Trees and Shrubs

Acacia burkei		*Grewia bicolor*	M
Acacia nilotica	M	*Grewia flava*	
Acacia robusta		*Grewia monticola*	
Acacia tortilis	M	*Grewia vernicosa*	
Aloe marlothii	p	*Gymnosporia buxifolia*	M
Berchemia discolor		*Opuntia ficus-indica*	A
Bolusanthus speciosus	M	*Ozoroa* sp	
Boscia foetida	p	*Peltophorum africanum*	
Combretum hereroense	d	*Sclerocarya birrea*	MP
Dichrostachys cinerea	M	*Searsia engleri*	
Diospyros lycioides		*Securinega virosa*	
Dodonaea angustifolia		*Tarchonanthus camphoratus*	
Ehretia rigida		*Ximenia caffra*	M
Euclea undulata	DM	*Ziziphus mucronata*	M

Grasses

Aristida adscensionis		*Eragrostis rigidior*	D
Aristida congesta		*Fingerhuthia africana*	
Aristida stipitata		*Heteropogon contortus*	
Brachiaria serrata		*Stipagrostis uniplumis*	
Cymbopogon excavatus	d	*Themeda triandra*	
Enneapogon scoparius			

Forbs

Barleria sinensis		*Lippia scaberrima*	
Blepharis subvolubilis		*Melhania prostata*	
Bulbostylis hispidula		*Melhania* sp	
Commicarpus pentandrus		*Ocimum americanum*	
Geigeria burkei		*Pearsonia* sp	
Hermannia modesta		*Rhynchosia* sp	
Hibiscus micranthus		*Tribulus terrestris*	W
Indigofera sp		*Waltheria indica*	W
Ipomoea ommaneyi		*Zinnia peruviana*	W
Kyphocarpa angustifolia			

Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	27	1	28	0	3	10
Grasses	11	0	11	0	0	0
Forbs	16	3	19	0	0	0
Total	54	4	58	0	3	10

Discussion

This bushveld community occurs widespread and are not threatened. Although the vegetation is disturbed and degraded, the species richness is high but no red data species were found during the survey. Note should be taken of the presence of a few smaller individuals of *Sclerocarya birrea* (Marula) which is a protected tree. A permit from the provincial forestry department and nature conservation authority will be needed if any individual of this species that may occur in the way of the proposed development has to be removed or cut. *Aloe marlothii* and *Boscia foetida*, protected by provincial ordinance, is also found in the area. The developers should take care to identify all Marula trees for protection or for application of permits to cut or remove individual trees.

The alien *Opuntia ficus-indica* (Prickly Pear) is and invader species which should be eradicated.

It is suggested that:

- The proposed development could be supported.
- All alien plant species be removed and controlled, (Conservation of Agricultural Resources Act, Act 43 of 1983, Amendment of 2001).
- The aloes should be rescued and can be used in any rehabilitation program.

- Only indigenous species should be used for gardening within the mining development area.

4. Drainage Lines

The drainage line is located on the eastern boundary of the site. This drainage line is very shallow, very inconspicuous, covered with general plains bushveld, sometimes with slightly larger trees. The soils are covered with white calcareous limestone pebbles. The vegetation is degraded thorny bushveld, dominated by *acacia tortilis, Acacia nilotica* and *Dichrostachys,* therefore blending with the *Dichrostachys cinerea* Plains Bushveld

The grass layer is often poorly developed, 0.3 m tall and covers only 30%. The most dominant grasses are *Enneapogon scoparius* and *Eragrostis rigidior.* Various forb species occur scattered in the grassy layer, and these are not abundant.

Figure 6: The limestone in the drainage line

Community 4: Drainage Lines			
Status	Drainage lines are considered as sensitive		
Soil	Sandy with limestone	Rockiness	5-10%
Conservation Value	High	Sensitivity:	High
Agricultural potential:	Low	Need for rehabilitation	Low
Dominant spp.	*Acacia tortilis, Acacia nilotica, Aloe wickensii,*		

Vegetation structure		
Layer	**Height (m)**	**Cover (%)**
Trees	3-5	5-10
Shrubs	1-3	10
Grass	0.3	30
Forbs	0.3	5

Trees and Shrubs

Acacia nilotica	Md	*Grewia flava*	
Acacia tortilis	Md	*Grewia flavescens*	
Aloe marlothii	p	*Gymnosporia buxifolia*	M
Combretum hereroense		*Lycium bosciifolium*	
Dichrostachys cinerea	M	*Opuntia ficus-indica*	A
Ehretia rigida		*Ormocarpum trichocarpum*	
Eriocephalus sp		*Pappea capensis*	
Euclea undulata	dM	*Searsia engleri*	

Grasses

Aristida adscensionis		*Eragrostis rigidior*	d
Aristida congesta		*Eragrostis trichophora*	
Enneapogon cenchroides		*Melinis repens*	
Enneapogon desvauxii		*Oropetium capensis*	
Enneapogon scoparius	d	*Pogonarthria squarrosa*	

Forbs

Abutilon angulatum		*Hermannia modesta*	
Acalypha villicaulis	M	*Hermbstaedtia odorata*	
Acrotome inflata		*Hibiscus micranthus*	
Aloe cryptopoda	p	*Huernia sp*	p
Aloe globuligemma	p	*Indigofera sp*	
Aloe greatheadii	pM	*Kleinia longiflora*	M
Aptosimum lineare		*Kyphocarpa angustifolia*	W
Asparagus sp		*Lantana rugosa*	
Barleria sinensis		*Leucas glabrata*	
Blepharis mitrata		*Lippia javanica*	
Catharanthus roseus	W	*Ocimum americanum*	
Chascanum pinnatifidum		*Oxygonum dregeanum*	
Clerodendrum ternatum		*Pavonia burchellii*	
Euphorbia schinzii		*Phyllanthus maderaspatensis*	
Evolvulus alsinoides		*Senna italica*	W
Felicia muricata		*Sida alba*	
Fimbristylis hispidula		*Solanum incanum*	
Geigeria burkei		*Tribulus terrestris*	W
Gomphocarpus fruticosus	W	*Vernonia poskeana*	
Gomphrena celosioides	W	*Waltheria indica*	W
Heliotropium steudneri		*Zinnia peruviana*	W

Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	15	1	16	0	1	5
Grasses	10	0	10	0	0	0
Forbs	34	8	42	0	4	2
Total	59	9	68	0	5	7

Discussion

All drainage lines are regarded as ecologically sensitive. No development is planned in the area of the drainage lines. The drainage lines should be included in an open space plan, and thus protected.

5. Moist Open Dambo Shrubveld

A narrow, east-west stretching belt of Moist Open Dambo Shrubveld is present in the northern section of the site. Few small scattered shrubs occur in a dense grass layer, with clayey soils indicating moister conditions. The most prominent species are the grasses *Bothriochloa insculpta* and *Urochloa mosambicensis*. Forbs species are very rarely found in the dense grass layer.

Community 5: Moist Open Dambo Shrubveld			
Status	Moist Dambo		
Soil	clay	Rockiness	5-10%
Conservation Value	Medium	Sensitivity:	Low
Agricultural potential:	Low	Need for rehabilitation	Low
Dominant spp.	*Bothriochloa insculpta, Urochloa mosambicensis*		

Vegetation structure		
Layer	**Height (m)**	**Cover (%)**
5	3-5	5
Shrubs	1-3	15
Grass	0.3	85
Forbs	0.3	<1

The following plant species were recorded from this plant community:

Trees and Shrubs

Acacia karroo	M	*Euclea undulata*	dM
Boscia foetida	pM	*Grewia bicolor*	M
Combretum apiculatum		*Grewia monticola*	
Commiphora pyracanthoides		*Gymnosporia buxifolia*	M
Dichrostachys cinerea	M	*Lycium bosciifolium*	

Searsia engleri		*Ziziphus mucronata*	M
Securinega virosa			

Grasses and Sedges

Aristida congesta		*Eragrostis superba*	
Bothriochloa insculpta	D	*Heteropogon contortus*	
Digitaria brazzae		*Panicum maximum*	
Eragrostis rigidior		*Urochloa mosambicensis*	D

Forbs

Justicia sp		*Schkruhria pinnata*	M

Number of species recorded:

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	13	0	13	0	1	7
Grasses	8	0	8	0	0	0
Forbs	2	0	2	0	0	1
Total	32	2	23	0	1	8

Discussion

This is a narrow belt of moist grassland which has Medium conservation value but due to its very small size the sensitivity is regarded as Low.

It is suggested that:

- The proposed development could be supported.

Figure 7: The Moist Open Dambo Grassland

6. *Aloe* Shrubveld

This area is restricted to the central part of the study site (24°20'50.8"S; 29°30'35.7"E). The dominant woody species are mainly *Grewia flava, Euclea undulata, Searsia engleri* and *Gymnosporia buxifolia*, though the presence of many Aloes is the most conspicuous.

Community 6: *Aloe* Shrubveld			
Status	Natural though utilised		
Soil	Sandy with limestone	**Rockiness**	5-10%
Conservation Value	Low	**Sensitivity:**	Medium
Agricultural potential:	Low	**Need for rehabilitation**	Low
Dominant spp.	*Aloe wickensii, Aloe greatheadii, Aloe fosteri, Aloe globuligemma*		

Vegetation structure		
Layer	**Height (m)**	**Cover (%)**
Trees	3-5	5
Shrubs	1-3	40
Grass	0.3	55
Forbs	0.3	5

Trees and shrubs

Aloe marlothii	p	*Euclea undulata*	dM
Boscia foetida	p	*Grewia flava*	d
Combretum hereroense		*Gymnosporia buxifolia*	
Dichrostachys cinerea		*Lycium bosciifolium*	
Eriocephalus sp		*Searsia engleri*	

The grass layer is often poorly developed, 0.3 m tall and covers only 55%. The most dominant grasses are *Enneapogon scoparius* and *Eragrostis rigidior.*

Grasses

Aristida adscensionis		*Eragrostis trichophora*	
Aristida congesta		*Heteropogon contortus*	
Enneapogon cenchroides		*Melinis repens*	
Enneapogon scoparius	d	*Pogonarthria squarrosa*	
Eragrostis rigidior	d		

Forbs

Aloe cryptopoda	p	*Hibiscus micranthus*	
Aloe fosteri	p	Indigofera *sp*	
Aloe greatheadii	p	*Kyphocarpa angustifolia*	W
Aptosimum lineare		*Lantana rugosa*	
Asparagus sp		*Melhania* sp	
Barleria sinensis		*Melhania* sp	
Chascanum pinnatifidum		*Ocimum americanum*	
Clerodendrum ternatum		*Petalidium oblongifolium*	
Cucumis zeyheri		*Phyllanthus maderaspatensis*	
Evolvulus alsinoides		*Polygala hottentotta*	
Felicia muricata		*Rhynchosia* sp	
Fimbristylis hispidula		*Vernonia poskeana*	
Geigeria burkei		*Waltheria indica*	W
Heliotropium steudneri		*Zinnia peruviana*	W
Hermannia modesta			

Discussion

Of significance is the presence of Aloes in this area. The aloes should be rescued and can be used in any rehabilitation program..

It is suggested that:

- The proposed development could be supported.

- All alien plant species be removed and controlled, (Conservation of Agricultural Resources Act, Act 43 of 1983, Amendment of 2001).
- The aloes should be rescued and can be used in any rehabilitation program..
- Only indigenous species should be used for gardening within the mining development area.

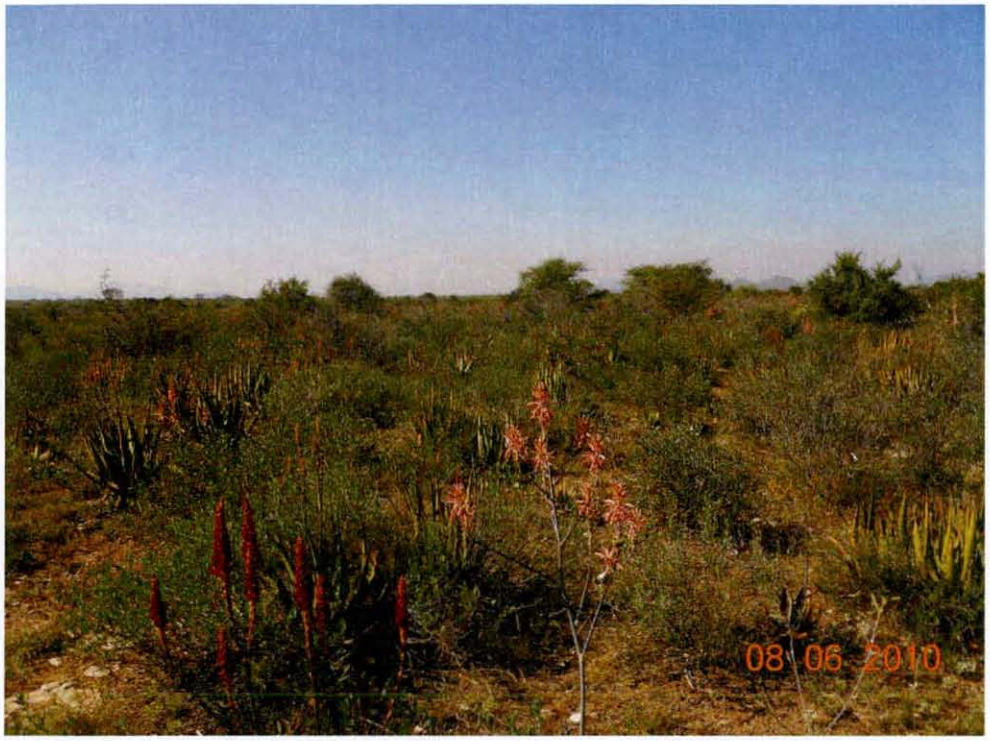

Figure 8: The *Aloe* Shrubveld

7. Agricultural Fields, Old Fields

Some Agricultural Fields and Old Fields occur in the north-western parts of the area. Some are currently planted with maize. Older old fields are covered with small shrubs of *Dichrostachys cinerea* and *Acacia tortilis*, and also a variety of weedy species. Most of the Old Field or current agricultural fields are situated outside the site investigated. These areas have from an ecological point of view no conservation value.

Figure 9: A typical agricultural field

No vegetation surveys were made in the old fields. The development of the road can be supported in this area

5.3 Species of Conservation Concern

Threatened species

A Threatened species and Species of Conservation Concern list for the Grid 2429BC was obtained from the POSA database on the SANBI website. Threatened species are those that are facing high risk of extinction, indicated by the categories Critically Endangered, Endangered and Vulnerable. Species of Conservation Concern include the Threatened Species, but additionally have the categories Near Threatened, Data Deficient, Critically Rare, Rare and Declining. This is in accordance with the new Red List for South African Plants (Raimondo *et al.* 2009).

Species of Conservation Concern (SANBI website):

Species	Status
Myrothamnus flabellifolius Welw.	DDT
Aneilema longirrhizum Faden	NT
Adenia fruticosa Burtt Davy subsp. *fruticosa*	NT

None of these were found during the field survey. No suitable habitat for *Myrothamnus flabellifolius* and *Adenia fruticosa occurs* on the site, both growing on rocky outcrops. *Aneilema longirrhizum* is a wetland species.

According to Dzerefos (2002) the following species are also vulnerable species that could occur in the area of the proposed development:

- *Asparagus* sp. nov. aff. *A. minutiflorus*
- *Eulophia leachii*
- *Gladiolus sekhukhuniensis*
- *Huernia stapelioides*

Although these species could occur, they were not observed on the current study site.

Protected species

Protected trees are rare on the site, a few individuals of the nationally protected *Sclerocarya birrea* were noted, while the provincially protected *Boscia foetida* and the aloes *Aloe marlothii, Aloe cryptopoda, Aloe globuligemma* and *Aloe greatheadii are* also locally present. A permit from the Dept Forestry will be needed if any of these trees should be removed, or even pruned or cut. Even large Marula trees can be transplanted successfully, if needed. It is recommended that all aloes that occur in the way of the proposed development, be rescued and planted in the gardens of the mine.

Alien Invaders

Scientific name (Common name)	Category[1]
Agave americana·(Century plant/Sisal)	Not listed
Agave sisalana (Sisal)	2
Argemone ochroleuca (White mexican poppy)	1
Datura ferox (Large thorn apple)	1
Melia azedarach (Seringa)	3
Opuntia ficus-indica (Sweet prickly pear)	1
Senna didymobotrya (Peanut butter cassia)	3
Solanum elaeagnifolium (Silver leaf bitter apple)	1
Xanthium strumarium (Large cocklebur)	1

A few of these species occur scattered over the area, especially closer to the Makarung town, some being more conspicuous e.g. *Opuntia ficus-indica* (Sweet prickly pear) and *Agave americana*·(Century plant/Sisal).

[1] Category 1 plants are declared weeds and should be removed and destroyed immediately; Category 2 plants can only be planted if a permit is acquired; Category 3 plants do not require removal but the species may not be stocked by garden centres or planted.

Medicinal species

Species[1]	Habitat	Medicinal
Acacia karroo	Found on plains	Gum used for medicine
Acacia nilotica	Found on plains	Gum used for medicine
Acacia tortilis	Found on plains	Bark used medicinally
Aloe greatheadii	Aloe on plains	Leaves applied to burns, sores and wounds
Asparagus suaveolens	Amongst rocks in valley	Roots harvested
Bolusanthus speciosus	Plains	Bark is used for abdominal problems
Boscia albitrunca	Plains and hills	Root decoctions used for haemorrhoids inflamed eyes and ear infusions
Boscia foetida	Found on plains.	Root decoctions used for menstruation
Dichrostachys cinerea	Often in overgrazed areas	All parts are used for snake bites, scorpion stings, toothache and sore eyes
Corchorus asplenifolius		
Euclea undulata	Widespread	Bark and root used
Grewia bicolor	Widespread	Bark used medicinally.
Gymnosporia buxifolia	Plains.	Traded on the Witwatersrand; to treat pleurisy
Kleinia longiflora	Rocky areas	Medicinal use recorded
Ledebouria revoluta	Plains.	Bulb used medicinally
Schkuhria pinnata		
Sclerocarya birrea	Widespread	Bark, roots and leaves used for heartburn, diarrhoea, diabetes, fever and malaria
Ximenia caffra	Found on plains	Bark and leaves used medicinally
Ziziphus mucronata	Widespread	Roots leaves and bark have a variety of uses

These species are found on the plains. Only *Boscia albitrunca* and *Sclerocarya caffra* are protected. All the others are quite widespread and not threatened. Most of the *Boscias* found on this property are *Boscia foetida*, protected by provincial ordinance, but not by the National Forestry Act.

6. IMPACT ASSESSMENT: IMPACTS ON VEGETATION

6.1 Methods

The following generic criteria drawn from published literature and general South African practise will be used to describe magnitude and significance of impacts in an objective, systematic manner.

These criteria are:

- Extent or scale of the impact (what size of the area will be affected?)
- Duration (how long will the impact last?)
- Intensity (the intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself.
- Probability (how likely is it that the impact will occur?)
- Significance (how severe will the impact be?)
- Mitigatory potential and mitigation measures

Impacts should be identified for the construction and operational phases of the proposed development. Proposed mitigation measures should be practical and feasible such that they can be realistically implemented by the applicant.

The impacts are given in table form. Conventions and definitions used in these tables are described below:

Extent of impact

Site:	Effect confined to the development area
Local:	Effect limited to within 3-5km of the development area
Regional:	Effect extends beyond the borders of the development area to influence the area as a whole.

Duration of impact

Short:	Effect last for a period up to five years
Medium:	Effect continues for a period of between five and ten years

Long:	Effect continues for a period in excess of 10 years
Permanent:	Effect lasts permanently

Intensity

Low:	Will have no or little effect on the vegetation and fauna
Medium:	Will have some effect but parts of vegetation will remain in tact
High:	Will destroy the vegetation or habitat for fauna completely

Probability of occurrence

Low:	Less than 33% chance of occurrence
Medium:	Between 33 and 66% chance of occurrence
High:	Greater than 66% chance of occurrence

Significance

Low:	Where the impact will have a relatively small effect on the environment which does not need to be accommodated
Medium:	Where the impact can have an influence on the environment that might require modification of the project
High:	Where the impact definitely has an impact on the environment and needs mitigation

Status

Positive:	Impact will be beneficial to the environment
Negative:	Impact will not be beneficial to the environment
Neutral:	No positive or negative impact

Confidence

Low:	It is uncertain whether the impact will occur
Medium:	It is likely that the impact will occur
High:	It is relatively certain that the impact will occur

6.2 Results

Impact Table

Impact on Vegetation	Extent	Duration	Intensity	Probab	Signifi	Status	Conf
1. *Dichrostachys cinerea* Bushveld	Site	Permanent	Low	High	Low	Neg	High
2. *Combretum apiculatum* Bushveld	Site	Permanent	Low	High	Low	Neg	High
3. Dense *Euclea undulata* Shrubveld	Site	Permanent	Low	High	Low	Neg	High
4.Dry Drainage Lines	Local	Permanent	Medium	Low	High	Neg	High
5. Moist open Dambo Shr	Local	Permanent	Medium	High	Medium	Neg	High
6. The *Aloe* Shrubveld							
7. Old Fields	Site	Permanent	Low	High	Low	Neg	High

6.3 Discussion

Vegetation

The impact on natural vegetation is of Low significance, because the area of the alignment is already disturbed. The Drainage lines are sensitive ecosystems where the impack must be regarded as High, though it is not planned to develop within the drainage line. Development within this area should be avoided.

Mitigation measures

- Avoid erosion at all times
- Remove all alien plant species
- Rehabilitate the disturbed areas with indigenous plant species
- Sow indigenous grass (*Eragrostis curvula, Digitaria eriantha, Cynodon dactylon* mixture) on the disturbed area to enhance vegetation cover and avoid erosion
- Try to save as many of the larger indigenous trees as possible.
- Rescue all aloes and plant in mine gardens.

7. RESULTS: FAUNA

The possible presence of **red data** Mammals, Birds Retiles and Amphibians which may occur in the area, within the Mixed Bushveld Habitat Type, were evaluated for the site, by assessing suitable habitat. Only the important red data species were evaluated in terms of habitat available on the site, and also in terms of the present development and presence of man in the area. These red data species are discussed here:

7.1 Mammals

The larger mammals (antelopes) that are normally found only in nature reserves or game farms within the area are excluded from the list.

Taxon name	Common Name	SA RD 2004	Suitable habitat on site	Possibility of being present on site
Chrysospalax villosus	Rough-haired Golden Mole	CR C2a(i), D	marginally	No
Cloeotis percivali	Short-eared Trident Bat	CR A2, a	Yes	Could fly over, no caves on site
Dasymys incomtus	Water Rat	NT	Very limited	No
Leptailurus serval	Serval	NT	Yes	Medium
Lutra maculicollis	Spotted-necked Otter	NT	No	No
Manis temminckii	Pangolin	VU C1	Yes	Low
Mellivora capensis	Honey Badger	NT	Yes	Low
Miniopterus schreibersii	Schreibers' Long-fingered Bat	NT	Yes	Could fly over – no caves present
Myotis tricolor	Temminck's Hairy Bat	NT	Yes	Could fly over, no caves present
Mystromys albicaudatus	White-tailed Rat	EN A3c	Yes	Low
Parahyaena brunnea	Brown Hyaena	NT	Yes	Medium
Pipistrellus rusticus	Rusty Bat	NT	Yes	Could fly over, no roosting habitat

Rhinolophus blasii	Peak-saddle Horseshoe Bat	VU D2	Yes	Could fly over, no roosting habitat
Rhinolophus darlingi	Darling's Horseshoe Bat	NT	Yes	Could fly over, no roosting habitat

From the above table it is shown that:

- No suitable habitat exists for the Golden Mole and the Water Rat.
- Six of the listed species are bats, these animals may occur in the area, will usually fly over the site. There may be breeding habitat on the hills close to the site.
- There is suitable habitat for Serval, Pangolin, Honey Badger, White-tailed Rat and Brown Hyaena, though the survey could not confirm their presence. Due to very long time period of human occupation it is doubtful whether Honey Badger and Pangolin still occur in the area, though Serval and White-tailed Rat may still be present in the area.

It should be noted that the area has been utilised and inhabited and that there has been human presence for a long period of time.

7.2 Birds

A large number bird species are found in this habitat type within the grid.
Red data species (IUCN Categories) are given in the following table:

Species name	Common name	RD Status	Comment
Aquila rapax	Tawny Eagle	Vulnerable	May fly over site, hunt and perch occasionally
Buphagus erythrorhynchus	Red-billed Oxpecker	Near Threatened	May occur occasionally - larger mammals do occur on the farms in the neighbourhood
Falco biarmicus	Lanner Falcon	Neat threatened	May fly over site, perch and hunt occasionally
Falco naumanni	Lesser Kestrel	Vulnerable	May fly over site, perch and hunt occasionally

Gyps africanus	Afr. White-backed Vulture	Vulnerable	May fly over site
Gyps coprotheres	Cape Vulture	Vulnerable	May fly over site
Polemaetus bellicosus	Martial Eagle	Vulnerable	May fly over site, perch and hunt occasionally
Sagittarius serpentaris	Secretarybird	Near Threatened	Yes - May fly over site, hunt

7.3 Reptiles

Although about 42 species of reptiles (snakes, lizards, geckos, tortoises) have been recorded from this habitat type, only one, the South African Python, is on the red data list. There is suitable habitat on the site, and Pythons may occur here, but there has been a very long period of intensive human occupation.

The Giant Plated Lizard and the Flat Lizard (*Platysaurus* spp.) were common in rocky outcrops to the south of the study area. Both species are protected according to the Transvaal Provincial Administration Nature Conservation ordinance no. 12 of 1983. These lizards are highly territorial and they are unlikely to move away to another suitable habitat when disturbed.

7.4 Amphibia

Fourteen frog species have been reported from the general area. However frog habitat is generally very limited or absent on the site, and red data species are probably not present.

8. GENERAL DISCUSSION AND CONCLUSION

The vegetation is disturbed – no special pristine vegetation types are present. No red data species were found, though a few individuals of protected species are present.

.

The area of the dry drainage line is considered to be sensitive (DWAE policy).

Although red data mammals and birds and reptiles may be found in the area, none are threatened by the proposed development.

The area is suitable for the construction of the mining infrastructure.

9. REFERENCES

Acocks, J.P.H. 1988. Veld types of South Africa, 3rd ed. *Memoirs of the Botanical Survey of South Africa.* 57: 1–146.

Alexander, G. & Marais J. 2007. *A Guide to the Reptiles of Southern Africa.* Struik Publishers, Cape Town 408pp.

Barnes, K.N. (ed.). 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

Birdlife South Africa. 2010. Checklist of birds in South Africa 2010. Africa Geographic, Cape Town.

Branch, W.R. (Editor), August 1988. South African Red Data Book – Reptiles and Amphibians. S.A.National Scientific Programmes, Report No. 151, 244 pp.

Branch, W.R. 1998. Field Guide to the Snakes and other Reptiles of Southern Africa. 3rd edition. Struik Publishers, Cape Town. 399 pp., maps, 112 plates.

Branch, W.R. 2002. 'The Conservation Status of South Africa's threatened Reptiles': 89 – 103. In:- G.H.Verdoorn & J. le Roux (editors), The State of Southern Africa's

Species, Proceedings of a conference held at the Rosebank Hotel, 4 – 7 September 2001. World Wildlife Fund.

Bredenkamp, G.J. & Brown, L.R. 2001. Vegetation – A reliable ecological basis for environmental planning. Urban Greenfile Nov-Dec 2001: 38-39.

Broadley, D.G. 1990. FitzSimons' Snakes of Southern Africa. Jonathan Ball & Ad Donker Publishers. 387pp.

Department of Environmental Affairs and Tourism. 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of Lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Notices.

Du Preez L. & Carruthers V. 2009. A Complete Guide to the Frogs of Southern Africa. Struik Publishers, Cape Town. 488 pp.

Friedman, Y. and Daly, B. (editors). 2004. Red Data Book of the Mammals of South Africa: A Conservation Asessment: CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust. South Africa.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds.). 1997. The Atlas of Southern African Birds. Vol. 1 & 2. BirdLife South Africa, Johannesburg.

Henderson, L. 2001. Alien weeds and invasive plants. ATC, Pretoria.

Hockey, P. A. R., Dean, W. R. J. & Ryan, P. G. (eds) 2005. Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

Low, A.B. & Rebelo, A.G. (eds) 1996 Vegetation of South Africa, Lesotho and Swaziland. Dept Environmental Affairs & Tourism, Pretoria.

Meester, J.A.J., Rautenbach, I.L., Dippenaar, N.J. & Baker, C.M. 1986. Classification of Southern African Mammals. Transvaal Museum Monograph No. 5. Transvaal Museum, Pretoria, RSA.

Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. eds. 2004. Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland.SI/MAB Series #9. Smithsonian Institution, Washington, DC.

Mucina, L, & Rutherford, M.C. (Eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Mucina, L., Bredenkamp, G.J., Hoare, D.B. & McDonald, D.J. 2000. A National vegetation database for South Africa. South Africa Journal of Science 96:497-498.

Mueller-Dombois, D. & Ellenberg, H. 1974. Aims and methods of vegetation ecology. Wiley, New York.

Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C. Kamundi, D.A. & Manyama, P.A. (Eds.). 2009. Red list of South African plants 2009. *Strelitzia* 25:1-668.

Rautenbach, I.L. 1982. Mammals of the Transvaal. Ecoplan Monograph No. 1. Pretoria, RSA.

SANBI & DEAT. 2009. Threatened Ecosystems in South Africa: Descriptions and Maps. DRAFT for Comment. South African National Biodiversity Institute, Pretoria, South Africa.

Skinner, J.D. & Chimimba, T.C. 2005. The Mammals of the Southern African Subregion. 3rd edition. Cambridge University Press.

Tarboton, W.R., Kemp, M. I. & Kemp, A. C. 1987. Birds of the Transvaal. Transvaal Museum, Pretoria.

The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983).

The Environmental Conservation Act, 1989 (Act 73 of 1989)

The National Environment Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004). Government Gazette RSA Vol. 467, 26436, Cape Town, June 2004.

The National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004). Draft List of Threatened Ecosystems. Government Gazette RSA Vol. 1477, 32689, Cape Town, 6 Nov 2009.

The National Forest Act of 1998 (Act 84 0f 1998, amended in 2006)

The Natural Scientific Professions Act (Act 27 of 2003)

Van Wyk, B.E., Van Oudtshoorn, B. & Gericke, N. 1997. Medicinal plants of South Africa. Briza, Pretoria.

Westhoff, V. & Van der Maarel, E. 1978. The Braun-Blanquet approach. In: Whittaker, R.H. (ed.) Classification of plant communities. W. Junk, The Hague.

ABRIDGED CURRICULUM VITAE: GEORGE JOHANNES BREDENKAMP

Born: 10 February 1946 in Johannesburg, South Africa.

Citizenship: South African

Marital status: Married, 1 son, 2 daughters

Present work address

Department of Botany, University of Pretoria, Pretoria, 0002, South Africa

Tel:(27)(12)420-3121 Fax: (27)(12)362 5099

E-Mail: gbredenk@postino.up.ac.za

or

EcoAgent CC

PO Box 25533, Monument Park, 0105, South Africa

Tel: (27)(12) 346 3180

Fax: (27)(12) 460 2525

Cell 082 5767046

E-Mail: ecoagent@mweb.co.za

Qualifications:

1963 Matriculation Certificate, Kemptonpark High School

1967 B.Sc. University of Pretoria, Botany and Zoology as majors,

1968 B.Sc. Hons. (cum laude) University of Pretoria, Botany.

1969 T.H.E.D. (cum laude) Pretoria Teachers Training College.

1975 M.Sc. University of Pretoria, Plant Ecology .

1982 D.Sc. (Ph.D.) University of Pretoria, Plant Ecology.

Theses: (M.Sc. and D.Sc.) on plant community ecology and wildlife management in nature reserves in South African grassland and savanna.

Professional titles:

• MSAIE South African Institute of Ecologists and Environmental Scientists
- 1989-1990 Council member

• MGSSA Grassland Society of Southern Africa
- 1986 Elected as Sub-editor for the Journal
- 1986-1989 Serve on the Editorial Board of the Journal
- - 1990 Organising Committee: International Conference: Meeting Rangeland challenges in Southern Africa
- 1993 Elected as professional member

• PrSciNat. South African Council for Natural Scientific Professions **Registration Number 400086/83**
- 1993-1997 **Chairman** of the Professional Advisory Committee: Botanical Sciences
- 1993-1997: **Council** Member
- 1992-1994: Publicity Committee
- 1994-1997: Professional Registration Committee

Professional career:

- Teacher in Biology 1970-1973 in Transvaal Schools
- Lecturer and senior lecturer in Botany 1974-1983 at University of the North
- Associate professor in Plant Ecology 1984-1988 at Potchefstroom University for CHE
- Professor in Plant Ecology 1988-2008 at University of Pretoria.
- 2009 – current Professor Extra-ordinary in the Dept of Plant Science, University of Pretoria
- • Founder and owner of the Professional Ecological Consultancy firms Ecotrust Environmental Services CC and Eco-Agent CC, 1988-present.

Academic career:

• Students:
- Completed post graduate students: M.Sc. 53; Ph.D. 14.

- Presently enrolled post-graduate students: M.Sc. 4; Ph.D. 2.

• Author of:

- 175 scientific papers in refereed journals
- >150 papers at national and international congresses
- >250 scientific (unpublished) reports on environment and natural resources
- 17 popular scientific papers.
- 39 contributions in books

• Editorial Committee of

- South African Journal of Botany,
- Journal Grassland Society of Southern Africa,
- Bulletin of the South African Institute of Ecologists.
- Journal of Applied Vegetation Science.(Sweden)
- Phytocoenologia (Germany)
-

• FRD evaluation category: C2 (=leader in South Africa in the field of Vegetation Science/Plant Ecology)

Membership:

• International Association of Vegetation Science.
• British Ecological Society
• International Society for Ecology (Intecol)
• Association for the Taxonomic study of the Flora of Tropical Africa (AETFAT).
• South African Association of Botanists (SAAB)

1988-1993 Elected to the **Council** of SAAB.
1989-1990 Elected as **Chairman** of the Northern Transvaal Branch
1990 Elected to the Executive Council as **Vice-President**
1990- Sub-editor Editorial Board of the Journal
1991-1992 Elected as **President** (2-year period)
1993 **Vice-President** and Outgoing President

• Wildlife Management Society of Southern Africa
• Suid-Afrikaanse Akademie vir Wetenskap en Kuns
(=South African Academy for Science and Art).
• Wildlife Society of Southern Africa

1975 - 1988: Member

1975 - 1983: Committee member, Pietersburg Centre

1981 - 1982: **Chairman**, Pietersburg Centre

• Dendrological Society of Southern Africa

1984 - present: Member

1984 - 1988: Committee member, Western Transvaal Branch

1986 - 1988: **Chairman**, Western Transvaal Branch

1987 - 1989: Member, Central Committee (National level)

1990 - 2000: Examination Committee

• Succulent Society of South Africa

1987 - 2000

• Botanical Society of South Africa

2000 – present: Member

2001- 2008: Chairman, Pretoria Branch

2002 – 2006: Chairman, Northern Region Conservation Committee

2002- 2007: Member of Council

Special committees:

• Member of 10 special committees re ecology, botany, rangeland science in South Africa.

• Member of the International Code for Syntaxonomical Nomenclature 1993-present.

Merit awards and research grants:

1968 Post graduate merit bursary, CSIR, Pretoria.

1977-1979 Research Grant, Committee re Research Development, Dept. of Co-operation and Development, Pretoria.

1984-1989 Research Grant, Foundation for Research Development, CSIR, Pretoria.

1986-1987 Research Grant, Dept. of Agriculture and Water Supply, Potchefstroom.

1990-1997 Research Grant, Dept. of Environmental Affairs & Tourism, Pretoria.

1991-present Research Grant, National Research Foundation , Pretoria.

1991-1993 Research Grant, Water Research Commission.

1999-2003 Research Grant, Water Research Commission.

2006 South African Association of Botanists Silver Medal for outstanding contributions to South African Botany

Abroad:

1986 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom

Visits to Israel, Italy, Germany, United Kingdom, Portugal.

1987 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom.

Visits to Germany, Switzerland, Austria, The Netherlands, United Kingdom.

1990 Travel Grant, FRD.

Visit to Japan, Taiwan, Hong-Kong.

1991 Travel Grant, FRD.

Visits to Italy, Germany. Switzerland, Austria, France, The Netherlands, United Kingdom.

1993 Travel Grant, University of Pretoria.

Visits to the USA, Costa Rica, Czech Republic, Austria.

1994 Travel Grant FRD.

Visits to Switzerland, The Netherlands, Germany, Czech Republic.

1995 Travel Grant FRD, University of Pretoria

Visits to the USA

1996 Travel Grant, University of Pretoria

Visit to the UK.

1997 Travel Grant University of Pretoria, Visit Czech Republic, Bulgaria

1998 Travel Grant, University of Pretoria, Visit Czech Republic, Italy, Sweden

1999 Travel Grant, University of Pretoria, Visit Hungary, Spain, USA

2000 Travel Grant, University of Pretoria, Visit Poland, Italy, Greece.

2001 Travel Grant, NRF, Visit Brazil

2006 German Grant Invited lecture in Rinteln, Germany

Consultant

Founder and owner of Ecotrust Environmental Services CC and Eco-Agent CC

Since 1988 **>250** reports as consultant on environmental matters, including:

- Game Farm and Nature Reserve planning,
- Environmental Impact Assessments,
- Environmental Management Programme Reports,
- Vegetation Surveys,

- Wildlife Management,
- Veld Condition and Grazing Capacity Assessments,
- Red data analysis (plants and animals).