nearby stream. These salts will cause temporary problems for the ecosystem, but are washed downstream, diluted and will have no long term effects. The short term damage to the stream can be reversed fairly easily, but only if the ecosystem has not been seriously damaged by the salts over a long time. A mitigation measure is also proposed whereby during low flow periods (dry season) a pulse of clean water is discharged into the stream after the saline effluent, diluting the salts and pushing them downstream faster, so that the salts become so dilute as to have little or no effect.

From this scenario, the criteria are:

- nature = negative = 1
- extent = local = 2
- duration = medium = 3
- intensity = moderate = 3
- probability = very likely = 4
- mitigation = moderate = 3
- reversibility = moderate = 3,

and therefore impact significance is:

S = N x (E+D) x I x P ÷ ½(M+R)
 = 1 x (2+3) x 3 x 4 ÷ ½(3+3)
 = 60 ÷ 3
 = 20.

Note that the impact prior to mitigation is major, but that due to the mitigation and the fact that the ecosystem can recover easily from the effects of salt (high reversibility), the residual impact becomes minor/moderate.

SCENARIO 2 – The above scenario applies, except that the effluent contains metals. These metals become adsorbed onto clay and organic matter in the stream bed and are accumulative toxins within the ecosystem, getting into the food chain and concentrating upwards into predator species. Fresh water flushing will only very slightly mitigate this and ecosystem recovery will not be easy or fast.

From this scenario, the criteria are:

- nature = negative = 1
- extent = local = 2
- duration = very long = 5
- intensity = moderate = 3
- probability = very likely = 4
- mitigation = slight = 2
- reversibility = slight = 2,

and therefore impact significance is:

$S = N \times (E+D) \times I \times P \div \frac{1}{2}(M+R)$
$= 1 \times (2+5) \times 3 \times 4 \div \frac{1}{2}(2+2)$
$= 84 \div 2$
$= 42.$

Note that in this case, the original impact (of the metals) is more serious than the salt, but it is the limited mitigation and reversibility that also act on the residual score and result in this score being moderate.

NORTHEREN CAPE DEPARTMENT OF ENVIRONMENT AND NATURE CONSERVATION

Ref: NC/JTG/BR1/2012
Enquiries: Dineo Kgosi
Tel: (053) 807-7430 **Fax:** (053) 831-3530 **Email:** dkgosi@ncpg.gov.

LICENCE NUMBER:	2012/L1/1/BRMO
CLASS:	G: C: B-
WASTE DISPOSAL SITE:	BLACK ROCK MINE OPERATIONS
LOCATION:	PORTION 1 OF THE FARM SANTOY, WITHIN THE GROUNDS OF BLACK ROCK MINE OPERATIONS, HOTAZEL DISTRICT, NORTHERN CAPE PROVINCE
LICENCE HOLDER:	ASSMANG MANGANESE, BLACK ROCK MINE OPERATIONS
ADDRESS:	P O BOX 1480, KURUMAN, 8460

LICENCE IN TERMS OF SECTION 20(b) OF THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008(ACT NO. 59 OF 2008)

I, J J Mutyorauta in my capacity as Director - Department of Environment and Nature Conservation (hereinafter referred to as "the Department"), in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), hereby recommend the authorisation of the above-mentioned Licence Holder to dispose of general waste at the above-mentioned waste disposal facility, subject to the conditions specified herein.

In this Licence, "DIRECTOR" means the Director of Environmental Quality Management of the Northern Cape Department of Environment and Nature Conservation and the "HOD" means the Head of Department of Northern Cape Department of Environment and Nature Conservation who may both be contacted at the address below:

The Director: Environmental Quality Management
Department of Environment and Nature Conservation
Private Bag X 6102
KIMBERLEY
8300

1. SITE DETAILS

1.1 LOCATION

1.1.1. This licence authorises the disposal of general waste on Portion 1 of the farm Santoy, within Black Rock Mine Operations, Hotazel district,, Northern Cape Province (hereinafter referred to as "the Site").

1.1.2 The location of the Site must be according to the co-ordinates indicated on the licence application form, submitted by the Licence Holder which is defined as follows:

Number of corner	Latitude	Longitude
North West	27º 7' 35.2"	22º 50' 11.1"
North East	27º 7' 35.3"	22º 50' 12.7"
South East	27º 7' 47.5"	22º 50' 14.4"
South West	27º 7'48.5"	22º 50' 8.3"

1.2 DOCUMENTS CONSIDERED

1.2.1 Waste license application for conversion of a Waste permit to a waste license in terms of the National Environment Management Act: Waste Act, Act 54 of 2008. Dated 21 May 2012

1.2.2 Copy of the Permit dated 16 January 2002.

LICENCE CONDITIONS

1.3 SITE SECURITY AND ACCESS CONTROL

1.3.1 The Licence Holder must ensure effective access control on the Site by having it fenced to a minimum height of 1.8 metres, with gates of the same height at all entrances, to reasonably prevent unauthorised entry and curtail the spreading of wind-blown waste.

1.3.2 The Licence Holder must ensure that all entrance gates are manned during the hours of operation and locked outside the hours of operation.

1.3.3 The Licence Holder must prevent the acceptance of waste not authorised at the site as per condition 3.1 below.

1.3.4 Weatherproof, durable and legible notices in at least three official languages applicable in the area, shall be displayed at each entrance to the site. These notices shall prohibit unauthorised entry and state the hours of operation, the name, address and telephone number of the Licence Holder and the person responsible for the operation of the site.

2. MANAGEMENT

2.1 GENERAL MANAGEMENT

2.1.1 The activities must be managed and operated:

(a) in accordance with an updated environmental management system that inter alia identifies and minimises risks of pollution, including those arising from operations, maintenance, accidents, incidents and non-compliance and those drawn to the attention of the Licence Holder as a result of complaints;

(b) in accordance with conditions of this licence and with any other written instruction by the HOD; and

(c) by sufficient persons who are competent in respect of the responsibilities to be undertaken by them in connection with the operation of the activities.

2.1.2 Any persons having duties that are or may be affected by the matters set out in this licence must have convenient access to a copy of it, kept at or near the place where those duties are carried out. A copy of this licence may be published on any website deemed fit by the Department.

2.2 APPOINTMENT OF WASTE MANAGEMENT CONTROL OFFICER

2.2.1 A Waste Management Control Officer (WMCO) must be appointed to monitor and ensure compliance and correct implementation of all mitigation measures and provisions as stipulated in the Licence.

The WMCO must:

(a) Identify and submit potential measures in respect of waste minimization, including the reduction, recovery, re-use and recycling of waste to the license holder and the licensing authority

(b) Report any non-compliance with any license conditions or requirements or provisions of NEM:WA to the licensing authority through the means reasonably available,

(c) Monitor the construction of the infrastructure to ensure that the layout plans are in accordance to the designs and record important findings of the site inspection.

2.2.2 Duties and responsibilities of the WMCO are not exempting the licence holder from complying with legal obligations of this licence and in terms of NEM: WA.

2.3 EMERGENCY PREPAREDNESS PLAN

2.3.1 The Licence Holder must maintain and implement an emergency preparedness plan and review it annually when conducting audit and after each emergency and or major accident. The plan must among others include:

(a) Vehicle/Machinery Fire & Malfunction
(b) Landfill Site Fire
(c) Slope Failure
(d) Natural disaster such as floods
(e) Industrial action
(f) Contact details of police, ambulance and any emergency centre closer to the site.

3 PERMISSIBLE WASTE

3.1 Any portion of the site which has been constructed or developed according to condition 4 of this licence, may be used for the disposal of all waste types which are classified as general waste according to the latest edition of the 1998 2nd Edition of the "Minimum Requirements" series of documents (DWAF Minimum Requirements). See Annexure I for waste prohibited unless it forms less than 3 percent of the waste stream from residential areas.

4 COMMISSIONING OF THE ACTIVITY

4.1 The Licence holder must maintain on a continuous basis a drainage system capable of diverting and draining from the Site all runoff water arising from land adjacent to the site, which could be expected as a result of the 1 in 50 years flood over a period of 24 hours.

4.2 The Licence Holder must establish and maintain the "buffer zone" of 200 metres within the waste disposal site in such a way that the actual disposal site will form the nucleus of the total area of the disposal site.

4.3 Should any archaeological artefacts be exposed during operation of the site in the vicinity of the finding must be stopped. Under no circumstances shall any artefacts be destroyed. Such an archaeological site must be marked and fenced off, and South African Heritage Resource Agency must be contacted within 48 hours.

4.4 All provisions of the Occupational Health and Safety Act, 85 of 1993 and any other applicable legislation must be adhered to by the holder of this licence.

5 GENERAL OPERATION AND IMPACT MANAGEMENT

5.1 IMPACT MANAGEMENT

5.1.1 Licence Holder must ensure that wind-blown waste and litter must be picked up and removed from fences at all times to prevent pollution or nuisance.

5.1.2 Licence Holder must ensure that emissions from the activities are free from odour at levels likely to cause annoyance outside the site, as perceived by an authorised officer of the Department and interested and affected parties.

5.1.5 Licence Holder must ensure that scavenging animals, scavenging birds and other pests does not cause a nuisance.

5.1.6 Waste disposed on the site may only be reclaimed at a designated area under roofed area provided the reclamation activity does not add any negative impact on the environment and that relevant safety precautions in terms of the Occupational Health and Safety Act, 85 of 1993 and its regulations as amended are adhered to.

5.1.7 Waste deposited on site must not be allowed to burn and suitable measures must be implemented to prevent fires on the site or extinguish fires which may occur.

5.1.8 Amongst others, the following activities are not permitted on the working face of disposal site:

(a) Servicing and washing of equipments
(b) Eating

5.2 OPERATION

5.2.1 Licence Holder must ensure that records in terms of volume/weight, source and nature of all wastes received; reclaimed and landfilled are maintained and reported as per Annexure III hereafter on annual basis.

5.2.2 Waste that is not permissible under condition 3.1 above must be dealt with according to relevant legislation or the Department's policies and practices.

5.2.3 Waste disposed off on the site must be compacted and covered on a weekly basis with a minimum of 150 millimetres of soil or other material approved by the HOD.

5.2.4 Licence Holder must ensure that the site is operated in such a manner that nuisance conditions, health hazards, the potential creation of nuisance conditions or health hazards are prevented.

6 MONITORING

6.1 ENVIRONMENTAL POLLUTION MONITORING

6.1.1 If, in the opinion of the HOD, nuisance or health risks may be or are occurring on site, the Licence Holder must initiate an investigation into the cause of the problem or suspected problem. Such investigation must include the monitoring of relevant environmental pollution, nuisance and health risk variables, at those monitoring points and such frequency as may be determined in consultation with the HOD. Should the investigation reveal any unacceptable levels of pollution, the Licence Holder must submit mitigatory measures to the satisfaction of the HOD.

6.2 INVESTIGATIVE WATER QUALITY MONITORING

6.2.1 If, in the opinion of the Director: EQM, water pollution may be occurring or is occurring the Licence Holder must initiate an investigation into the cause of the problem or suspected problem. Such investigation must include the monitoring of water quality variables, at those monitoring points and such frequency as may be determined by the Director: EQM. Should the investigation reveal any unacceptable levels of pollution, the Licence Holder must submit mitigatory measures to the satisfaction of the Director: EQM.

6.3 MONITORING METHODS AND PARAMETERS

6.3.1 The Licence Holder must carry out all tests required in terms of this Licence in accordance with methods prescribed by and obtainable from the South African Bureau of Standards (SABS), referred to in the Standards Act, 2008 (Act 8 of 2008).

6.3.2 The Licence Holder may only use another method of analysis if written proof is submitted to this Department specifying that the method to be used is at least equivalent to the SABS method.

7 AUDITING

7.1 INTERNAL AUDITS

7.1.1 Internal audits must be conducted annually by the Licence Holder and on each audit occasion an official report must be compiled by the relevant auditor to report the findings of the audits, which must be made available to the external auditor specified in condition 7.2.1.

7.2 EXTERNAL AUDITS

7.2.1 The Licence Holder must appoint an independent external auditor to audit the Site annually and this auditor must compile an audit report documenting the findings of his audit, which must be submitted by the Licence Holder according to condition 9.9, below. The audit report must:

(a) specifically state compliance with regard to each licence condition;

(b) include an interpretation of all available data and test results regarding the operation of the site and all its impacts on the environment;

(c) specify target dates for the implementation of the recommendations by the Licence Holder to achieve compliance;

(d) contain recommendations regarding non-compliance or potential non-compliance and must specify target dates for the implementation of the recommendations by the Licence Holder and whether corrective action taken for the previous audit non conformities was adequate; and

(e) show monitoring results graphically and conduct trend analysis.

7.3 DEPARTMENTAL AUDITS AND INSPECTIONS

7.3.1 The Department reserves the right to audit and/or inspect the site at any time and at such frequency as the HOD may decide, or to have the site audited or inspected.

7.3.2 The Licence Holder must make any records or documentation available to the Director: EQM upon request, as well as any other information the HOD may require.

7.3.3 The findings of these audits or inspections must be made available to the Licence Holder within 30 days of the end of the audit or inspection. Information from the audits must be treated in accordance with the Promotion of Access to Information Act, 2000 (Act 2 of 2000).

8 RECORDING

8.1 The Licence Holder must keep records and update all the information referred to in Annexure III and submit this information to the HOD on an annual basis.

8.2 All records required or resulting from activities required by this licence must:

(a) be legible;

(b) be made as soon as reasonably practicable and should form part of the external audit report;

(c) if amended, be amended in such a way that the original and any subsequent amendments remain legible and are easily retrievable and,

(d) be retained in accordance with a documented procedures which is approved by the Department.

8.3 Records demonstrating compliance with condition 2.1.1 must be maintained.

9 REPORTING

9.1 The Licence Holder must, within 24 hours notify the HOD and the Director: EQM of the occurrence or detection of any incident on the Site, or incidental to the operation of the site, which has the potential to cause, or has caused pollution of the environment, health risks, nuisance conditions or water pollution.

9.2 The Licence Holder must, within 14 days, or a shorter period of time, if specified by the HOD and/or the Director: EQM, from the occurrence or detection of any incident referred to in condition 10.1, submit an action plan, which must include a detailed time schedule, and resource allocation signed off by top management, to the satisfaction of the HOD and/or the Director: EQM of measures taken to –

(a) correct the impact resulting from the incident;

(b) prevent the incident from causing any further impact; and

(c) prevent a recurrence of a similar incident.

9.3 In the event that measures have not been implemented within 21 days of the incident to address impacts caused by the incident referred to in condition 10.1, or measures which have been implemented are inadequate, the HOD and/or the Director: EQM may implement the necessary measures at the cost and risk of the Licence Holder.

9.4 The Licence Holder must keep an incident report and complaints register, which must be made available to external auditor, Departmental auditors for the purpose of audit.

9.5 The Department must be notified without delay in the case of the following:

(a) any malfunction, breakdown or failure of equipment or techniques, accident or fugitive emission which has caused , is causing or may cause significant pollution;

(b) the breach of this licence; and

(c) any significant adverse environmental and health effects.

9.6 Prior written notification must be given to the HOD of the following events and in the specified timescales.

(a) as soon as practicable prior to the permanent cessation of any operational activities

(b) full or partial cessation of the operational activities for a period likely to exceed 3 months

(c) full or partial resumption of the operation of all or part of the activities after a cessation notified under (b) above

9.6.1 The Department must be notified within 7 days of any changes to the management of the site including the name of the incoming person together with evidence that such person has the required technical competence .

9.7 The Department must be notified within 14 days of the following changes:

(a) Licence Holder's trading name, registered name or registered office address;

(b) Particular's of the Licence Holder's ultimate holding company (including details of an ultimate holding where a Licence Holder has become a subsidiary;

(c) Steps taken with a view to the Licence Holder , or any one of them, going into bankruptcy, entering into composition or arrangement with creditors, or ,in the case of them being in a partnership, dissolving the partnership.

9.8 Each external audit report referred to in condition 7.2 must be submitted to the HOD within 30 days from the date on which the external auditor finalised the audit.

10 REHABILITATION AND CLOSURE OF THE SITE

10.1 CLOSURE PLAN

10.1.1 The Licence Holder must rehabilitate the site or any portion thereof, in accordance with a closure report and rehabilitation plan, which must be submitted to the HOD for approval at least one year prior to the intended closure of the Site, or any portion thereof.

10.2 SITE REHABILITATION

10.2.1 Immediately following the cessation of operations with the intention to close the site, or any portion thereof, the surface of the site must be covered and the site must be maintained in such a way that:

(a) the formation of pools due to rain is prevented;

(b) free surface runoff of rain-water is ensured;

(c) contamination of storm water is prevented;

(d) no objects or material which may hamper the rehabilitation of the site are present and;

(e) little or no erosion occurs, until the approved rehabilitation (and end use) plan referred to in condition 10.1.1 is completely implemented.

10.2.2 The Licence Holder will remain responsible for the site, or any of its impacts on the environment, after operations on the site have ceased.

11 LEASING AND ALIENATION OF THE SITE

11.1 Should the Licence Holder want to alienate or lease the site, he/she must notify the HOD in writing and obtain approval. Should approval be granted, the Licence Holder shall remain liable to comply with the condition of this licence.

12 TRANSFER OF WASTE MANAGEMENT LICENCE

12.1 Should the Licence Holder want to transfer holder-ship of this, he/she must apply in terms of Section 52 of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) and obtain approval from the HOD for such a transfer.

13 GENERAL

13.1 This licence shall not be transferable unless such transfer is subject to condition 12.1.

13.2 This licence shall not be construed as exempting the Licence Holder from compliance with the provisions of the National and Provincial Legislation and any relevant Ordinance, Regulation, By-laws and relevant National Standards and norms.

13.3 Transgression of any condition of this licence could result in the validity of the licence being terminated by the Department.

13.4 Non-compliance with a condition of this licence may result in criminal prosecution or other actions provided for in Section 67(1) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

13.5 Any Committees, Public Authority or Organisation appointed in terms of the application shall not be held responsible for any damages or losses suffered by the Licence Holder or his/her successor in title in any instance where operation are to be temporarily or permanently stopped for reasons of non-compliance with this licence.

13.6 In terms of section 28 and 30 of the National Environmental Management Act No. 107 of 1998, and section 19 and 20 of the National Water Act No. 36 of 1998, any costs incurred to remedy environmental damage must be borne by the person responsible for the damage. It is therefore imperative that the Licence Holder reads through and understand the legislative requirements pertaining to the project. It is the Applicant's responsibility to take reasonable measures which include informing and educating contractors and employees about environmental risks of their work and training them to operate in an environmental acceptable manner.

13.7 Any changes to, or deviations from, the project description set out in this licence must be approved, in writing, by the Department before such changes or deviations may be effected. In assessing whether to grant such approval or not, the Department may request such information as it deems necessary to evaluate the significance and impacts of such changes or deviations and it may be necessary for the holder of the licence to apply for further licence in terms of the regulations.

13.8 This licence is valid for a period of twenty (20) years and shall be reviewed every five (5) years from the date of issue or at any time before or after that date. Based on the results of the review, especially compliance to licence conditions or recommendations from the audit reports and or changing legislation, the licence could be amended or withdrawn or validity thereof extended.

14 APPEAL OF LICENCE

14.1 Because this is a permit conversion and not a new licence application, an appeal procedure will not be necessary however the licence holder is advised to inform all affected and interested parties of the conversion in writing and within five (5) days, of receiving this license from the Department.

14.2 Also kindly Advise the interested and affected parties that a copy of this licence and reasons for the decision will be furnished upon request

Mutyorauta

Mr JJ Mutyorauta

DIRECTOR- ENVIRONMENTAL QUALITY MANAGEMENT

DATE: 10th August 2012

ANNEXURE I

APPEALS PROCEDURE IN TERMS OF CHAPTER 7 OF R. 385 OF 2006 TO BE FOLLOWED BY THE APPLICANT AND INTERESTED AND AFFECTED PARTIES UPON RECEIPT OF NOTIFICATION OF A WASTE MANAGEMENT LICENCE

APPLICANT	INTERESTED AND AFFECTED PARTIES (IAPs)
1. Receive a notification of a Waste Management Licence from the relevant Competent Authority	1. Receive a notification of a Waste Management Licence from Applicant/Consultant
2. Within 10 days of receipt of notification, notify the relevant Competent Authority and all IAPs of intention to appeal	2. Within 10 days of receipt of notification, notify the relevant Competent Authority of intention to appeal
3. Notification served by the Applicant must include: 3.1. A copy of the notice of intention to appeal; and 3.2. A notice indicating where and for what period the appeal submission will be available for inspection by all IAPs	3. Appellant must serve on the Applicant 3.1. A copy of the notice of intention to appeal 3.2. A notice indicating where and for what period the appeal submission will be available for inspection by the applicant
4. The appeal must be submitted to the relevant Competent Authority or delegated organ of State within 30 days of lodging of the notice of intention to appeal	4. The appeal must be submitted to the relevant Competent Authority or delegated organ of State within 30 days of lodging of the notice of intention to appeal
5. A person or organ of state that receives notice of an appeal may submit a responding statement to the relevant Competent Authority or delegated organ of state within 30 days from the date that the appeal submission was made available for inspection by the appellant	5. An Applicant that receives notice of an appeal may submit a responding statement to the relevant Competent Authority or delegated organ of State within 30 days from the date the appeal submission was made available for inspection by the appellant

NOTES:

1. An appeal against a decision must be lodged with:-

a) the MEC if the decision was issued by the Head of Department (or another official) acting in his/ her capacity as the delegated Competent Authority;

b) the delegated organ of state where relevant.

2. An appeal must be:-

a) on an official form obtainable or published by the relevant department;

b) accompanied by:

- a statement setting out the grounds of appeal;
- supporting documentation which is referred to in the appeal and is not available to the relevant Competent Authority;
- a statement that the appellant has complied with regulation 62 (2) or (3) together with copies of the notices referred to in regulation 62;
- the prescribed appeal fee, if any.

NNEXURE II

WASTE WHICH MAY NOT BE ACCEPTED ON THE SITE: CONDITION 3.1

1. Waste where specific control has been established in terms of the Nuclear Energy Act, 1999 (Act 46 of 1999).

2. Waste types controlled in terms of the Minerals and Petroleum Resources Development Act, 2002 (Act 28 of 2002) and the Electricity Act, 1987 (Act 41 of 1987), Nuclear Energy Act, 1999 (Act 46 of 1999), unless written permission has been obtained from the HOD.

3. Waste which is defined, according to the Minimum Requirements, as an extreme hazard or Hazard Group 1 (HG1); high hazard or Hazard Group 2 (HG2); moderate hazard or Hazard Group 3 (HG3) and low hazard or Hazard Group 4 (HG4), unless an application for delisting has been successfully submitted to the Manager: Waste Discharge and Disposal through the Chief HOD: RPW and written approval was obtained from the Manager: Waste Discharge and Disposal for the disposal of this waste on the Site.

4. Flammable wastes, with a closed cup flash point less than 61°C.

5. Corrosive substances, as defined and described in the Minimum Requirements as Class 8 (1998 edition: page 6-8, Diagram III).

6. Oxidising substances and organic peroxides, as defined and described in the Minimum Requirements as Class 5 (1998 edition: page 6-8, Diagram III).

7. Any waste with a substance which is a Group A and/or Group B carcinogen/mutagen. Group A carcinogens/mutagens have been proven in humans, both clinical and epidemiological. Group B carcinogens/mutagens have been proven without doubt in laboratory animals.

8. Any waste with a substance at a concentration greater than 1% where the substance is a Group C and/or Group D carcinogen/mutagen. Group C carcinogens/mutagens have shown limited evidence in animals. Group D carcinogen/mutagen - the available data is inadequate and doubtful.

10. Any infectious waste which is generated during the diagnosis, treatment or immunisation of humans or animals; in the research pertaining to this; in the manufacturing or testing of biological agents including blood, blood products and contaminated blood products, cultures, pathological wastes, sharps, human and animal anatomical wastes and isolation wastes that contain infectious substances.

11. All materials which fall in Class 1 (explosives), Class 2 (compressed gases) and Class 7 (radioactive materials), as defined and described in the Minimum Requirements.

12. Any waste with a pH less than 6 or greater than 12.

13. Any waste which is difficult to analyse and classify.

14. Any complexes of heavy metal cautions, paint and paint sludges, or laboratory chemicals.

15. Organic or inorganic element or compound which may have a definite acute or chronic negative effect on human health and/or the environment, due to its toxic, physical, chemical or persistent characteristics;

16. Medical waste; and

17. Scheduled pharmaceutical products registered in terms of the Medicines and Related Substances Control Act, 1965 (Act 101 of 1965) or associated containers, are disposed of on the Site

ANNEXURE III

INFORMATION WHICH SHALL BE SUBMITTED ON AN ANNUAL BASIS: CONDITION 8.1

* = *Indicate with an X. Please print legibly.*

NAME OF SITE: ______________________ DATE OF REPORT: ________ (yy/mm/dd)

1. Registered owner(s) of property on which disposal site is situated:

Name	Telephone	
Postal Address	Fax	
	Postal Code	

2. Operator in control of disposal site:

Name	Telephone	
Identity number	After hours	
Educational Qualifications (*)		

3. Latest estimated lifetime of the disposal site: __________yr.

4. *Indicate the type of waste and approximate quantities of waste disposed of during the year:*

Type of waste	Quantity (m^3 $annum^{-1}$)	Compacted (C)	Uncompacted (U)
Non-hazardous waste			
Household			
Garden refuse			
Building rubble			
Industrial (Specify Source)			
TOTAL			

5. *Indicate the applicable waste types and quantities salvaged during the year (*)*

Salvaging undertaken?		Yes
Type	(Collector's Name & final destination of Waste)	Quantity (m^3)
Paper/wood fibre		
Plastics		
Glass		
Rubber		
Textiles		
Iron		
Other (Specify)		
Other (Specify)		

Receptor What is at risk? What do I wish to protect?	Source What is the agent or process with potential to cause harm?	Harm What are the harmful consequences if things go wrong?	Pathway How might the receptor come into contact with the source?	Probability of exposure How likely is this contact?	Consequence How severe will the consequences be if this occurs	Magnitude of risk What is the overall magnitude of the risk? (Low-Medium - High)	Justification for magnitude On what did I f my judgement?	Risk Management How can I best manage the risk to reduce the magnitude?	Residual risk What is the magnitude of the risk after management? This residual risk will be controlled by Compliance Assessment)
Local human population	Airbone dusts /particulars	Nuisance -dust on cars, clothing etc.	Deposition from air						
Local human population	Noise from machine	Nuisance loss of amenity, loss of sleep	Air transport						
Local human population	Fugitive releases, waste, litter and mud on roads	Nuisance loss of amenity.	Vehicles entering and leaving the Site. Waste escaping the Site						
Local human population	Odour	Nuisance loss of amenity.	Air transport						
Local human population	Scavenging birds and animals	Nuisance loss of amenity.	Air transport and over land						
	Pests (e.g flies)	Nuisance loss of amenity.	Air transport and over land						
Local human population	Flooding of Site	If waste is washed off site it may cause contamination	Flood waters						
Groundwater and surface waters	Fire on site leading to run-off from polluted fire fighting waters.	Contaminating of groundwater and aquatic ecosystems	Direct and indirect run-off						
Local human population and/or livestock gaining unauthorised access to the activities	All non-site hazards- particularly relating to waste handling & storage activity	People/ livestock coming into contact with hazards	Direct physical contact						
		Arson and/or vandalism causing the release of polluting materials	Arson-air. Liquids polluting watercourses and/or groundwater						

Ground water	Contaminated run-off from waste	Contaminating of ground water	Soil to ground water to borehole.						
Local human population	Smoke from burning of waste in case of fire.	Nuisance, loss of amenity, loss of sleep. Respiratory irritation/illness	Air transport						
EXPAND TABLE AS PER YOUR RISKS									

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

AMENDMENT OF
THE BROAD-BASED SOCIO-ECONOMIC EMPOWERMENT CHARTER FOR THE SOUTH AFRICAN MINING AND MINERALS INDUSTRY

SEPTEMBER 2010

CONTENTS

PREAMBLE

The systematic marginalisation of the majority of South Africans, facilitated by the exclusionary policies of the apartheid regime, prevented Historically Disadvantaged South Africans (HDSAs) from owning the means of production and from meaningful participation in the mainstream economy. To redress these historic inequalities, and thus give effect to section 9 (equality clause) of the Constitution of the Republic of South Africa Act 108 of 1996 (Constitution), the democratic government has enacted, inter alia, the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA).

The objective of the MPRDA is to facilitate meaningful participation of HDSAs in the mining and minerals industry. In particular, section 100(2)(a) of the MPRDA provides for the development of the Mining Charter as an instrument to effect transformation with specific targets. Embedded in the Mining Charter of 2002 is the provision to review the progress and determine what further steps, if any, need to be made to achieve its objectives.

In line with this provision, the DMR has concluded a comprehensive assessment to ascertain the progress of transformation of industry against the objectives of the Charter in the mining industry. The findings of the assessment identified a number of shortcomings in the manner in which the mining industry has implemented the various elements of the Charter, viz. ownership, procurement, employment equity, beneficiation, human resource development, mine community development, housing and living conditions, all of which have not embraced the spirit of the Charter to the latter. To overcome these inadequacies, amendments are made to the Mining Charter of 2002 in order to streamline and expedite attainment of its objectives. Additionally, the review of the Charter introduces an element of sustainable growth of the mining industry, which seeks to ensure sustainable transformation and growth of the mining industry.

VISION

To facilitate sustainable transformation, growth and development of the mining industry.

MISSION

To give effect to section 100(2)(a) of the MPRDA and section 9 of the Constitution

DEFINITIONS

"BEE entity" means an entity of which a minimum of 25% + 1 vote of share capital is directly owned by HDSA as measured in accordance with flow through principle;

"Beneficiation" means the transformation of a mineral (or a combination of minerals) to a higher value product, which can either be consumed locally or exported. The term "beneficiation" is often used interchangeably with mineral "value-addition" or "downstream beneficiation";

"Broad-Based Socio-Economic Empowerment (BBSEE)" means a socio-economic strategy, plan, principle, approach or act, which is aimed at:

(a) Redressing the results of past or present discrimination based on race, sex and disability of historically disadvantaged persons in the minerals and petroleum industry, related industries and in the value chain of such industries; and

(b) Transforming such industries so as to assist in, provide for, initiate, facilitate or benefit from the:
- Ownership participation in existing or future mining, prospecting, exploration and beneficiation operations;
- Participation in or control of management of such operations;
- Development of management, scientific, engineering or other skills of HDSA's;
- Involvement of or participation in the procurement chains of operations;
- Integrated socio-economic development for mine workers, host communities, major labour sending areas and areas that due to unintended consequences of mining are becoming ghost towns by mobilising all stakeholder resources;

"Calendar year" is defined as the one year period that begins on January 1st and ends on December 31st;

"Community" means a coherent, social group of persons with interest of rights in a particular area of land which the members have or exercise communally in terms of an agreement, custom or law;

"Demographics" means the numerical characteristics of a population (e.g. population size, age, structure, sex/gender, race, etc.)

"Effective ownership" means the meaningful participation of HDSAs in the ownership, voting rights, economic interest and management control of mining entities;

"EMP" means an approved environmental programme contemplated in Section 39;

"Enterprise development" means monetary and non monetary support for existing or fostering of new HDSA companies in the mining sector of the economy, with the objective of contributing to their development, sustainability as well as financial and operational independence;

"ESOPs" mean Employees Share Ownership Schemes;

"Historically Disadvantaged South Africans" ("HDSA") refers to South African citizens, category of persons or community, disadvantaged by unfair discrimination before the Constitution of the Republic of South Africa, 1993 (Act No. 200 of 1993) came into operation which should be representative of the demographics of the country;

"Labour sending area" areas from which a majority of mineworkers, both historical and current are or have been sourced;

"Level of management" refers to line of demarcation between various managerial positions;

"Life of Mine" means the number of years that a particular mine will be operational;

"Meaningful economic participation" includes, inter alia, the following key attributes:

- BEE transactions shall be concluded with clearly identifiable beneficiaries in the form of BEE entrepreneurs, workers (including ESOPs) and communities;
- Barring any unfavourable market conditions, some of the cash flow should flow to the BEE partner throughout the term of the investment, and for this purpose, stakeholders will engage the financing entities in order to structure the BEE financing in a manner where a percentage of the cash-flow is used to service the funding of the structure, while the remaining amount is paid to the BEE beneficiaries. Accordingly, BEE entities are enabled to leverage equity henceforth in proportion to vested interest over the life of the transaction in order to facilitate sustainable growth of BEE entities.

- BEE shall have full shareholder rights such as being entitled to full participation at annual general meetings and exercising of voting rights, regardless of the legal form of the instruments used;
- Ownership shall vest within the timeframes agreed with the BEE entity, taking into account market conditions.

"Mining Charter" means the broad-based socio-economic empowerment Charter for the South African Mining and Minerals Industry;

"Mine Community" refers to communities where mining takes place and labour sending areas;

"Non-discretionary procurement expenditure" means expenditure that cannot be influenced by a mining company, such as procurement from the public sector and public enterprises;

"Shareholder" shall mean a person who is entitled to exercise any voting rights in relation to a company, irrespective of the form, title or nature of the securities to which those voting rights are attached.

"Social Fund" refers to a trust fund that provides financing for investments targeted at meeting the needs of poor and vulnerable communities as informed by commitments made by companies in terms of their social and labour plans;

"Stakeholder" refers to a person, group, organisation, or system which affects or can be affected by an organisation's actions which may relate to policies intended to allow the aforementioned to participate in decision making in which all may have a stake;

"Sustainable development" means the integration of social, economic and environmental factors into planning, implementation and decision-making to ensure that the mineral and petroleum resources development serves present and future generations;

1. OBJECTIVES

The Broad Based Socio Economic Empowerment Charter for the South African Industry, hereafter referred to as "the Mining Charter", is a Government instrument designed to effect sustainable growth and meaningful transformation of the mining industry. The Mining Charter seeks to achieve the following objectives:

(a) To promote equitable access to the nation's mineral resources to all the people of South Africa;

(b) To substantially and meaningfully expand opportunities for HDSA to enter the mining and minerals industry and to benefit from the exploitation of the nation's mineral resources;

(c) To utilise and expand the existing skills base for the empowerment of HDSA and to serve the community;

(d) To promote employment and advance the social and economic welfare of mine communities and major labour sending areas;

(e) To promote beneficiation of South Africa's mineral commodities; and

(f) Promote sustainable development and growth of the mining industry.

2. ELEMENTS OF THE MINING CHARTER

2.1 Ownership

Effective ownership is a requisite instrument to effect meaningful integration of HDSA into the mainstream economy. In order to achieve a substantial change in racial and gender disparities prevalent in ownership of mining assets, and thus pave the way for meaningful participation of HDSA for attainment of sustainable growth of the mining industry, stakeholders commit to:

- Achieve a minimum target of 26 percent ownership to enable meaningful economic participation of HDSA by 2014;
- The only offsetting permissible under the ownership element is against the value of beneficiation, as provided for by Section 26 of the MPRDA and elaborated in the mineral beneficiation framework.

The continuing consequences of all previous deals concluded prior to the promulgation of the Mineral and Petroleum Resources Development Act, 28 of 2002 would be included in calculating such credits/offsets in terms of market share as measured by attributable units of production.

2.2 Procurement and Enterprise Development

Local procurement is attributable to competitiveness and transformation, captures economic value, presents opportunities to expand economic growth that allows for creation of decent jobs and widens scope for market access of South African capital goods and services. In order to achieve this, the mining industry must procure from BEE entities in accordance with the following criteria, subject to the provisions of clause 2.9:

- Procure a minimum of 40% of capital goods from BEE entities by 2014;
- Ensure that multinational suppliers of capital goods annually contribute a minimum of 0.5% of annual income generated from local mining companies towards socio-economic development of local communities into a social development fund from 2010;
- Procure 70% of services and 50% of consumer goods from BEE entities by 2014.

The targets above are exclusive of non-discretionary procurement expenditure.

2.3 Beneficiation

Beneficiation seeks to translate comparative advantage in mineral resources endowment into competitive advantage as fulcrum to enhance industrialisation in line with State developmental priorities. In this regard, mining companies must facilitate local beneficiation of mineral commodities by adhering to the provision of Section 26 of the MPRDA and the mineral beneficiation strategy:

- Mining companies may offset the value of the level of beneficiation achieved by the company against a portion of its HDSA ownership requirements not exceeding 11 percent.

2.4 Employment Equity

Workplace diversity and equitable representation at all levels are catalysts for social cohesion, transformation and competitiveness of the mining industry. In order to create a conducive environment to ensure diversity as well as participation of HDSA at all decision-making positions and core occupational categories in the mining industry, every mining company must achieve a minimum of 40% HDSA demographic representation at:

- Executive Management (Board) level by 2014;
- Senior management (EXCO) level by 2014;
- Core and Critical skills by 2014;
- Middle management level by 2014;
- Junior management level by 2014.

In addition, mining companies must identify and fast-track their existing talent pools to ensure high level operational exposure in terms of career path programmes.

2.5 Human Resource Development

The mining industry is knowledge based and thus hinges on human resource development, constituting an integral part of social transformation at workplace and sustainable growth. To achieve this objective, the mining industry must:

- Invest a percentage of annual payroll (as per relevant legislation) in essential skills development activities reflective of the demographics, but excluding the mandatory skills levy, including support for South African based research and development initiatives intended to develop solutions in exploration, mining, processing, technology efficiency (energy and water use in mining), beneficiation as well as environmental conservation and rehabilitation; as follows:
    - Target for 2010 = 3%;
    - Target for 2011 = 3.5%;
    - Target for 2012 = 4%;
    - Target for 2013 = 4.5%;
    - Target for 2014 = 5%.

2.6 Mine Community Development

Mine communities form an integral part of mining development, there has to be meaningful contribution towards community development, both in terms of size and impact, in keeping with the principles of the social license to operate. Stakeholders must adhere to the following:

- Consistent with international best practices in terms of rules of engagement and guidelines, mining companies must invest in ethnographic community consultative and collaborative processes prior to the implementation/development of mining projects;
- Mining companies must conduct an assessment to determine the developmental needs in collaboration with mining communities and identify projects within the needs analysis for their contribution to community development in line with Integrated Development Plans (IDPs), the cost of which should be proportionate to the size of investment.

2.7 Housing and Living Conditions

Human dignity and privacy for mineworkers are the hallmarks to enhance productivity and expedite transformation in the mining industry in terms of housing and living conditions. In this regard mining companies must implement measures to improve the standards of housing and living conditions for mineworkers as follows:

- Convert or upgrade hostels into family units by 2014;
- Attain the occupancy rate of one person per room by 2014;
- Facilitate home ownership options for all mine employees in consultation with organised labour by 2014.

2.8 Sustainable Development and Growth of the Mining Industry

Mineral resources are non-renewable in nature, forthwith exploitation of such resources must emphasise the importance of balancing concomitant economic benefits with social and environmental needs without compromising future generations, in line with Constitutional provisions for ecological, sustainable development and use of natural resources. To this end, with consideration to clause 2.9, every mining company must implement elements of sustainable development commitments included in the "*Stakeholders' Declaration on Strategy for the sustainable growth and meaningful transformation of South Africa's Mining Industry of 30 June 2010 and in compliance with all relevant legislation*", as follows:

- Improvement of the industry's environmental management by:
    - Implementing environmental management systems that focus on continuous improvement to review, prevent, mitigate adverse environmental impact;
    - Undertake continuous rehabilitation on land disturbed or occupied by mining operations in accordance with appropriate regulatory commitments;
    - Provide for the save storage and disposal of residual waste and process residues;
    - Design and plan all operations so that adequate resources are available to meet the closure requirements of all operations.
- Improvement of the industry's health and safety performance by:
    - Implementing a management systems focused on continuous improvement of all aspects of operations that have a significant impact on the health and safety of employees, contractors and communities where mining takes place;
    - Providing all employees with health and safety training and require employees of contractors to have undergone such training;
    - Implement regular health surveillance and risk-based monitoring of employees.
- Stakeholders undertake to enhance the capacity and skills in relevant South African research and development facilities in order to ensure quality, quick turn around, cost effectiveness and integrity of such facilities. To this extent, mining

companies are required to utilise South African based facilities for the analysis of samples across the mining value chain.

2.9 Reporting (Monitoring and Evaluation)

Every mining company must report its level of compliance with the Mining Charter annually, as provided for by Section 28(2)(c) of the MPRDA.

The Department shall monitor and evaluate, taking into account the impact of material constraints which may result in not achieving set targets.

3. NON-COMPLIANCE

Non compliance with the provisions of the Charter and the MPRDA shall render the mining company in breach of the MPRDA and subject to the provisions of Section 47 read in conjunction with Sections 98 and 99 of the Act.

4. AMENDMENTS

The Minister of the Department of Mineral Resources may amend the Mining Charter as and when the need arises.