



TERRESTRIAL ECOLOGICAL ASSESSMENT REPORT

Wepex Trading (Pty) Ltd

Iron and Manganese Prospecting Site

Remaining extent of the farm Gloucester 674 (Glosam)



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Wepex Trading (Pty) Ltd

Remaining extent of the farm Gloucester 674 (Glosam)

District of Postmasburg

Northern Cape Province

**Terrestrial Ecological Assessment Report in application for a
Prospecting Right to explore Iron- and Manganese ore deposits**

August 2016

EXECUTIVE SUMMARY

Wepex Trading Pty (Ltd) is proposing the prospecting of Iron and Manganese Ore on the Remaining extent of the Farm Gloucester 674 (Glosam), in the Postmasburg District Municipality of the Northern Cape Province. It lies 35 km north of Postmasburg and 40 km south of Kathu on the R325 (Figure 1). The total extent of the prospecting area is 1 195.75 ha. An ecological assessment is required in order to consider the impacts that the proposed activities might have on the ecological integrity of Glosam and therefore Boscia Ecological Consulting has been appointed by Wadala Mining and Consulting on behalf of the applicant to provide a terrestrial ecological assessment report. A desktop study and field investigation was performed to obtain ecological information for the proposed area and identify the ecological characteristics and sensitivity of the site.

Two broadscale vegetation types occur within the mining area; i.e. Kuruman Mountain Bushveld and Kuruman Thornveld. These vegetation units are not considered to have been significantly transformed and are classified as least threatened. Seven plant communities were identified on site of which the thornveld on historic mine footprint, shrubland on manganese ridges and woodland along the ephemeral stream are associated with the core prospecting area. These areas are considered to be of medium, high and very high sensitivity respectively. The most profound impacts are expected to be related to the possible accidental/intentional killing of fauna, proliferation of alien invasive species and contribution to the cumulative effects of other mining activities in the region. These impacts are however not considered to significant and can be well mitigated.

Species of conservation concern that are found in these earmarked habitats could potentially be damaged or removed. These specifically include *Boscia albitrunca*, which is widespread across the study area. A licence application regarding protected trees should be lodged with Department of Agriculture, Forestry and Fisheries prior to any potential disturbances to these trees. *Boscia albitrunca* is also protected in terms of the NCNCA, along with species like *Gymnosporia buxifolia*, *Olea europaea* subsp. *africana* and *Pelargonium minimum*, which also occur in the earmarked area. A permit application regarding protected flora as well as the harvesting of indigenous vegetation need to be lodged with the Northern Cape Department of Environment and Nature Conservation prior to any clearance of vegetation.

To conclude, the proposed prospecting activities will not have a major impact on the ecological integrity of Glosam, with associated impacts mainly considered to be low. Authorisation should nevertheless be granted on condition that the applicant commits to the adherence of effective avoidance, management, mitigation and rehabilitation measures.

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1. INTRODUCTION

1.1. Background information

Wepex Trading Pty (Ltd) is proposing the prospecting of Iron and Manganese Ore on the Remaining extent of the Farm Gloucester 674 (Glosam), in the Postmasburg District Municipality of the Northern Cape Province. It lies 35 km north of Postmasburg and 40 km south of Kathu on the R325 (Figure 1). The total extent of the prospecting area is 1 195.75 ha.

An ecological assessment is required in order to consider the impacts that the proposed activities might have on the ecological integrity of Glosam and therefore Boscia Ecological Consulting has been appointed by Wadala Mining and Consulting on behalf of the applicant to provide a terrestrial ecological assessment report.

This assessment report describes the characteristics of habitats on Glosam, identifies species of conservation concern, identifies invasive and encroaching species and their distribution, indicates the source of impacts from the operation and assesses these impacts as well as the residual impacts after closure. Avoidance and mitigation measures associated with each identified impact are recommended and ecological responsibilities pertaining to relevant conservation legislation are also indicated. These should all be included in the EMPR.

1.2. Scope of study

The specific terms of reference for the study include the following:

- conduct a desktop study and field investigation in order to identify and describe different habitats and associated species of conservation concern within the environment that may be affected by the proposed activity;
- identify the relative ecological sensitivity of the project area;
- produce an assessment report that:
 - indicates identified habitats and fauna and flora species, along with their ecological sensitivity,
 - determines the potential impacts of the project on biodiversity,
 - provides mitigation measures and recommendations to limit project impacts.
 - indicates ecological responsibilities pertaining to relevant conservation legislation.

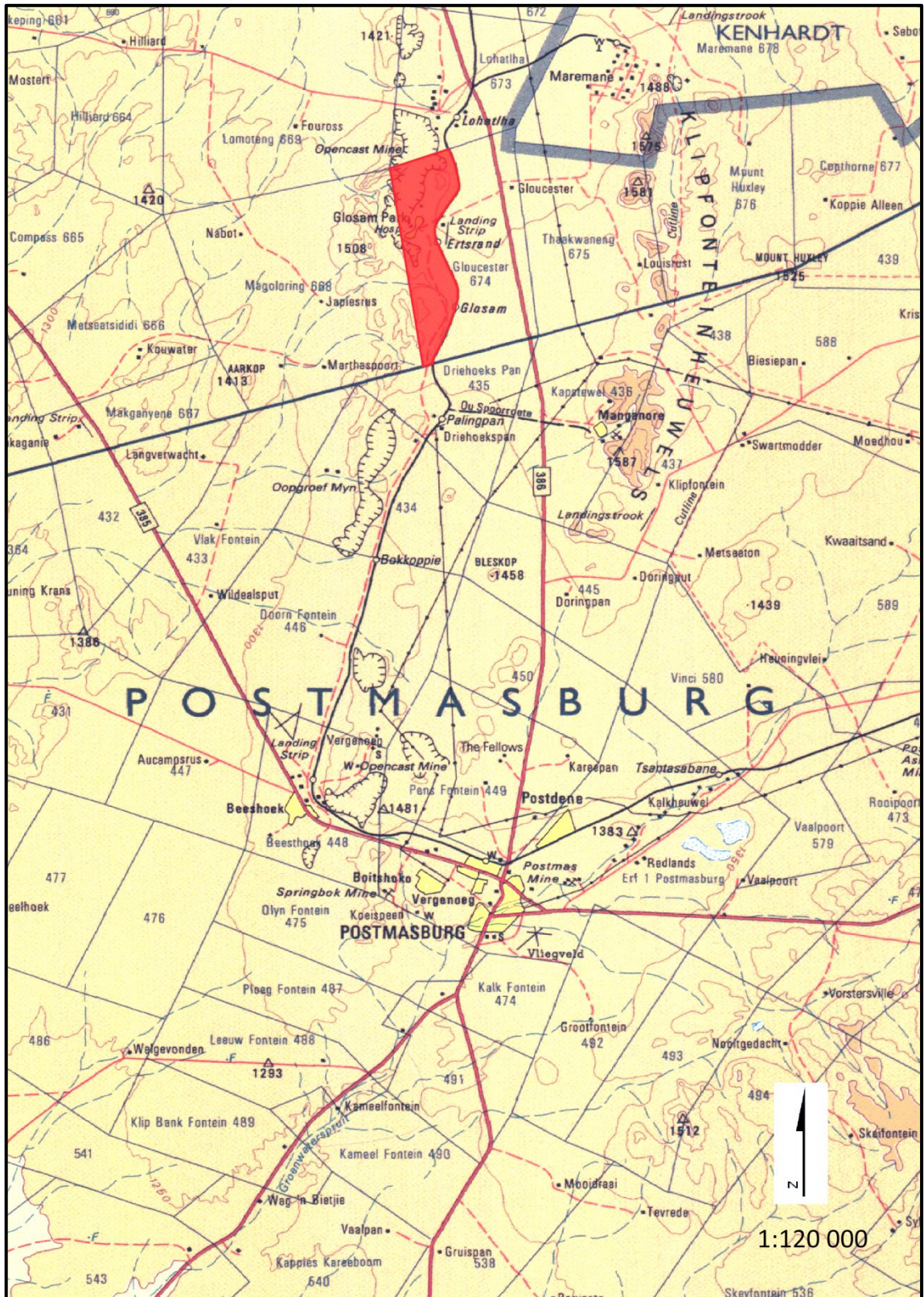



Figure 1. The location of the proposed prospecting area.

1.3. Details of the specialist consultant

Company Name:	Boscia Ecological Consulting cc	Registration no:	2011/048041/23
Address	PostNet Suite #194 Private Bag X2 Diamond 8305		
Contact Person	Dr Elizabeth (Betsie) Milne		
Contact Details	Cell: 082 992 1261	Email: BosciaEcology@gmail.com	
Qualifications	PhD Botany (Nelson Mandela Metropolitan University) Masters Environmental Management (University of the Free State) BTech Nature Conservation (Tshwane University of Technology)		
Declaration of independence	<p>I, Elizabeth (Betsie) Milne declare that I:</p> <ul style="list-style-type: none"> • act as the independent specialist in this application; • regard the information contained in this report as it relates to my specialist input/study to be true and correct; • do not have, and will not have any financial interest in the undertaking of the activity; other than the remuneration of work performed in terms of the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act; • have and will not have any vested interest in the activity proceedings; • have no, and will not engage in conflicting interest in the undertaking of the activities; • undertake to disclose to the component authority any material information that have or may have the potential to influence the decision of the competent authority, or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act; • will provide the competent authority with access to all information at my disposal regarding the study. <div style="text-align: center;">  </div>		

1.4. Description of the proposed activity

Prospecting activities on Glosam will include non-invasive techniques and drilling. Geological surface mapping will be done to evaluate the potential of the ore deposit within the prospecting area. This will entail surface geological mapping, structural mapping and subsurface interpretations of the structural trends.

Mapping will be performed in conjunction with geophysical surveys, which entails ground magnetics and ground gravity geophysical procedures on a pre-determined grid of 100 m x 100 m, in order to delineate ore formations. Minimal vegetation clearance will be required during the geophysical surveys to provide freedom of movement to the geo-technicians that are traversing the grids.

In-situ ore material across the area will also be analysed to determine the subsurface ore grade variation throughout the prospecting area. The samples will be selected based on the availability of fresh subsurface ore material.

For the drilling programme, a total of 30 drill holes are planned to depths ranging from 50 m to 100 m. The locations of these holes will be based on results obtained from the geological interpretations during the non-invasive phase. Prospecting activities will make use of existing roads and track as far as possible. However, additional tracks estimated at 5 km in length as well as 30 drill-pads will be created.

Ultimately, all prospecting data will be validated and captured in order to generate geological models and resource estimates. The core area where proposed prospecting activities are expected to take place is indicated in Figure 2. The prospecting activities are expected to conclude within 17 month.

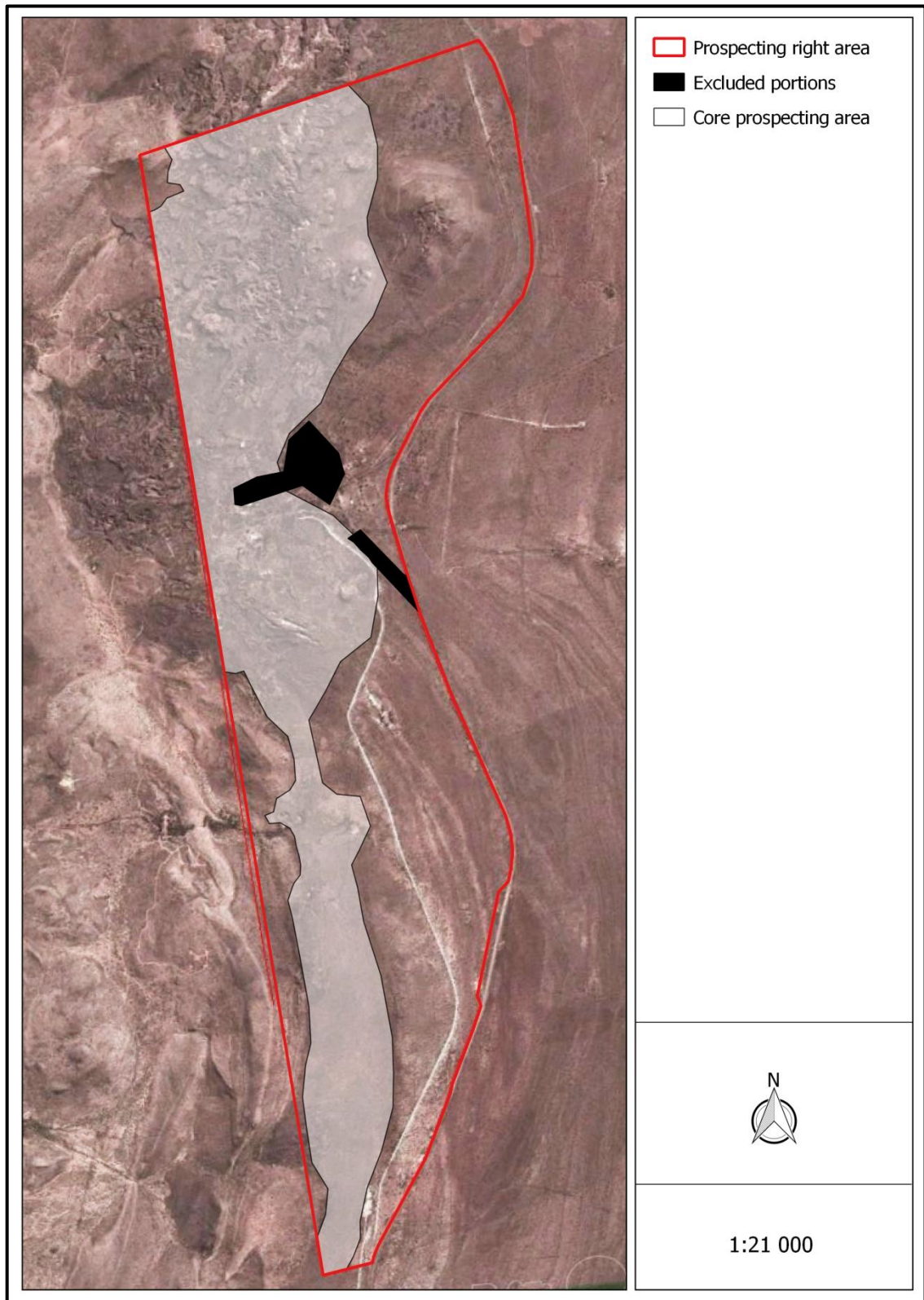


Figure 2. An indication of the core area where prospecting activities are expected to take place.

2. METHODOLOGY

The study comprised a combination of field and desktop surveys for fauna and flora data collection in order to obtain the most comprehensive data set for the assessment. The fieldwork component for this report was conducted on 24 and 25 July 2016, but observations made during a site investigation on 23 February 2016 for a rehabilitation plan on a preceding project, is also included here. Most data for the desktop component was obtained from the quarter degree square that includes the study area (2823AA).

2.1. Flora

2.1.1. Field survey

For the field work component, satellite images were used to identify homogenous vegetation units within the proposed prospecting area. Representative sampling plots were allocated in these units and sampled with the aid of a GPS in order to characterise the species composition. The following quantitative data was collected:

- Species composition
- Species percentage cover
- Amount of bare soil and rock cover
- Presence of biotic and anthropogenic disturbances

Additional checklists of plant species were compiled during the surveys by traversing a linear route and recording species as they were encountered in each unit. A photographic record of some species encountered during the site visit is available on the following link: <http://www.ispotnature.org/projects/encounters-in-the-northern-cape>.

2.1.2. Desktop survey

For the desktop component, the South African National Vegetation Map (Mucina and Rutherford 2006) was used to obtain data on broad scale vegetation types. The SANBI: BGIS database and the regional Environmental Management Framework were consulted to obtain biodiversity information for the Tsantsabane Local Municipality, in which the study area falls. Further searches were undertaken specifically for Red List plant species within the current study area.

Historical occurrences of Red List plant species were obtained from the SANBI:POSA database for the quarter degree squares that includes the study area. The IUCN conservation status of plants in the species list was also extracted from the SANBI database and is based on the Threatened Species Programme (SANBI 2014).

2.2. Fauna

2.2.1. Desktop survey

A desktop survey was undertaken to obtain lists of mammals, reptiles, amphibians and birds which are likely to occur in the study area. These were derived based on distribution records from the literature, including Friedmann and Daly (2004) and Stuart and Stuart (2015) for mammals, Alexander and Marais (2007) and Bates et al. (2014) for reptiles, Du Preez and Carruthers (2009) for amphibians and Taylor et al. (2015) for birds.

Additional information on faunal presence was extracted from the various databases hosted by the ADU web portal, <http://adu.org.za>, as well as from Robert's Multimedia Birds of Southern Africa (Gibbon 2006). A map of important bird areas (BirdLifeSA 2015) was also consulted. The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.

The likelihood of Red Data species occurring on site has been determined using the distribution maps in the Red Data reference books (Friedmann and Daly 2004; Bates et al. 2014; Taylor et al. 2015; ADU 2016) and comparing their habitat preferences with the habitat described from the field survey. The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria (IUCN 2015) and/or the various red data books for the respective taxa.

2.2.2. Field survey

The faunal field survey was conducted concurrent with the vegetation survey. The habitats on site were assessed to compare with the habitat requirements of species determined during the literature survey.

The presence of faunal species was determined as follows:

- Identification by visual observation
- Identification of bird and mammal calls
- Identification of signs (spoor, faeces, burrows and nests)

2.3. Sampling limitations

Due to the brief duration of the survey and the lack of seasonal coverage, the species list obtained during the site visit cannot be regarded as comprehensive. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present are captured. However, this is rarely possible due to time and cost constraints. The survey is however likely to have included most of the dominant and common species present.

The site visit for the study took place during winter. This is not the most optimal time of the year, but many grasses and shrubs were either flowering or were bearing fruit and were therefore in an acceptable state for the assessment. The best time to evaluate vegetation in the study area is however after at least some summer rain when the vegetation has responded and is in an actively growing state. The aridity and patchy rainfall of the region however rarely provides ideal conditions for these urgent types of surveys. The results presented here can therefore only reflect the condition of the vegetation. Consequently, the timing of the site visit is considered to be a possible limiting factor.

2.4. Sensitivity mapping and assessment

An ecological sensitivity map of the site was produced by integrating the information collected on site with the available ecological and biodiversity information available in the literature and various spatial databases.

The sensitivity mapping entails delineating different habitat units identified on the satellite images and assigning likely sensitivity values to the units based on their ecological properties, conservation value and the potential presence of species of conservation concern, as well as their probability of being affected by proposed activities. The sensitivity of the different units identified in the mapping procedure increased with probability and was rated according to the following scale:

- Low:** Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of activities can proceed within these areas with little ecological impact.
- Medium:** Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. Activities within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- High:** Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Activities within these areas are undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- Very High:** Critical and unique habitats that serve as habitat for species of conservation concern, or perform critical ecological roles. These areas are essentially no-go areas for activities and should be avoided as much as possible.

2.5. Impact assessment and mitigation

The criteria used to assess the significance of the impacts are shown in Table 1. The different project activities and associated infrastructure were identified and considered in order to identify and analyse the various possible impacts. The limits were defined in relation to project characteristics. Those for severity, extent, duration and probability are subjective, based on rule-of-thumb and experience. Natural and existing mitigation measures were considered. These natural mitigation measures were defined as natural conditions, conditions inherent in the project design and existing management measures, which alleviate impacts. The consequence value of the impacts was calculated by using the following formula:

$$\frac{\text{CONSEQUENCE}}{(\text{Severity} + \text{Spatial Scope} + \text{Duration})} \times \frac{\text{PROBABILITY}}{(\text{Frequency of activity} + \text{Frequency of impact})}$$

Consequence of impacts is defined as follows:

Very Low: Impact would be negligible. Almost no mitigation and/or remedial activity would be needed, and any minor steps which might be needed would be easy, cheap and simple.

Low: Impact would have little real effect. Mitigation and/or remedial activity would be either easily achieved or little would be required or both.

Low – Medium: Impact would be real but not substantial within the bounds of those which could occur. Mitigation and/or remedial activity would be both feasible and fairly easily possible.

Medium – High: Impact would be real and rather substantial within the bounds of those which could occur. Mitigation and/or remedial activity would be feasible, but not necessarily possible without difficulty.

High: Impacts of substantial order. Mitigation and/or remedial activity would be feasible but difficult, expensive, time consuming or some combination of these.

Very High: Of the highest order possible within the bounds of impacts which could occur. There would be no possible mitigation and/or remedial activity to offset the impact at the spatial or time scale for which was predicted.

Table 1. Criteria used to assess the significance of expected impacts resulting from the proposed operation.

Weight	Severity	Spatial scope (Extent)	Duration
5	Disastrous	Trans boundary effects	Permanent
4	Catastrophic / major	National / Severe environmental damage	Residual
3	High/ Critical / Serious	Regional effect	Decommissioning
2	Medium / slightly harmful	Immediate surroundings / local / outside mine fence	Life of operation
1	Minimal/potentially harmful	Slight permit deviation / on-site	Short term / construction (6 months – 1 yrs.)
0	Insignificant / non-harmful	Activity specific / No effect / Controlled	Immediate (0 – 6 months)

Weight number	1	2	3	4	5	
Frequency						
Probability	Frequency of impact	Highly unlikely	Rare	Low likelihood	Probable / possible	Certain
		Practically impossible	Conceivable but very unlikely	Only remotely possible	Unusual but possible	Definite
	Frequency of activity	Annually or less	6 monthly / temporarily	Infrequent	Frequently	Life of operation

CONSEQUENCE (Severity + Spatial Scope + Duration)															
PROBABILITY (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

Colour code	Significance rating	Value	Negative impact Management strategy	Positive Impact Management strategy
	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
	LOW – MEDIUM	51 – 75	Improve current management	Maintain current management
	LOW	26 – 50	Improve current management	Maintain current management
	VERY LOW	1 – 25	Improve current management	Maintain current management

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. Current and historic land use

The major land uses in the region are mining (manganese and iron ore) and agriculture. According to the Southern African Agricultural Geo-referenced Information System, the land capability of the plains in the east is non-arable with low potential grazing land, while the hills in the west are considered to be wilderness. The grazing capacity is between 18 and 30 ha/AU, with the agricultural region being demarcated for cattle farming. The property is categorised to have no suitability for crop yield.

Glosam is characterised by a fairly complex mining history. Various formal and informal mining companies have mined the area for iron ore and manganese between the late 1920s and 1984. This produced numerous open pits scattered across the site (Figure 3). These pits and associated road networks are still visible today as well as various building and structures related to the past mining activities; some of which are of archaeological significance. Exploration activities have also been performed over the past decade.

Current land use activities on the prospecting right area are indicated in Figure 3 and include site infrastructure and security office for the neighbouring Emang Mmogo Mine, two cell phone reception towers managed by MTN and Cell C, a number of ESKOM power lines and Sedibeng Water reservoir and pipeline infrastructure. Areas in the south of the prospecting right area are mainly used for grazing by livestock and wildlife and a Transnet railway track lines the eastern border of the prospecting right area. This railway line links the Kalahari mines with Port Elizabeth via Kimberley.

3.2. Geology and soils

The study area is predominantly underlain by the rocks of the Transvaal Supergroup, Griqualand West Sequence. Here, dolomitic limestone with subordinate coarsely crystalline dolomite of the Ghaaplatto formation from the Campbell group covers a large area in the eastern half of the study area (Figure 4). Shale, flagstone, quartzite and conglomerate from the Gamagara Formation of the Postmasburg group are found in west, while the iron and manganese deposits are associated with the unconformity between the latter formations.

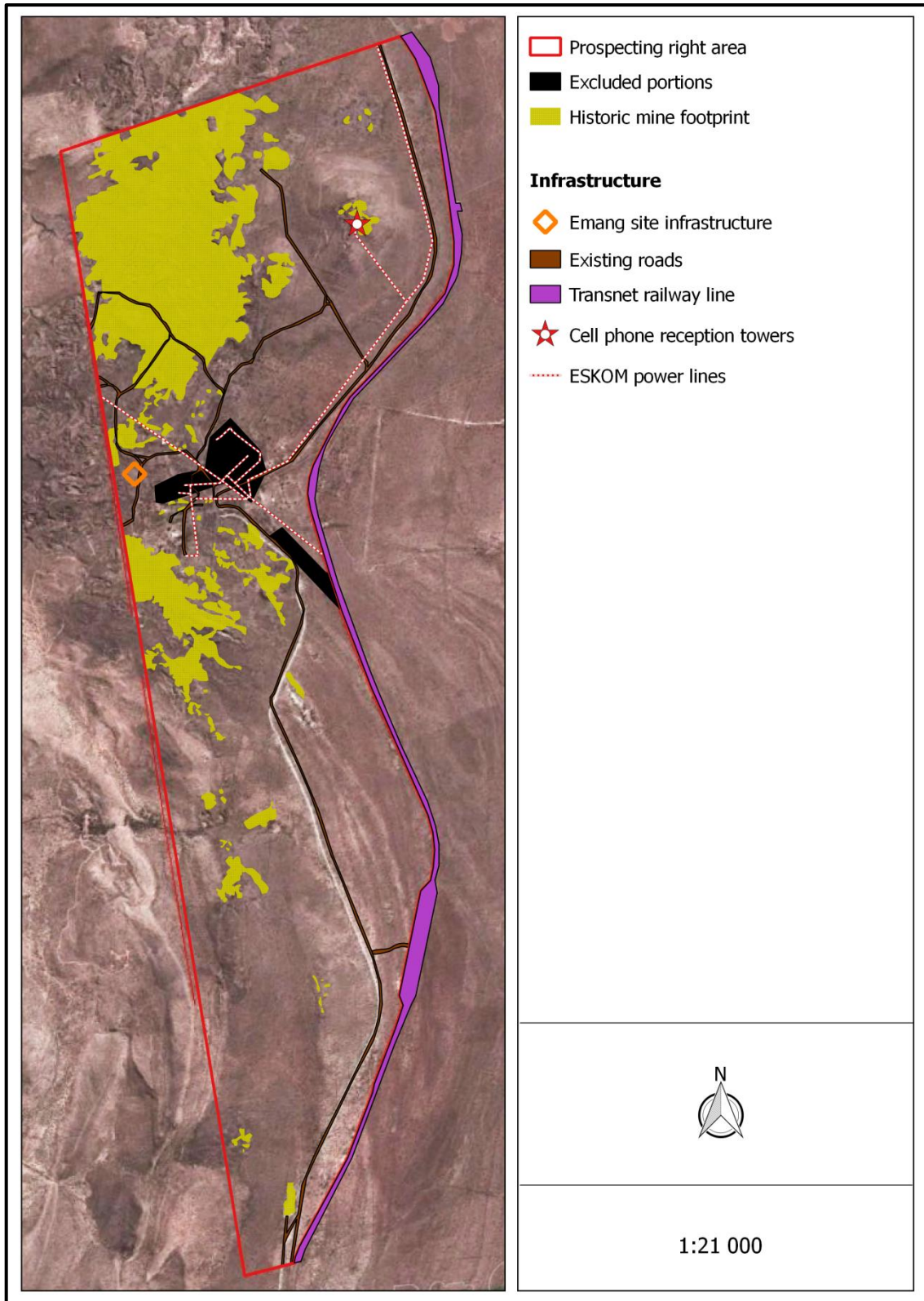


Figure 3. Current and historic land use features on Glosam. The open areas are considered to be pristine grazing land.

The manganese ore deposit of Glosam is extremely irregular and has been deposited on a karstic landscape of the Cambellrand Subgroup, where the ferruginous manganese ore occur within large solution cavities. This was deposited as a wad trapped in karst hollows near the surface together with exogenic detrital material. Younger detrital manganese ore associated with the present day erosional surface accumulates along slopes and exposed karst topography. This is visible as scree and gravel on the floor of the historic mine pits.

Level plains with some relief (4), is the dominant terrain unit of the landscape in the eastern half of the prospecting area, which is closely associated with the Ag111 landtype (Figure 5 and Figure 6). The western half is however dominated by open hills and ridges, closely associated with the lb238 landtype. These hills are rocky with minimal soil cover and the steep slopes produce high runoff erosion risks. On the plains, red-yellow apedal, freely drained soils with high base status are found. These soils have minimal development and are shallow (< 300 mm), occurring on hard or weathering rock. The rather flat terrain has low potential for runoff erosion. The sandy soils of the study area are prone to wind erosion.

3.3. Vegetation

3.3.1. Broadscale vegetation patterns

The study area falls within the Savanna Biome (Mucina and Rutherford 2006) and according to Mucina et al. (2005), two vegetation units are present on site (Figure 7); i.e. Kuruman Thornveld and Kuruman Mountain Bushveld. This map has however not been mapped at a very fine scale and therefore does not reflect the true character of the site.

Kuruman Thornveld is distributed in the North-West and Northern Cape Provinces, and lies at altitudes between 1 300 and 1 500 m. This unit is distributed East of Kuruman to Lykso, and south of Bendell towards Good Hope. The unit is presented as flat rocky plains and some sloping hills with very well-developed, closed shrub layer and well-developed open tree stratum consisting *Vachellia erioloba*. The unit mainly consists of Superficial Kalahari Group sediments, with deep red wind-blown sand, but Campbell Group dolomite and chert also occur. The dominant land types are Ae, Ai, Ag and Ah. The unit is not currently conserved within any formal conservation areas and is classified as being least threatened with very low erosion and 2% transformation. The herb *Gnaphalium englerianum* is the only endemic plant species know to occur in this unit.

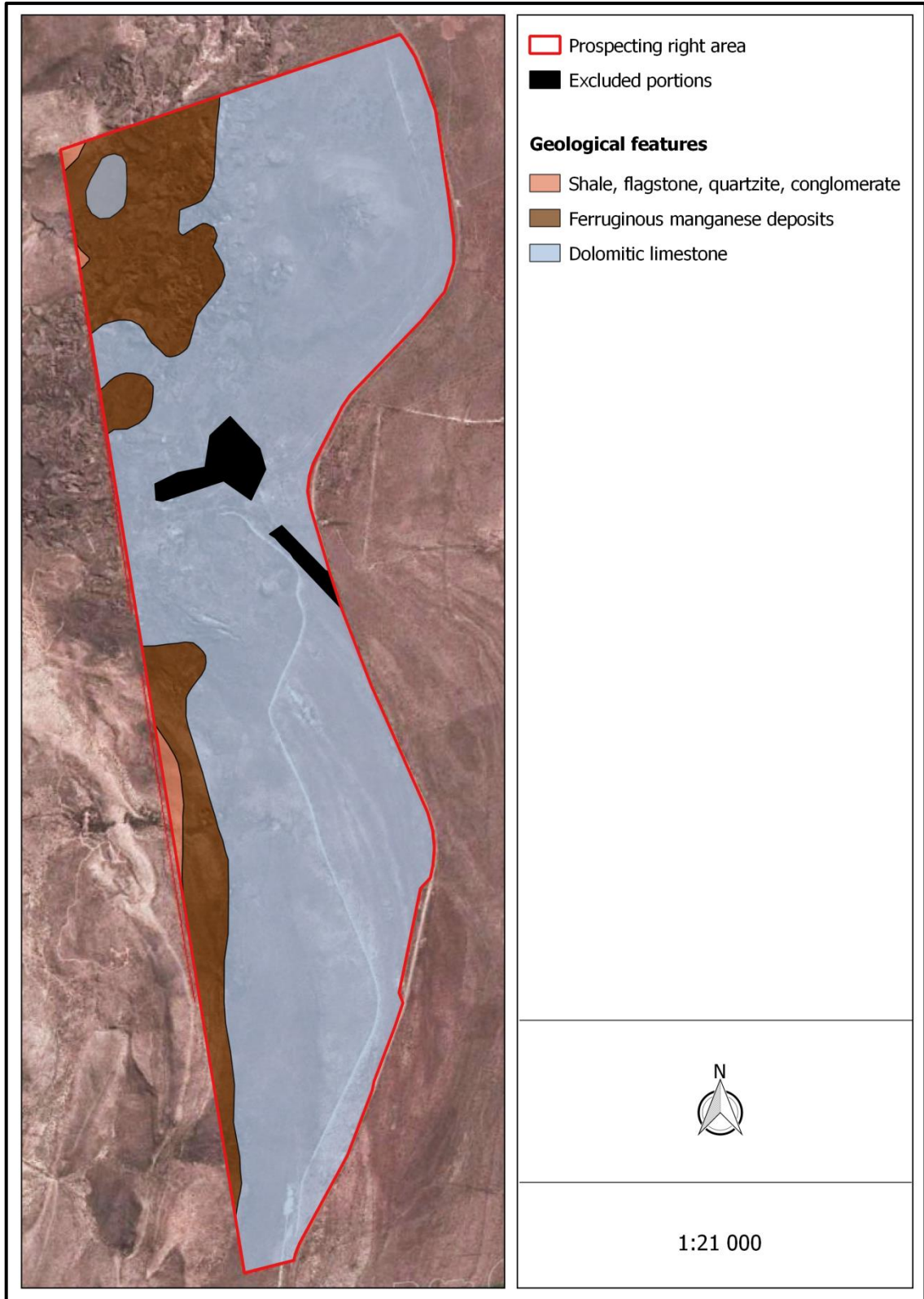


Figure 4. The distribution of geological features in the study area.

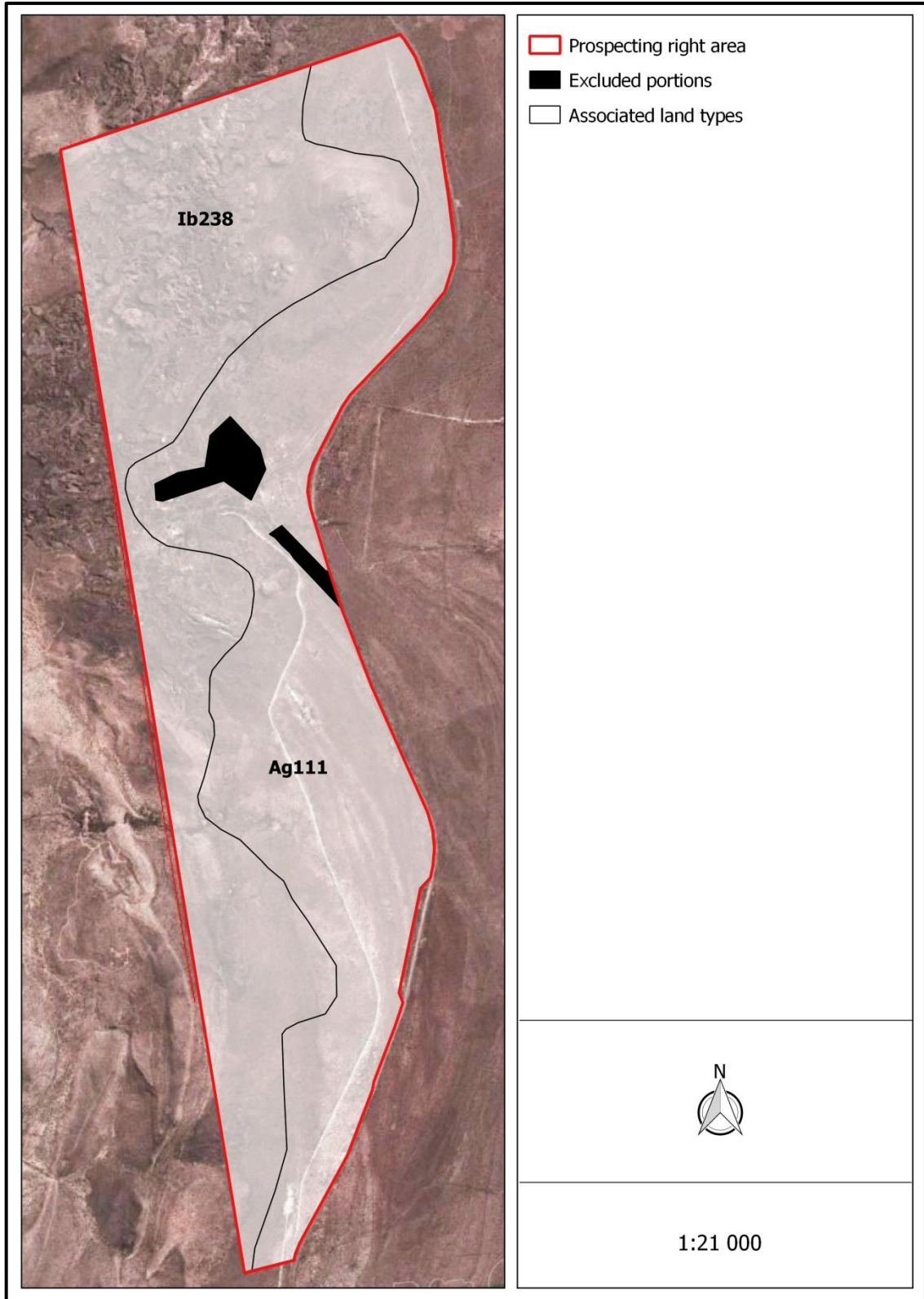


Figure 5. The dominant land types found in the study area.

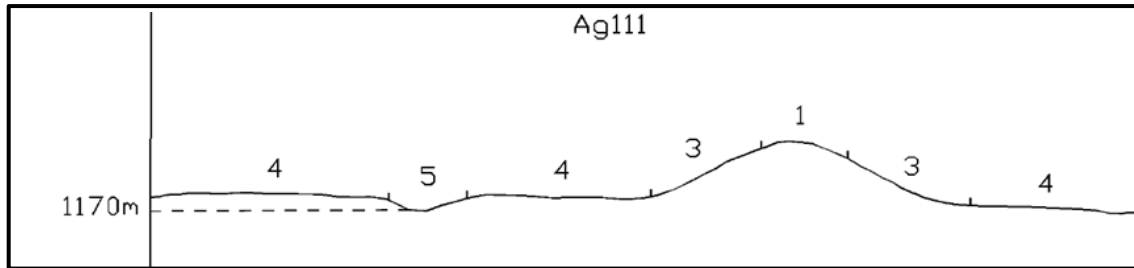


Figure 6. Terrain form sketch for the Ag111 land type of the study area. No terrain sketch is available for the Ib238 landtype.

Kuruman Mountain Bushveld is distributed in the Northern Cape and North-West Provinces at altitudes between 1 100 and 1 800 m. It stretches from the Asbestos Mountains southwest and northwest of Griekwastad, along the Kuruman Hills north of Danielskuil, passing west of Kuruman and re-emerging as isolated hills. The unit is typically presented as rolling hills with gentle to moderate slopes and hill pediment areas with an open shrubveld. Here, *Calobota cuspidosa* is conspicuous within a well-developed grass layer. The Hills consist of banded iron formation, with jasper, chert and riebeckite-asbestos of the Asbestos Hills Subgroup of the Griqualand West Supergroup. Soils are shallow, sandy and of the Hutton form. The most common land types are Ib, followed by Ae, Ic and Ag. The unit is considered to be least threatened and very little is transformed and with little erosion being present. It is not currently conserved within any formal conservation areas and the succulent *Euphorbia planiceps* is the only endemic species known from this unit.

3.3.2. Finescale vegetation patterns

The plant communities within the study area are delineated according to plant species correspondences, change in soil structure, topographical changes and disturbance regimes. The vegetation on site can be divided into seven distinct units (Figure 8) and are described below. These community descriptions include unique characteristics and the dominant species found in each unit. A complete plant species list, including those species likely to occur in the area is presented in Appendix 1.

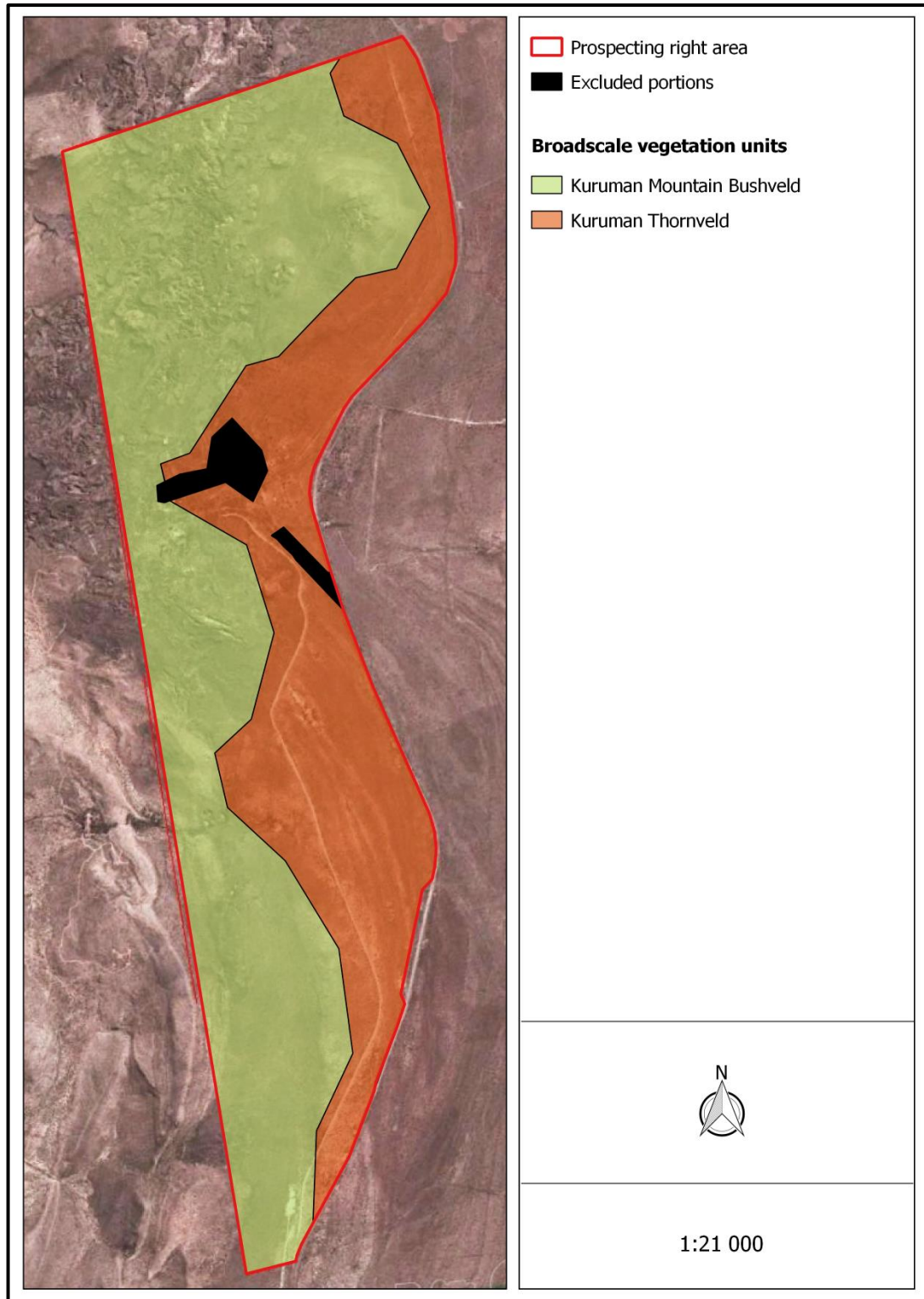


Figure 7. The distribution of broadscale vegetation units (Mucina et al. 2005) in the study area.

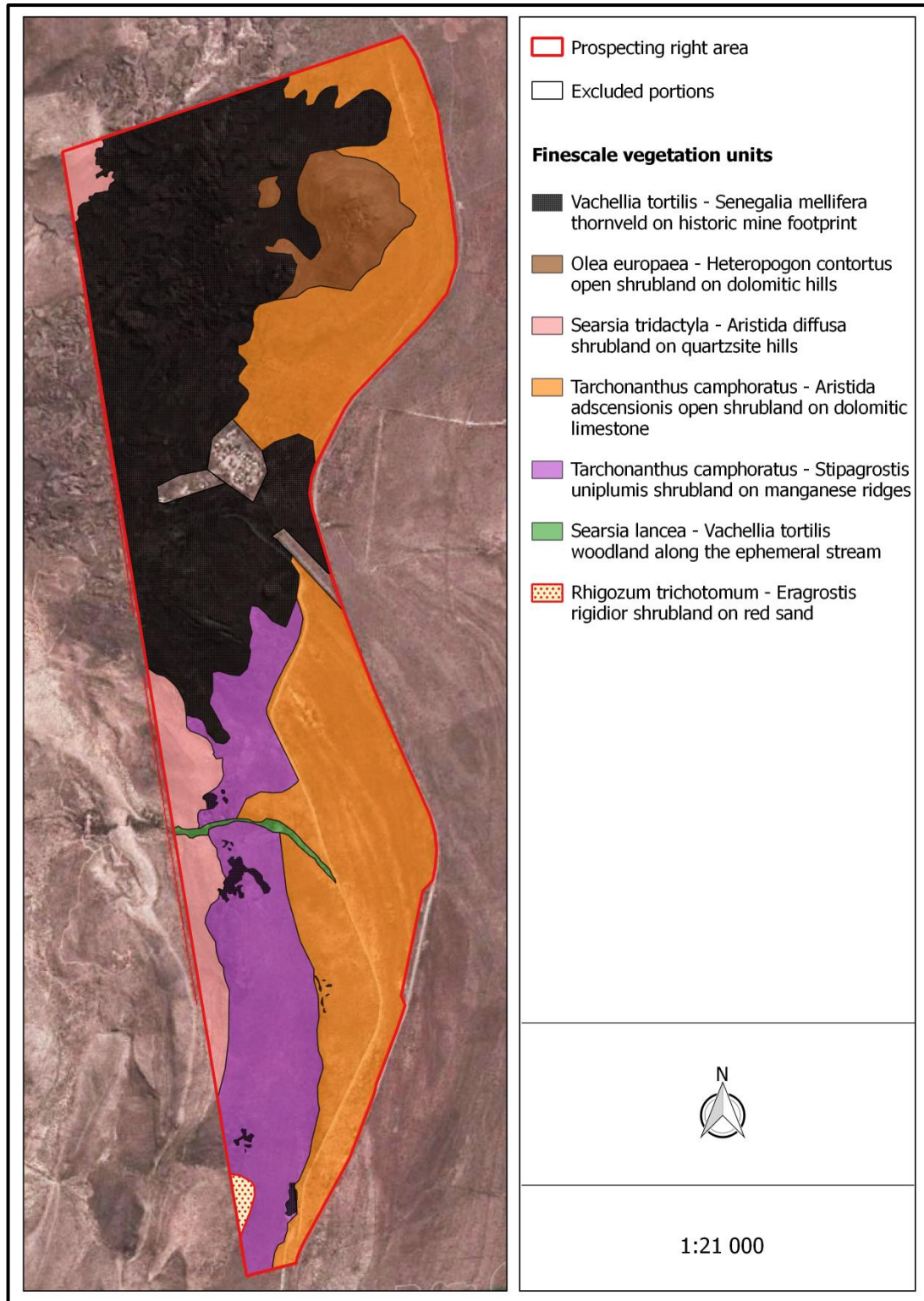


Figure 8. The distribution of finescale vegetation units in the study area.

i) *Vachellia tortilis* – *Senegalia mellifera* thornveld on historic mine footprint

This community occurs on transformed land produced by historic mining and associated activities. It is primarily found in the northern half of the study area (Figure 8) where overgrown pits and dumps are conspicuous in the landscape (Figure 9). The vegetation mainly grows as dense thornveld in abandoned pits, but are more sparse on the old dumps where rainfall continuous to erode the slope substrates.

The plant community typically consist of tall shrubs and trees, where *Vachellia tortilis* and *Senegalia mellifera* are equally dominant. Other common species include *Tarchonanthus camphoratus*, *Grewia flava*, *Searsia burchellii*, *S. tridactyla*, *S. lancea*, *Euclea crispa*, *Ehretia alba*, *Ziziphus mucronata* and *Calobota cuspidosa*.

The grass layer is not well developed where dense stands of woody vegetation occur, but are primarily found where the trees and shrubs are more sparsely distributed. Species distribution is also rather patchy, but those common to this community include *Aristida congesta* subsp. *barbicollis*, *A. diffusa*, *Eragrostis rotifer*, *E. echicochloidea*, *E. chloromelas*, *Heteropogon contortus*, *Cenchrus ciliaris*, *Stipagrostis uniplumis*, *Enneapogon desvauxii*, and *E. cenchroides*.

Other species found here include *Lopholaena cneorifolia*, *Pegolettia retrofracta*, *Chrysocoma ciliata*, *Lepidium africanum* subsp. *divaricatum*, *Pollichia campestris*, *Hermannia vestita*, *Cadaba aphylla* and *Blepharis marginata*

The nationally protected tree *Boscia albitrunca* is a conspicuous shrub in this community and occurs at an estimated density of three individuals per hectare. They are mainly found as stunted or young individuals (Figure 10). This species is also protected under provincial legislation. No other species of conservation concern was encountered here.

Exotic species include *Opuntia ficus-indica*, *O. lindheimeri*, *Prosopis glandulosa*, *Eucalyptus* sp., *Schinus molle*, *Salsola kali*, *Capsella bursa-pastoris* and *Chenopodium carinatum*.

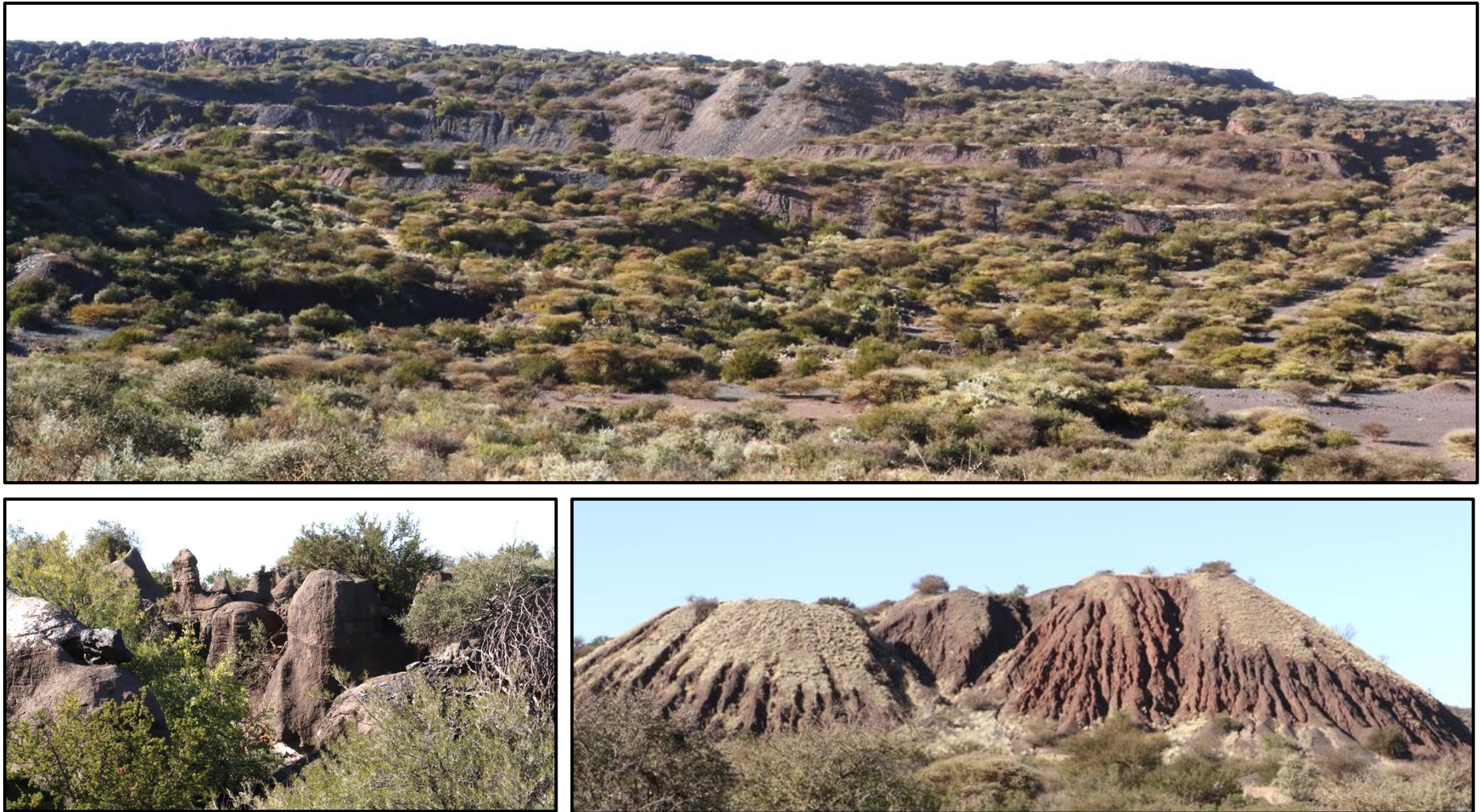


Figure 9. The historic mine footprint is presented as a thornveld that have re-established on pits and dumps and is a conspicuous feature of the landscape in the northern half of Glosam (top). The vegetation forms dense stands in the abandoned pits (bottom left), while the dumps are sparsely vegetated with high erosion risks (bottom right).

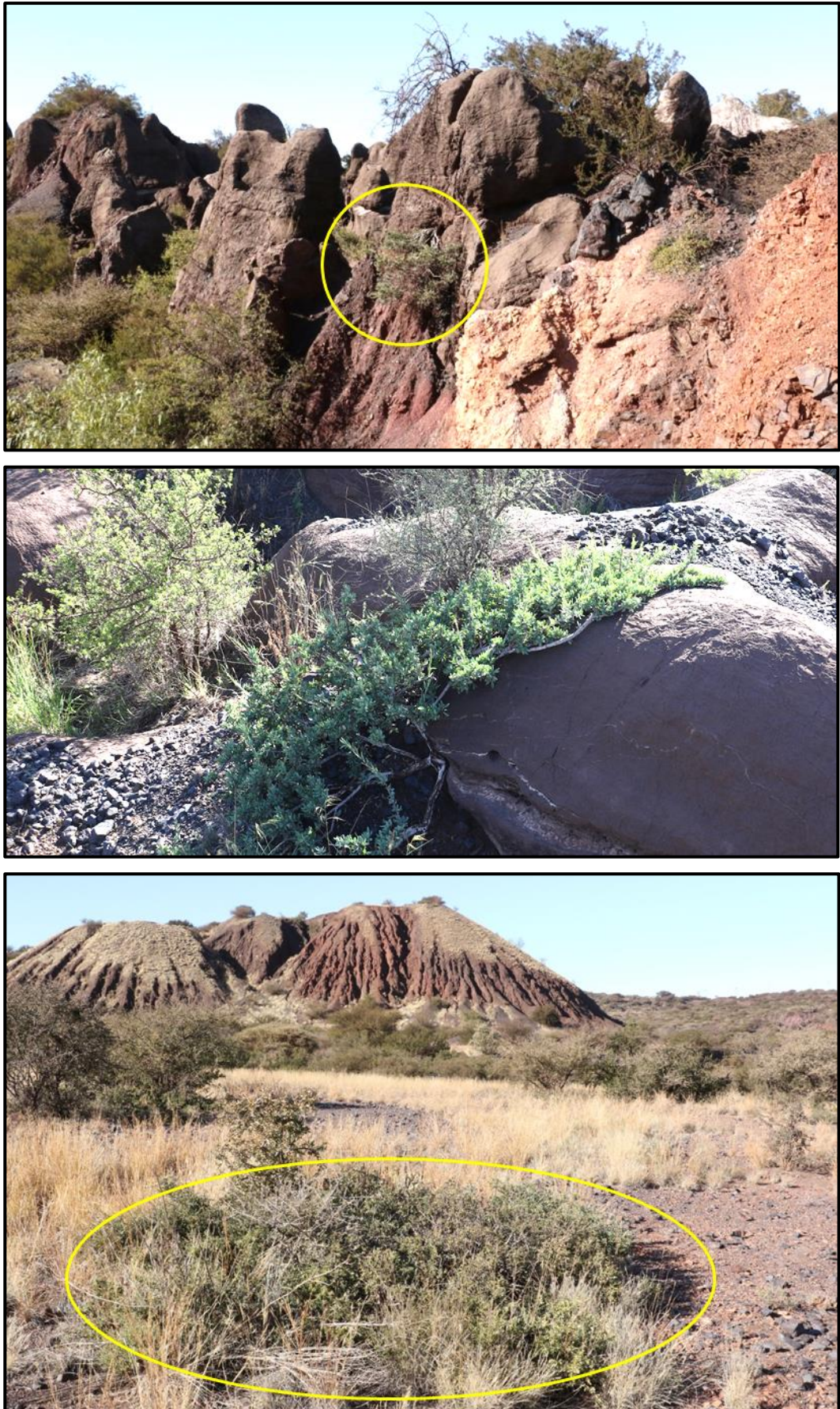


Figure 10. The protected tree *Boscia albitrunca* is widespread across the transformed footprint.

ii) *Olea europaea* – *Heteropogon contortus* open shrubland on dolomitic hills

This plant community is associated with the isolated hills in the north-eastern part of the study area (Figure 8). It is restricted to shallow soil and dolomitic rocks which constitute approximately 20 % of the ground cover. The vegetation is typically presented as an open shrubland, where shrubs are scattered in a grassy matrix (Figure 11).



Figure 11. The open shrubland on dolomitic hills are presented by shrubs that are scattered in a grassy matrix.

The tall shrub stratum is dominated by *Olea europaea* subsp. *africana*, but *Searsia tridactyla* and *Euclea undulata* are also very common. In some areas towards the footslopes *Croton gratissimus* var. *gratissimus* forms dominant patches. Other tall shrubs include *Putterlickia saxatilis*, *Tarchonanthus camphoratus*, *Ehretia alba*, *Euclea crispa*, *Rhigozum obovatum*, *Senegalia mellifera*, *Calobota cuspidosa* and *Lycium* sp. Common low shrubs include *Justicia thymifolia*, *J. puberula*, *Asparagus* sp., *Kleinia longiflora*, *Phyllanthus parvulus*, *Monechma divaricatum*, *Solanum* sp., *Peliostomum origanoides*, *Melolobium candicans*, *Pegolettia retrofracta*, *Thesium lineatum* and *Selago* sp.

The well-developed grass layer is dominated by *Heteropogon contortus*, but *Digitaria eriantha* is also widespread. Other grasses include *Eustachys paspaloides*, *Themeda triandra*, *Fingerhuthia africana*, *Chrysopogon serrulatus*, *Eragrostis nindensis*, *Cenchrus ciliaris*, *Enneapogon scoparius*, *Aristida adscensionis* and *Brachiaria serrata*.

Albucca cf. virens subsp. *virens* is a conspicuous species in this unit and is found widespread within the grassy matrix. Other herbaceous species include *Massonia* sp., *Rhynchosia totta* var. *totta* and *Geigeria* sp.

No nationally protected trees or red list species were encountered in this unit, but provincially protected species include *Olea europaea* subsp. *africana*, *Lessertia frutescens*, *Pelargonium minimum* and *Jamesbrittenia* sp.

iii) ***Searsia tridactyla* – *Aristida diffusa* shrubland on quartzsite hills**

This community is associated with hills of the Gamagara Formation that predominantly line a portion of the south-western border of the study area, but a small portion is also located in the north-western corner (Figure 8). Here, shrubs are scattered in a grassy matrix, with quartzsite boulders and termitaria being conspicuous (Figure 12). Shallow, rocky soil constitutes approximately 20 % of the ground cover.

Searsia tridactyla is the most dominant tall shrub, but shrubs like *Tarchonanthus camphoratus*, *Calobota cuspidosa*, *Ehretia alba*, *Grewia flava*, *Senegalia mellifera* and *Euclea crispa* are also common. Species like *Putterlickia saxatilis*, *Rhigozum obovatum*, *Searsia burchellii*, *S. ciliata*, *S. pyroides*, *Dodonaea viscosa* var. *angustifolia* and *Euclea undulata* are also found here. Common lower shrubs include *Pegolettia retrofracta*, *Phyllanthus parvulus*, *Justicia thymifolia*, *Thesium lineatum*, *Peliostomum origanoides*, *Chrysocoma ciliata*, *Eriocephalus ericoides*, *Hermannia affinis*, *H. vestita*, *Kleinia longiflora*, *Leonotis pentadentata*, *Monechma divaricatum*, *Pollichia campestris* and *Asparagus* spp.

The grass layer is very well developed and particularly species rich. *Aristida diffusa* dominates, but *Enneapogon scoparius*, *Brachiaria serrata*, *Heteropogon contortus*, *Aristida adscensionis*, *Eragrostis chloromelas* and *Stipagrostis uniplumis* are also very common. Other grasses like *Eragrostis lehmanniana*, *E. trichophora*, *E. nindensis*, *Fingerhuthia africana*, *Melinis repens*, *Aristida congesta* subsp. *congesta*, *Anthephora pubescens*, *Cymopogon pospischilii*, *Digitaria eriantha*, *Eustachys paspaloides*, *Schmidtia pappophoroides*, *Sporobolus fimbriatus* and *Themeda triandra* also occur, but at lower densities.

Other species found in this unit include *Cleome rubella*, *Geigeria* sp., *Pellaea calomelanos* and *Cheilanthes eckloniana*, while the exotic *Opuntia lindheimeri* is also found here, especially where this unit transitions from the historic footprint. The listed (declining) *Boophone disticha* is also found here, along with nationally and provincially protected *Boscia albitrunca*, which occurs at densities of two individuals per ha. Species protected provincially include *Pelargonium minimum*, *Olea europaea* subsp. *africana*, *Freesia andersoniae*, *Stapelia* sp. and *Oxalis* sp.



Figure 12. The shrubland on quartzite hills can be defined by the quartzite boulders (top) and termitaria (bottom) found here.

iv) *Tarchonanthus camphoratus* – *Aristida adscensionis* open shrubland on dolomitic limestone

This plant community is associated with the plains in the east (Figure 8), where shallow dark red soils over dolomitic limestone constitute 20 % of the ground cover. The vegetation is presented as an open shrubland where tall shrubs are scattered in a predominantly low growing grassy-shrubby matrix (Figure 13).

Tarchonanthus camphoratus dominates the tall shrub strata, but *Grewia flava*, *Searsia ciliata*, *S. tridactyla*, *Senegalia mellifera*, *Olea europaea* subsp. *africana* and *Ziziphus mucronata* are also very common. *Ehretia alba*, *Euclea crispa*, *Rhigozum obovatum*, *Searsia burchellii*, *S. lancea* and *Vachellia tortilis* are widespread, but occur at much lower densities. Low shrub *Eriocephalus ericoides* is the most conspicuous woody species in the matrix vegetation, followed by *Pentzia calcarea* and *P. incana*, but *P. globosa*, *Aptosimum marlothii*, *Calobota cuspidosa*, *Chrysocoma ciliata*, *Leonotis pentadentata*, *Monechma divaricatum*, *Asparagus* spp. and *Lycium* spp. are also very common. *Barleria rigida*, *Hermannia affinis*, *H. glabrata*, *Plinthus* sp. and *Viscum rotundifolium* occur at much lower densities.

Aristida adscensionis dominate the grass stratum, followed by *Aristida congesta* subsp. *barbicollis* and *Schmidtia pappophoroides*, but *Enneapogon scoparius*, *Fingerhuthia africana*, *Stipagrostis obtusa* and *S. uniplumis* are also very common. Other grasses like *Cymbopogon pospischilii*, *Digitaria eriantha*, *Eragrostis echicochloidea*, *E. lehmanniana*, *E. obtusa*, *E. rigidior*, *E. trichophora*, *Heteropogon contortus*, *Sporobolus fimbriatus*, *Themeda triandra*, *Setaria verticillata*, *Aristida congesta* subsp. *congesta*, *A. stipitata*, *Cenchrus ciliaris*, *Enneapogon cenchroides*, *Pogonarthria squarrosa* and *Tragus* sp. occur at lower densities or have patchy distributions. Other herbaceous species found here include *Dicoma capensis*, *Sesamum triphyllum* and *Geigeria* sp.

The nationally protected trees *Boscia albitrunca* and *Vachellia erioloba* occur in this unit. *B. albitrunca* is widespread, but occur at an estimated density of one individual per hectare, while *V. erioloba* is very scarce and at least one large adult was observed. Other species of conservation concerns include *Gymnosporia buxifolia* and *Crassula setulosa*. Exotic species include *Opuntia lindheimeri*.



Figure 13. The vegetation associated with dolomitic limestone on the plains are presented as an open shrubland where tall shrubs are scattered in a predominantly low growing grassy-shrubby matrix.



Figure 14. The nationally protected *Vachellia erioloba* is scarce in the shrubland of the plains, but at least one tall individual were encountered during the survey (top). *Boscia albitrunca* is more widespread but occurs at low densities (bottom).

v) ***Tarchonanthus camphoratus* – *Stipagrostis uniplumis* shrubland on manganese ridges**

The ridges sandwiched between the plains and the hills of the Gamagara Formation are typically associated with pockets of ferruginous manganese deposits (Figure 8). Here shallow, gravelly soils and rocky outcrops constitute 20 % of the ground cover. Tall shrub stands are common, while grasses and low shrubs grow opportunistically in the shrub canopy gaps (Figure 15).

Tarchonanthus camphoratus is conspicuous, followed by *Searsia tridactyla*, *S. burchellii*, *Olea europaea* subsp. *africana*, *Senegalia mellifera* and *Ehretia alba*. *Justicia thymifolia* is particularly tall in this unit, with individuals up to 2 m being found. Other widespread species include *Putterlickia saxatilis*, *Ziziphus mucronata*, *Calobota cuspidosa*, *Euclea crispa*, *E. undulata*, *Grewia flava*, *Rhigozum obovatum* and *Tarchonanthus obovatus*.

Common low shrubs include *Eriocephalus ericoides*, *Pentzia incana*, *Leonotis pentadentata*, *Felicia filifolia* subsp. *filifolia* and *Pegolettia retrofracta*, while *Aptosimum marlothii*, *Hermannia vestita*, *Monechma divaricatum*, *Sericocoma avolans*, *Asparagus* spp., *Cadaba aphylla*, *Chrysocoma ciliata*, *Osteospermum oppositifolium*, *Hermannia affinis*, *Peliostomum organoides*, *Pentzia calcarea*, *Selago* sp. and *Thesium lineatum* are also found here.

The grass layer is dominated by *Stipagrostis uniplumis*, but *Aristida congesta* subsp. *congesta* and *A. diffusa* are also very common. Other grasses found in this unit include *Aristida adscensionis*, *A. congesta* subsp. *barbicollis*, *Melinis repens*, *Cymopogon pospischilii*, *Enneapogon cenchroides*, *E. scoparius*, *Eragrostis trichophora*, *Fingerhuthia africana*, *Heteropogon contortus*, *Schmidtia pappophoroides* and *Tragus* sp. The herb *Geigeria* sp. is also found here.

Nationally and provincially protected *Boscia albitrunca* is found at estimated densities of one individual per hectare, while provincially protected bulb *Freesia andersoniae* is also found here. No exotic species were encountered.



Figure 15. The vegetation associated with pockets of ferruginous manganese deposits grow on shallow, gravelly soils and rocky outcrops. Here tall shrubs are dominant, while grasses and low shrubs grow opportunistically in the canopy gaps.

vi) *Searsia lancea* – *Vachellia tortilis* woodland along the ephemeral stream

The ephemeral stream is located in the southern half of the study area and drains from the hills and ridges in the west, towards the plains in the east (Figure 8). Although the stream only flows intermittently, the vegetation represents typical riparian woodland. The active channel is not well defined, but it is distinguishable (Figure 16).

Trees and tall shrubs like *Vachellia tortilis*, *Searsia lancea*, *Tarchonanthus camphoratus*, *Ziziphus mucronata* and *Olea europaea* subsp. *africana* (provincially protected) form dense riparian woodland along the stream banks. Here, *Asparagus* spp. are also common. The herbaceous layer is dominated by grass species such as *Sporobolus fimbriatus*, *Panicum maximum*, *Setaria verticillata* and *Eragrostis trichophora*, while exotics like *Tagetes minuta* and *Capsella bursa-pastoris* are also conspicuous. The herbaceous layer is particularly dense in the open canopy.



Figure 16. The vegetation associated with the ephemeral stream forms typical riparian woodland (top). The active channel (yellow line) is not well defined, but distinguishable (bottom).

vii) *Rhigozum trichotomum* – *Eragrostis rigidior* shrubland on red sand

A very small pocket, where red sand constitute approximately 30 % of the ground cover, is found in the south-eastern corner of the study area (Figure 8). It appears as if this unit established opportunistically after wind-blown sand were deposited along this eastern fringe of the Gamagara hills. A very unique species assemblage is found here, but broad transitional zones occur between this unit and those associated with the hills of the Gamagara Formation and the manganese ridges. The density of species of conservation concern is also particularly high here.

The shrub component is primarily stunted, with *Rhigozum trichotomum* being the most dominant species. Other shrubs scattered across the unit include *Tarchonanthus camphoratus*, *Justicia thymifolia*, *Grewia flava*, *Rhigozum obovatum*, *Searsia burchellii*, *S. tridactyla*, *Ehretia alba*, *Senegalia mellifera*, *Putterlickia saxatilis*, *Calobota cuspidosa* and *Ziziphus mucronata*. Dwarf shrubs include *Eriosephalus ericoides*, *Pegolettia retrofracta*, *Pentzia incana*, *Thesium lineatum*, *Monechma divaricatum*, *Felicia fascicularis* and *F. filifolia* subsp. *filifolia*.

The tall grass layer is not very well developed. Here, *Eragrostis rigidior* is most dominant, but *Schmidtia kalahariensis*, *S. pappophoroides*, *Stipagrostis uniplumis*, *Heteropogon contortus*, *Eragrostis trichophora*, *Brachiaria serrata* and *Cymbopogon pospischilii* are also very common.

The nationally protected *Boscia albitrunca* is very conspicuous and occurs at high densities, estimated at approximately five individuals per hectare. They are found as stunted and tall individuals across the unit. Other species of conservation concern include *Gymnosporia buxifolia* and *Olea europaea* subsp. *africana*. No exotics were encountered here.



Figure 17. The shrubland on red sand is represented by stunted tall shrubs, where *Rhigozum obovatum* dominates.

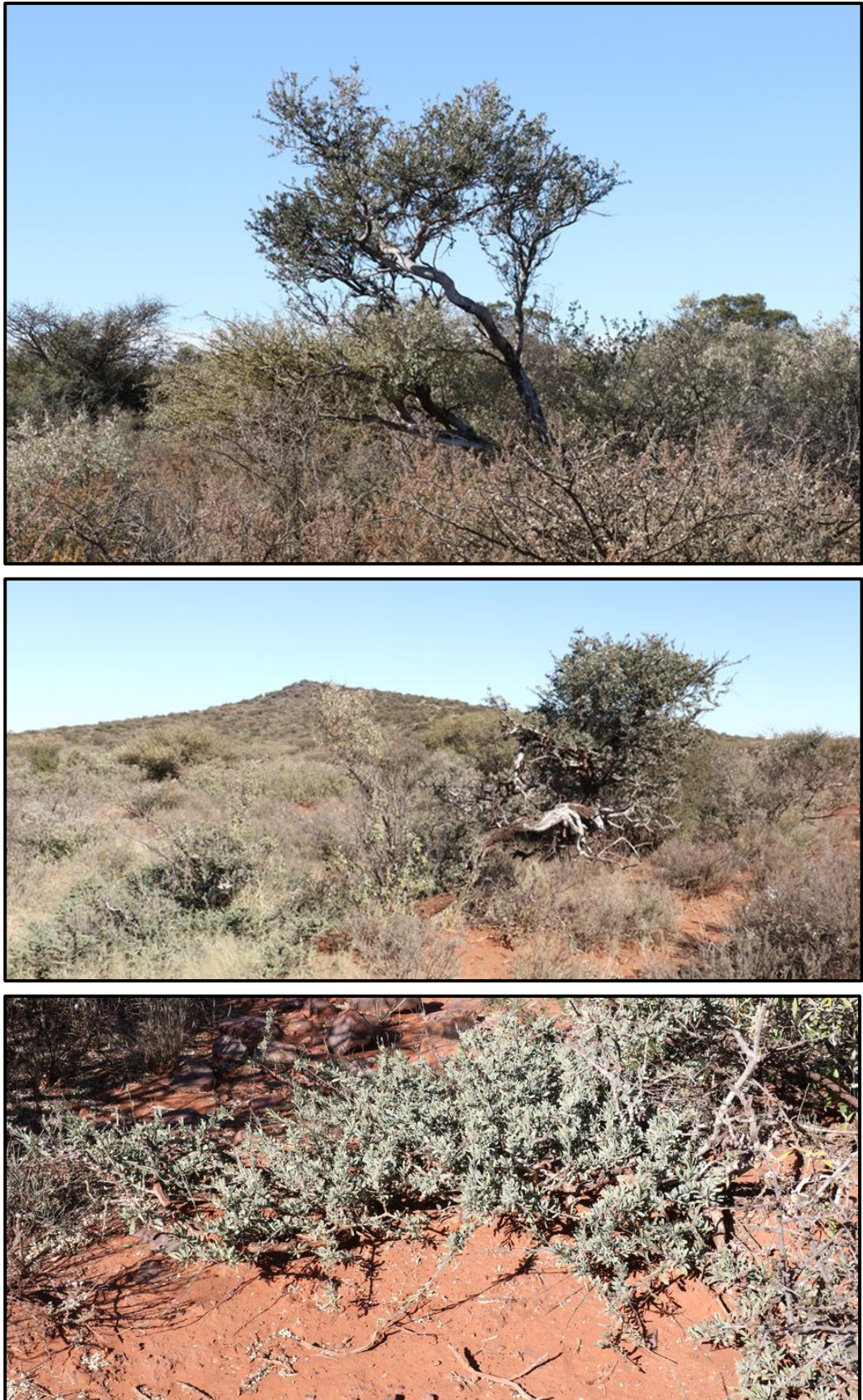


Figure 18. The nationally and provincially protected tree *Boscia albitrunca* is densely distributed on the small pocket of sand found in the south-western corner of the study area.

3.3.3. Population of sensitive, threatened and protected plant species

The SANBI Red List provides information on the national conservation status of South Africa's indigenous plants, while the National Forests Act (No. 84 of 1998) (NFA) and the Northern Cape Nature Conservation Act (Act No. 9 of 2009) (NCNCA) restricts activities regarding sensitive plant species. Section 15 of the NFA prevents any person to cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister. Section 49 (1) and 50 (1) of the NCNCA states that no person may, without a permit pick, transport, possess, or trade in a specimen of a specially protected (Schedule 1) or protected (Schedule 2) plants. Furthermore, Section 51(2) states that no person may, without a permit, pick an indigenous plant (Schedule 3) in such manner that it constitutes large-scale harvesting.

Most of the species recorded for the area are classified as least concern; a category which include widespread and abundant taxa according to the Red List. However, two species are listed to be of conservation concern, i.e. *Boophone disticha* and *Hereroa wilmaniae*. The bulb *B. disticha* is considered to be declining due to habitat loss and because trade volumes suggest unsustainable harvesting. It is however long-lived, widely distributed and can recolonize new sites due to its tumbleweed-like inflorescence. It was encountered in the shrubland on quartzsite hills. The succulent *H. wilmaniae* is classified as Data Deficient - Taxonomically Problematic and although it was not encountered during the survey, historic records suggest that it occurs in the region.

Species found on Glosam that are protected in terms of the NFA include *Vachellia erioloba* and *Boscia albitrunca* (Table 2). *Boscia albitrunca* occurs widespread across the study area, while only one *Vachellia erioloba* individual was encountered on the plains. It is not foreseen that any of these protected tree species will be destroyed during the proposed prospecting operation due to limited impacts associated with drilling. However, if any of the individuals are to be damaged or removed (seedlings to adults) during the operation, an application must be submitted to the Northern Cape Department of Agriculture, Forestry and Fisheries (DAFF) at least three months in advance to ensure that a licence is obtained from DAFF before such activities commence.








Table 2. Plant species found in the study area that are of conservation concern.

FAMILY	Scientific name	Status	NFA	NCNCA
AMARYLLIDACEAE	<i>Boophone disticha</i>	Declining		S2
APOCYNACEAE	<i>Stapelia</i> sp.			S2
CAPPARACEAE	<i>Boscia albitrunca</i>		X	S2
CELASTRACEAE	<i>Gymnosporia buxifolia</i>			S2
CRASSULACEAE	<i>Crassula setulosa</i>			S2
	<i>Kalanchoe rotundifolia</i>			S2
EUPHORBIACEAE	<i>Euphorbia mauritanica</i> var. <i>mauritanica</i>			S2
FABACEAE	<i>Lessertia frutescens</i>			S1
GERANIACEAE	<i>Pelargonium minimum</i>			S1
IRIDACEAE	<i>Freesia andersoniae</i>			S2
MESEMBRYANTHEMACEAE	<i>Hereroa wilmaniae</i>	DDT		S2
OLEACEAE	<i>Olea europaea</i> subsp. <i>africana</i>			S2
OXALIDACEAE	<i>Oxalis</i> sp.			S2
SCROPHULARIACEAE	<i>Jamesbrittenia</i> sp.			S2

Species which are protected in terms of the NCNCA are listed in Table 2. Those encountered during the survey include *Lessertia frutescens*, *Pelargonium minimum*, *Boophone disticha*, *Stapelia* sp., *Boscia albitrunca*, *Gymnosporia buxifolia*, *Crassula setulosa*, *Freesia andersoniae*, *Olea europaea* subsp. *africana*, *Oxalis* sp. and *Jamesbrittenia* sp. If any of these species are to be removed during the operation, a permit for the removal of protected species need to be lodged with the Northern Cape, Department of Environment and Nature Conservation (DENC) before such activities commence. A projection for species of conservation concern is presented in Table 3 and a photographic guide of these species is attached as Appendix 3.

Additionally, according to Section 51(2) of the NCNCA, a permit application needs to be lodged with DENC for the large-scale clearance of indigenous (Schedule 3) vegetation, before such activities commence.

Table 3. A projection of community sizes and species of conservation concern in the study area.

Communities	Total size (ha)	Predicted extent to be affected (ha)	Associated species of conservation concern	Population density (ind/ha)	Estimated population to be affected by prospecting
 <i>Vachellia tortilis</i> – <i>Senegalia mellifera</i> thornveld on historic mine footprint	± 403.72	To be determined	<i>Boscia albitrunca</i>	± 3	Undetermined
 <i>Olea europaea</i> – <i>Heteropogon contortus</i> open shrubland on dolomitic hills	± 49.73	To be determined	<i>Olea europaea</i> <i>Lessertia frutescens</i> <i>Pelargonium minimum</i> <i>Jamesbrittenia</i> sp.	3 1 1 <1	Undetermined
 <i>Searsia tridactyla</i> – <i>Aristida diffusa</i> shrubland on quartzsite hills	± 57.87	To be determined	<i>Boophone disticha</i> <i>Boscia albitrunca</i> <i>Olea europaea</i> <i>Pelargonium minimum</i> <i>Freesia andersoniae</i> <i>Stapelia</i> sp. <i>Oxalis</i> sp.	<1 2 2 3 1 <1 5	Undetermined
 <i>Tarchonanthus camphoratus</i> – <i>Aristida adscensionis</i> open shrubland on dolomitic limestone	± 380.81	To be determined	<i>Boscia albitrunca</i> <i>Vachellia erioloba</i> <i>Gymnosporia buxifolia</i> <i>Crassula setulosa</i>	1 <1 <1 <1	Undetermined
 <i>Tarchonanthus camphoratus</i> – <i>Stipagrostis uniplumis</i> shrubland on manganese ridges	± 177.62	To be determined	<i>Boscia albitrunca</i> <i>Freesia andersoniae</i>	1 3	Undetermined
 <i>Searsia lancea</i> – <i>Vachellia tortilis</i> woodland along the ephemeral stream	± 4.18	To be determined	<i>Olea europaea</i>	2	Undetermined
 <i>Rhigozum trichotomum</i> – <i>Eragrostis rigidior</i> shrubland on red sand	± 3.42	To be determined	<i>Boscia albitrunca</i> <i>Gymnosporia buxifolia</i> <i>Olea europaea</i>	5 <1 1	Undetermined

3.3.4. Weeds and invader plant species

Weeds and invasive species are controlled in terms of the National Environmental Management: Biodiversity (NEMBA) Act 10 of 2004, the Conservation of Agricultural Resources (CARA) Act 43 of 1993, as well as the NCNCA (Schedule 6). These are species that do not naturally occur in a given area and exhibit tendencies to invade that area, and others; at the cost of locally indigenous species. To govern the control of such species, NEMBA and CARA have divided weeds and invader species into categories (see Table 4).

All declared weeds and invasive species recorded in and around the study area are listed in Table 5, along with their categories according to CARA, NEMBA and NCNCA.

Table 4. The categorisation of weeds and invader plant species, according to NEMBA and CARA.

NEMBA	CARA
<p>1a Listed invasive species that must be combatted or eradicated.</p>	<p>1 Plant species that must be removed and destroyed immediately. These plants serve no economic purpose and possess characteristics that are harmful to humans, animals and the environment.</p>
<p>1b Listed invasive species that must be controlled.</p>	<p>2 Plant species that may be grown under controlled conditions. These plants have certain useful qualities and are allowed in demarcated areas. In other areas they must be eradicated and controlled.</p>
<p>2 Listed invasive species that require a permit to carry out a restricted activity within an area.</p>	<p>3 Plant species that may no longer be planted. These are alien plants that have escaped from, or are growing in gardens and are proven to be invaders. No further planting is allowed. Existing plants may remain (except those within the flood line, 30 m from a watercourse, or in a wetland) and must be prevented from spreading.</p>
<p>3 Listed invasive species that are subject to exemptions and prohibitions</p>	

Table 5. A list of declared weeds and invasive species recorded in the study area.

Scientific name	Common name	CARA	NEMBA	NCNCA
<i>Opuntia ficus-indica</i>	Sweet prickly pear	1	1b	S6
<i>Opuntia lindheimeri</i>	Small round - leaved prickly pear	1	1b	S6
<i>Salsola kali</i>	Tumbleweed	-	1b	-
<i>Prosopis glandulosa</i>	Honey mesquite	2	3	S6
<i>Eucalyptus sp.</i>	Gum tree	2	1b	S6

3.3.5. Indicators of bush encroachment

Bush encroacher species are controlled in terms of Regulation 16 of CARA; where land users of an area in which natural vegetation occurs and that contains communities of encroacher indicator plants are required to follow sound practices to prevent the deterioration of natural resources and to combat bush encroachment where it occurs. Declared indicators of bush encroachment in the Northern Cape, which were recorded in and around the study area, are listed in Table 6.

Table 6. A list of declared indicators of bush encroachment in the Northern Cape recorded in the study area.

Scientific name	Common name
<i>Senegalia mellifera</i>	Black thorn
<i>Vachellia tortilis</i>	Umbrella thorn
<i>Euclea crispa</i>	Blue guarri
<i>Euclea undulata</i>	Common guarri
<i>Grewia flava</i>	Wild raisin
<i>Rhigozum trichotomum</i>	Three-thorn rhigozum
<i>Tarchonanthus camphoratus</i>	Camphor bush

3.4. Faunal communities

According to Section 3(a) and 4(a) of the Northern Cape Nature Conservation (NCNCA) Act No. 9 of 2009, no person may, without a permit by any means hunt, kill, poison, capture, disturb, or injure any protected or specially protected animals. Furthermore, Section 12 (1) of NCNCA states that no person may, on a land of which he or she is not the owner, hunt a wild animal without the written permission from the landowner.

3.4.1. Mammals

Numerous habitats are found in the study area and therefore the proposed prospecting site is likely to host a diverse mammal community. As many as 54 terrestrial mammals and seven bat species have been recorded in the region (see Appendix 2). During the site visit species that were encountered include Chacma Baboon, Cape Hare, Rock Hyrax and Common Duiker. Altogether, 16 mammal species of conservation concern could potentially occur on Glosam (Table 7).

Table 7. A list of mammal species found in the region, which are of conservation concern.

Scientific name	Common name	IUCN	SA RDB	NCNCA
<i>Eidolon helvum</i>	African Straw-coloured Fruit-bat	NT		
<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat		NT	
<i>Rhinolophus denti</i>	Dent's Horseshoe Bat		NT	
<i>Orycteropus afer</i>	Aardvark			S1
<i>Parotomys littledalei</i>	Littledale's Whistling Rat		NT	
<i>Gerbilliscus leucogaster</i>	Bushveld Gerbil		DD	
<i>Atelerix frontalis</i>	South African Hedgehog		NT	S1
<i>Proteles cristata</i>	Aardwolf			S1
<i>Felis silvestris</i>	Wild Cat			S1
<i>Felis nigripes</i>	Black-footed Cat	VU		S1
<i>Vulpes chama</i>	Cape Fox			S1
<i>Hyaena brunnea</i>	Brown Hyaena	NT	NT	S1
<i>Otocyon megalotis</i>	Bat-eared Fox			S1
<i>Ictonyx striatus</i>	Striped Polecat			S1
<i>Mellivora capensis</i>	Honey Badger		NT	S1
<i>Manis temminckii</i>	Ground Pangolin	VU	VU	S1

All of the listed bat species have a high potential to occur on site, due to their wide habitat tolerance or affinity for savanna habitats. The Honey Badger and Bushveld Gerbil both have a high potential to occur on site, given the Honey Badger's wide habitat tolerance and the Bushveld Gerbils' association with sandy soils. The South African Hedgehog, Black-footed Cat and Ground Pangolin may occur in the area on account of their preferences for arid areas, but they are all rather skittish and will most likely occur at low densities.

The Littledale's Whistling Rat has a moderate potential to occur on the property on account of its associations with *Lycium* bushes. They mainly prefer riverine habitats, which is only associated with the ephemeral stream, but *Lycium* spp. are common and widespread. The Brown Hyena will most likely not occur in the study area due to the numerous anthropogenic activities that have occurred on the farm over the past 30 years. This fencing network in the area has most likely also restricted their distribution here.

Virtually all mammals of the study area are protected, either according to Schedule 1 or 2 of NCNCA (see Appendix 2). Those that are specially protected include Honey Badger, Striped Polecat, Bat-eared Fox, Brown hyena, Cape Fox, Black-footed cat, Wild Cat, Aardwolf, South African Hedgehog, Ground Pangolin and Aardvark (Table 7). Problem animals (Schedule 4) include Black-backed Jackal, Chacma Baboon, Vervet Monkey and Caracal.

The most invasive prospecting activities will be associated with drilling and is expected to take place in the historic mine footprint and the manganese ridges. Listed mammals that are most likely to be impacted resulting from the prospecting activities include the smaller mammals. This could be through accidental disturbances, accidental road kills, as well as intentional killings when animals are encountered that are believed to be dangerous. Although some areas will be cleared during geophysical surveys and drill pad construction, no significant habitat loss is expected from the proposed activities.

3.4.2. Reptiles

The proposed prospecting site lies within the distribution range of at least 36 reptile species (see Appendix 2), suggesting that the site has relatively low reptile species richness. No listed species are known to occur in the area, but most reptiles of the study area are protected either according to Schedule 1 or 2 of NCNCA (see Appendix 2). Specially protected species include the Flap-necked Chameleon and the Karoo Girdled Lizard.

The habitat diversity for reptiles in the study area is high and includes rocky outcrops, sandy shrubland, open shrubland as well as relatively dense thornveld. The rocky outcrops and hills are considered important habitat for reptiles due to the large number of microhabitats they create. A large proportion of the latter are associated with the earmarked prospecting area, but activities associated with drilling are not expected to have a considerable impact on the reptile community. The operation will cause some habitat disturbance but no habitat loss is expected. Road kills and intentional killings of snakes and reptiles perceived to be dangerous are most likely to be the most significant impact.

3.4.3. Amphibians

Only 12 amphibian species have been recorded in the region (Appendix 2), indicating that the site does not potentially have a diverse frog community. This is however normal for an arid area. No natural permanent water was observed in site that would represent suitable breeding habitats for most of these species, but the ephemeral stream will be important during periods of flow. As a result, only those species which are relatively independent of water are likely to occur regularly in the area.

The Giant Bull Frog is listed as Near Threatened and is protected according to Schedule 1 of the NCNCA. They prefer seasonal shallow grassy pans, vleis and other rain-filled depressions in open flat areas of grassland or savanna, but mainly remain buried up to 1 m underground until conditions become favourable. The site lies within the known distribution of this species and even though it has not been recorded from any of the quarter degree squares around the site, it could potentially occur on site. All other amphibians of the study area are protected according to Schedule 2 of NCNCA (see Appendix 2). Impacts on amphibians are likely to be very low and restricted largely to habitat loss from construction of drill pads.

3.4.4. Avifauna

The site does not fall within or near, i.e. within 150 km, of any of the Important Bird Areas (IBA) defined by Birdlife South Africa. A total number of 259 bird species have been recorded from the area (Appendix 2). This suggests that the area has been reasonably well sampled and that the species list is likely to be fairly comprehensive.

As many as 25 listed bird species are known from the study area, which are classified either as Vulnerable (VU), Near Threatened (NT), Endangered (EN) or Critically Endangered (CR) (Table 8). All birds are protected either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Those that are specially protected (Schedule 1) are also listed in Table 8.

Table 8. Bird species found in the study area that are of conservation concern.

Scientific name	Common name	IUCN	SA Bird Atlas	NCNCA
<i>Accipiter badius</i>	Shikra			S1
<i>Anthropoides paradiseus</i>	Blue Crane	VU	NT	
<i>Anthus crenatus</i>	Rock Pipit		NT	
<i>Aquila rapax</i>	Tawny Eagle		EN	
<i>Aquila verreauxii</i>	Black Eagle		VU	
<i>Ardeotis kori</i>	Kori Bustard	NT	NT	
<i>Bubo africanus</i>	Spotted Eagle Owl			S1
<i>Bubo lacteus</i>	Giant Eagle Owl			S1
<i>Buteo rufofuscus</i>	Jackal Buzzard			S1
<i>Buteo vulpinus</i>	Steppe Buzzard			S1
<i>Caprimulgus europaeus</i>	Eurasian Nightjar			S1
<i>Caprimulgus rufigena</i>	Rufouscheeked Nightjar			S1
<i>Caprimulgus tristigma</i>	Freckled Nightjar			S1
<i>Charadrius pallidus</i>	Chestnutbanded Plover	NT	NT	
<i>Ciconia abdimii</i>	Abdim's Stork		NT	
<i>Ciconia nigra</i>	Black Stork		VU	S1
<i>Circaetus pectoralis</i>	Blackbreasted Snake Eagle			S1
<i>Circus maurus</i>	Black Harrier	VU	NT	S1
<i>Circus pygargus</i>	Montagu's Harrier			S1
<i>Circus ranivorus</i>	African Marsh Harrier		EN	S1
<i>Coracias garrulous</i>	Eurasian Roller	NT	NT	
<i>Cursorius rufus</i>	Burchell's Courser		VU	
<i>Elanus caeruleus</i>	Black-shouldered Kite			S1
<i>Falco biarmicus</i>	Lanner Falcon		VU	S1
<i>Falco chicquera</i>	Red-necked Falcon	NT		S1
<i>Falco naumanni</i>	Lesser Kestrel			S1
<i>Falco peregrinus</i>	Peregrine Falcon			S1
<i>Falco rupicolis</i>	Rock Kestrel			S1

Table 8 (cont.). Bird species found in the study area that are of conservation concern.

Scientific name	Common name	IUCN	SA Bird Atlas	NCNCA
<i>Falco rupicoloides</i>	Greater Kestrel			S1
<i>Gallinula chloropus</i>	Common Moorhen			S1
<i>Glareola nordmanni</i>	Blackwinged Pratincole	NT	NT	S1
<i>Glaucidium perlatum</i>	Pearlspotted Owl			S1
<i>Gyps africanus</i>	White-backed Vulture	CR	CR	S1
<i>Gyps coprotheres</i>	Cape Vulture	EN	EN	S1
<i>Haliaeetus vocifer</i>	African Fish Eagle			S1
<i>Leptoptilos crumeniferus</i>	Marabou Stork		NT	S1
<i>Melierax canorus</i>	Pale Chanting Goshawk			S1
<i>Melierax gabar</i>	Gabar Goshawk			S1
<i>Milvus migrans</i>	Black Kite			S1
<i>Neotis ludwigii</i>	Ludwig's Bustard	EN	EN	S1
<i>Oxyura maccoa</i>	Maccoa Duck	NT	NT	
<i>Phoenicopterus minor</i>	Lesser Flamingo	NT	NT	S1
<i>Phoenicopterus ruber</i>	Greater Flamingo		NT	S1
<i>Polemaetus bellicosus</i>	Martial Eagle	VU	EN	S1
<i>Polihierax semitorquatus</i>	Pygmy Falcon			S1
<i>Polyboroides typus</i>	Gymnogene			S1
<i>Ptilopsis granti</i>	Southern White-faced Owl			S1
<i>Sagittarius serpentarius</i>	Secretarybird	VU	VU	S1
<i>Torgos tracheliotus</i>	Lappet-faced Vulture	EN	EN	S1
<i>Tyto alba</i>	Barn Owl			S1

A number of the listed species are expected to occur on site either as residents or by occasionally passing over the area. None were however observed during the site visit. In general, bird species of the study area are likely to experience very limited disturbances in the form of noise and movement and small-scale local habitat loss as a result of the proposed prospecting activities. This will especially impact those birds that rely on the affected habitats for breeding, nesting and foraging. The disturbances will be confined to the drilling grids and habitat loss is associated with the construction of drill pads. Birds are however highly mobile and are expected to move to similar adjacent habitats, if necessary.

Apart from general disturbances and limited habitat loss, other potential impacts would come from the accidental or intentional killing of birds. Species that are likely to get killed intentionally include vultures and owls, which often fall victim to religious beliefs or the medicinal trade. Monitoring and environmental inductions during the operation would be vital in order to ensure no or low impact.

3.5. Critical biodiversity areas and broadscale processes

The proposed prospecting site does not fall within a Critical Biodiversity Area, any formally protected area, or within a National Protected Areas Expansion Strategy Focus Area. Furthermore, the broadscale vegetation units that cover the study area (Kuruman Mountain Bushveld and Kuruman Thornveld) is classified as least threatened and therefore no formal fine scale conservation planning has been conducted.

Kuruman Mountain Bushveld has however been identified as a medium conservation priority area within the Siyanda Environmental Management Framework. The study area does however not fall within a proposed conservation area for the District Municipality, but has been included within the Siyanda Environmental Control Zone 1; i.e. a zone with potential sensitive groundwater resources. The karst aquifers that occur in the dolomite and lime stone rocks in the area represent a major strategic water resource. It is sensitive both in respect to the abstraction and potential pollution of groundwater. Therefore, a suggested management parameter is to prohibit the bulk storage of hazardous substances as well as unrehabilitated spoil heaps and mine dumps.

The study area also falls within the Griqualand West Centre (GWC) of Endemism (Van Wyk and Smith 2001). A centre of plant endemism is an area with high concentrations of plant species with very restricted distributions, known as endemics. They are extremely vulnerable; relatively small disturbances in a centre of endemism may easily pose a serious threat to its many range restricted species. The GWC (Figure 19) is considered a priority in the Northern Cape, because the number of threats to the area is increasing rapidly. This is a cause of concern, because the GWC is still greatly misunderstood and under researched.

Furthermore, the ephemeral stream of the study area is classified as a water course and is protected in terms of the National Water Act (Act No 36 of 1998).

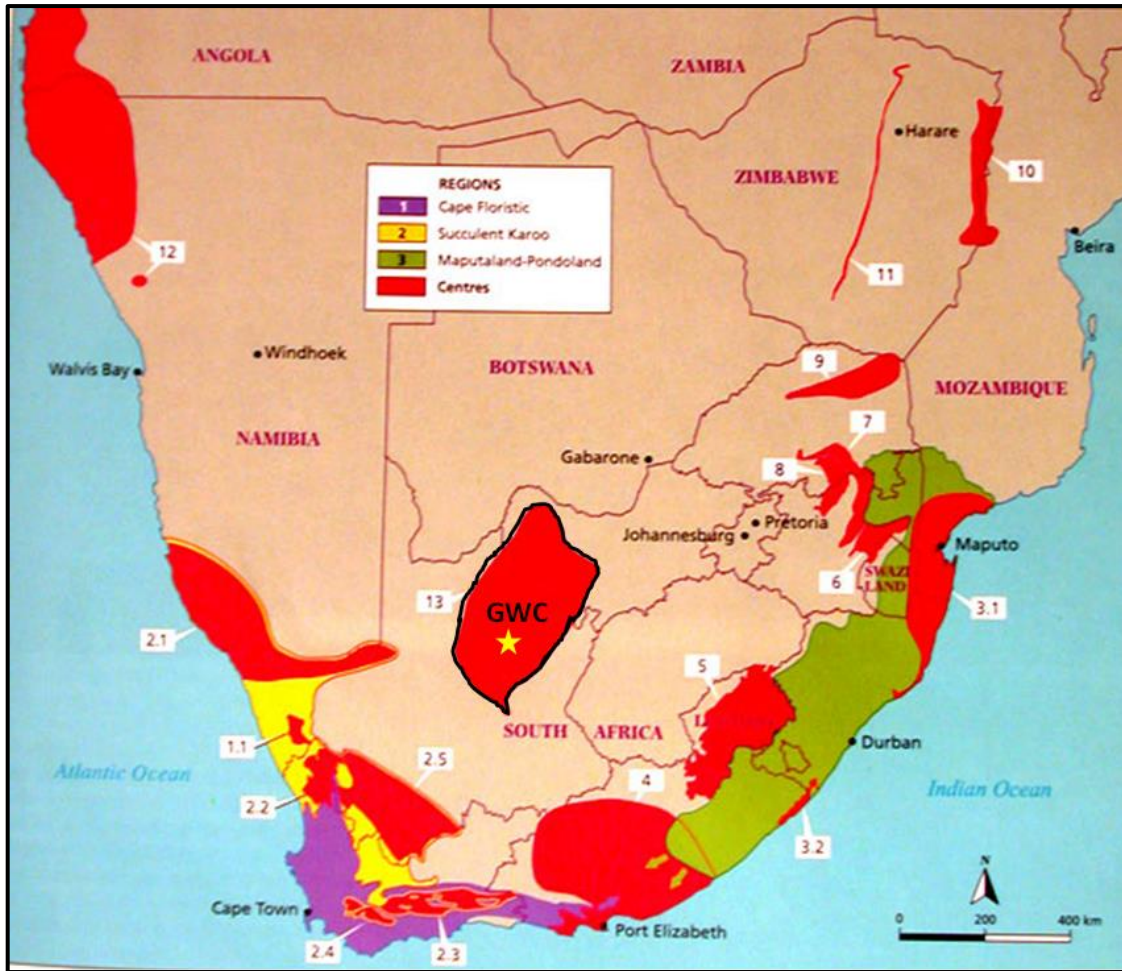


Figure 19. A map indicating the regions of floristic endemism in southern Africa, according to Van Wyk and Smith (2001). The location of the study area is presented by the yellow star.

In addition to the biodiversity elements, the study area falls within a zone where South Africa’s largest economically most important deposits of manganese and the principle deposits of iron ore are found. The manganese zone extends northwards over a distance of 150 km, from just south of Postmasburg to as far as the Wessels and black rock Mines north of Hotazel, while the most significant iron ore deposits occur in the vicinity of Postmasburg and Sishen (Figure 20). Any invasive prospecting activities are therefore expected to contribute to the cumulative effect of mining in the region.

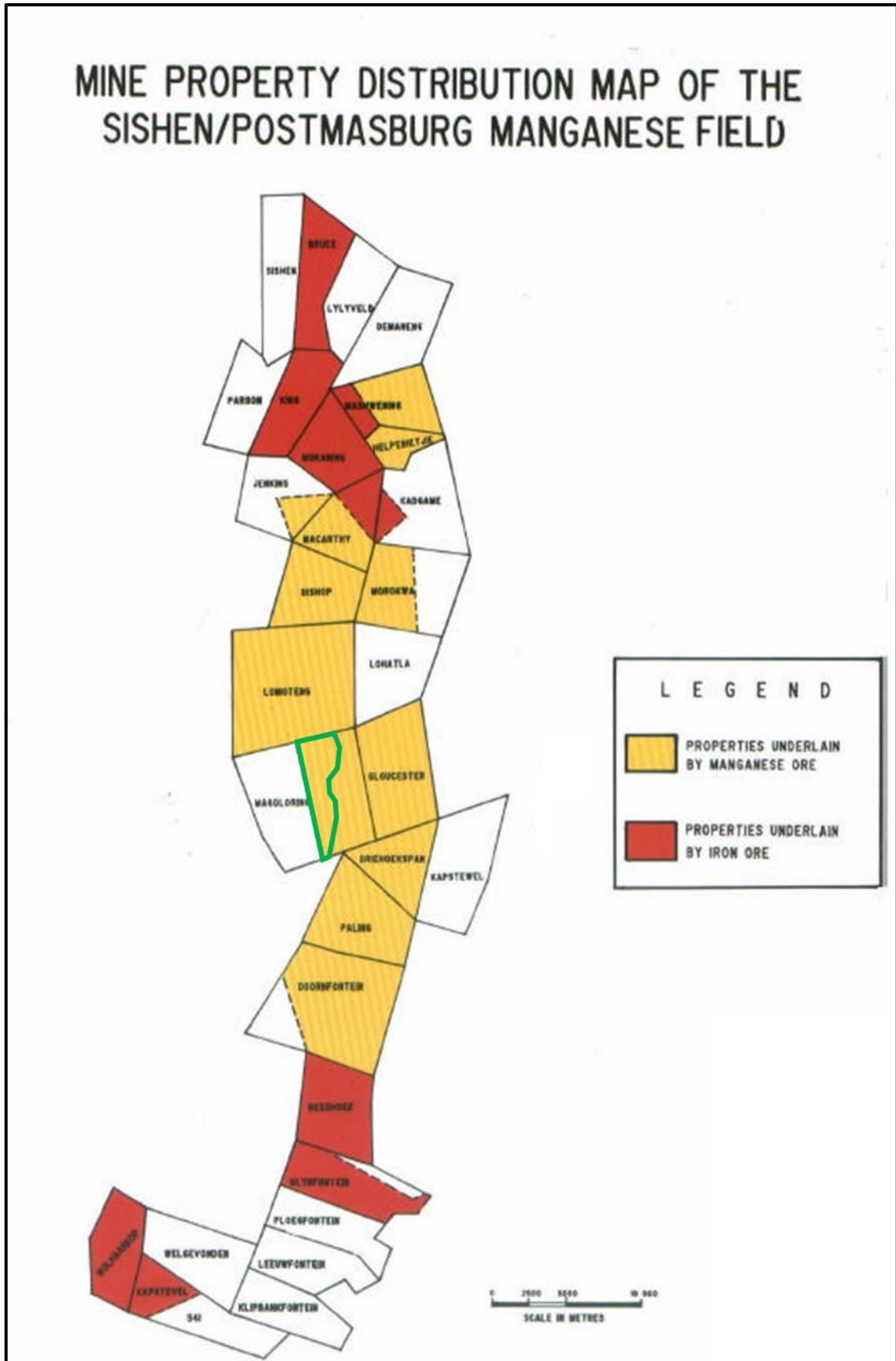


Figure 20. The distribution of mining properties in the Sishen/Postmasburg Manganese Field (Bonga 2005), with the proposed prospecting area indicated in green.

3.6. Site sensitivity

The sensitivity map for the proposed prospecting operation is illustrated in Figure 21. The ephemeral stream is considered to be of very high sensitivity. It is a watercourse, protected in terms of the National Water Act (Act No 36 of 1998) and play important hydrological functional roles in the catchment area. Furthermore, they are thought to host unique species adapted to ephemerality, which causes them to respond only when conditions are ideal. Very little is known about the ecological functioning of ephemeral streams, but it can be expected that when such habitats are destroyed, future generations are lost, along with potentially valuable scientific information.

The small pocket of sand in the south-western corner of the study area are also considered to be of very high sensitivity due to the high density of species of conservation concern, particularly *Boscia albitrunca*, found here. Such isolated communities are islands that usually host unique species assemblages compared to the surrounding communities and should be preserved.

The hills and ridges in the north and south-west of the study area are considered to be of high sensitivity. Not only does a number of protected plant species occur here, but the rocky habitats are believed to provide unique micro habitats to various small mammals, reptiles and birds. Their steep slopes also provide high erosion risks during runoff. The ridges in particular fall within the core area earmarked for prospecting activities.

The remaining shrubland on the plains and the thornveld on historic mine footprint is considered to be of medium sensitivity on account of the low density of protected plant species found on the plains and the vastly transformed landscape of the footprint areas. Activities should nonetheless be strictly controlled in order to limit impacts on the species of conservation concern that do occur within the unit.

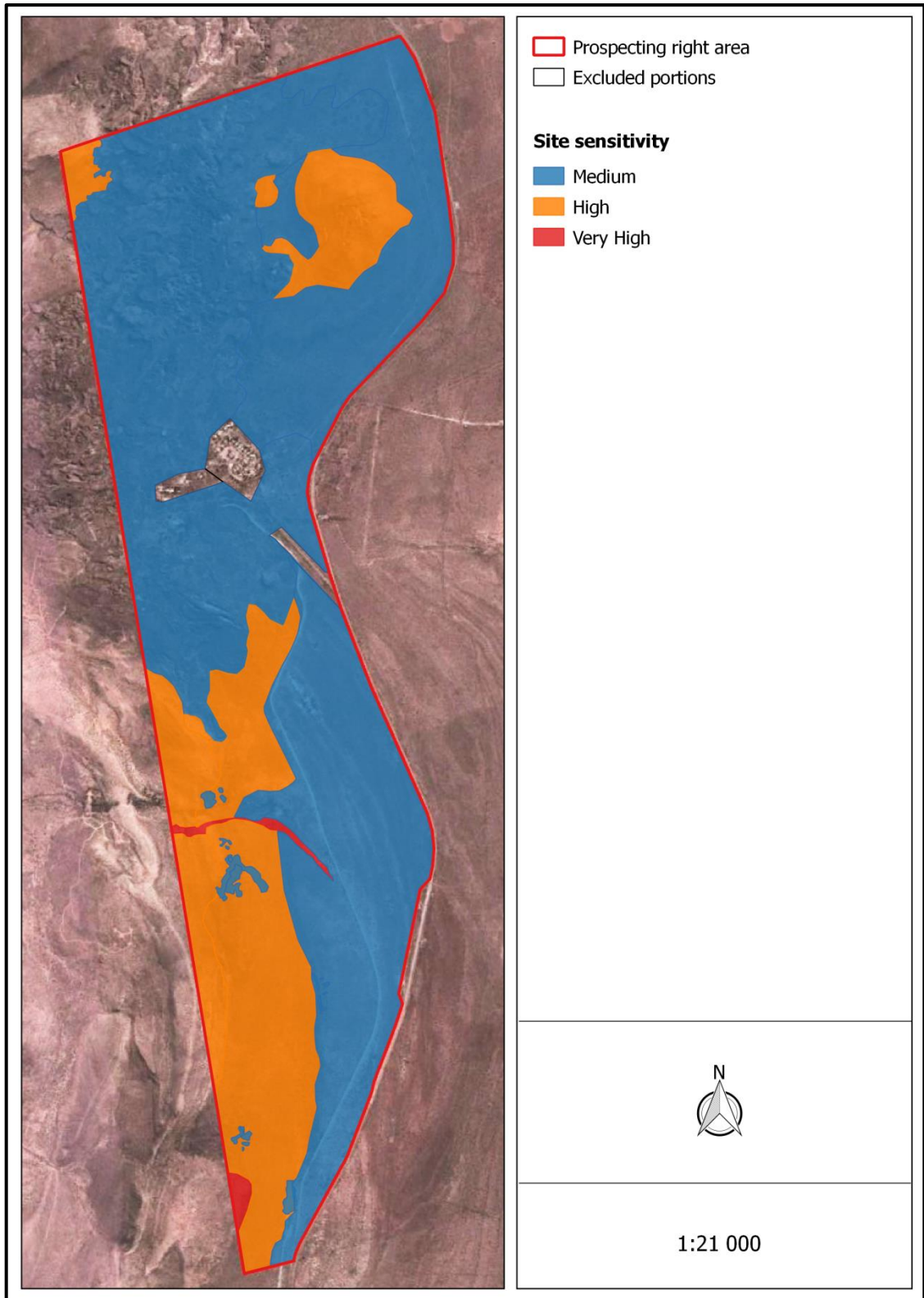


Figure 21. A sensitivity map for the proposed prospecting area.

4. IDENTIFICATION AND NATURE OF IMPACTS

In this section, the potential impacts and associated risk factors that may be generated by the proposed prospecting operation on Glosam are identified. In order to ensure that the impacts identified are broadly applicable and inclusive, all the likely or potential impacts that may be associated with the prospecting activities are listed.

4.1. Vegetation and floristics

4.1.1. Loss of natural and unique habitats

The vegetation in the path of drilling grids and drill pads will be damaged or completely removed. Vegetation clearing during these activities will lead to loss of intact habitat within the prospecting area and habitat disturbances. Such disturbances destroy primary vegetation and can allow secondary pioneers species or invasive plants to enter and re-colonise disturbed area. As primary vegetation is more functional in an ecosystem, this could irreversibly transform the vegetation characteristics in the area.

4.1.2. Loss of Red data and/or protected floral species

There are a number of protected species present at the site, such as *Boscia albitrunca*, *Vachellia erioloba*, *Boophone disticha*, *Lessertia frutescens* and *Pelargonium minimum*. It is possible that some of the protected species would be impacted by the operation. The most profound impacts will most likely be on *Boscia albitrunca* individuals that occur in the path of the drilling grids. Apart from its conservation concern, this tree is valuable sources of shade, especially in arid areas, where mammals seek protection and shade from its canopy. Other fauna also utilise this tree for nesting. Furthermore, the shade that the tree provides serves as a significant microhabitat for invertebrates, suggesting its importance in continuing biodiversity patterns in the region. Further ecological functions provided by the tree include nutrient cycling, diminishing nutrient leaching, mitigating soil degradation, preventing soil erosion, sequestering carbon and replenishing organic matter.

4.1.3. Introduction or spread of alien species

The disturbance created during the operation could encourage the invasion of the disturbed areas by alien species. Although there are not a lot of alien species present within the undisturbed parts of the site, there were some aliens present especially in disturbed areas produced by past mining activities on the farm. This includes *Opuntia* spp, *Prosopis glandulosa* and *Eucalyptus* sp. Some of these species, especially the *Opuntia* spp. will rapidly increase in abundance and expand into the disturbed areas if given the opportunity.

4.1.4. Encouraging bush encroachment

The disturbance created during the prospecting operation could potentially encourage bush encroachment. This is especially likely during the clearing of diverse habitats where opportunity is provided for highly competitive encroaching species like *Senegalia mellifera* to establish.

4.2. Fauna

4.2.1. Habitat fragmentation

The prospecting operation is not expected to cause major habitat transformation or habitat loss. Terrestrial habitats such as rock crevices, burrows, nests and vegetation on which small mammals, insects, amphibians, reptiles and birds are heavily reliant could however be disturbed during the clearing activities associated with the drilling operation, causing temporary displacement of these animals.

If the ephemeral stream is disturbed, some habitat loss will occur to those species that are dependent on it for breeding and foraging during flow periods, such as amphibians and birds.

During the creating of drill roads and pads vegetation will be cleared, which will create unnatural open spaces within the landscape. This might restrict the movement of smaller species and limit their access to foraging sites, but it is not expected to have major impacts on the nutrient cycle or ecological functioning.

4.2.2. Intentional/accidental killing of fauna

Smaller fauna might be killed along with their habitat during the clearing of land. Some species, particularly snakes and lizards are often intentionally killed as they are thought to be dangerous, while vultures and owls are killed for cultural and religious beliefs or for medicinal purposes. Furthermore, vehicular traffic is often a significant cause of accidental road kill.

4.2.3. Anthropogenic disturbances

Disturbance, like drilling activities and vehicular movement, result in disturbances to the naturally occurring faunal species. Possible associated disturbances include increased levels of noise, pollution, vibrations, illumination and human presence. Sensitive and shy fauna would move away from the area during the operation as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the activities and might be killed.

4.3. Topography, soil erosion and associated degradation of ecosystems

The plains of the site are fairly flat and although there are some more sloping areas towards the hills and ridges with higher runoff erosion risks; the minimal amount of disturbances and vegetation clearing created during drilling activities are not expected to leave the site vulnerable to soil erosion. Furthermore, no change to surface topography is expected and therefore local runoff erosion is not considered a likely impact during the operation.

4.4. Broadscale ecological processes

Transformation of intact habitat on a cumulative basis would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. Due to the large extent of mining activities in the region, the Siyanda District and in the Griqualand West Centre of Endemism, the cumulative impacts in the vicinity of the study area are considered to be high, but the proposed prospecting activities on Glosam are not likely to contribute significantly to these cumulative impacts.

5. ECOLOGICAL IMPACT ASSESSMENT

This section provides a detailed analysis of the impacts associated with the proposed prospecting operation. The impacts are assessed in terms of the relevant ecological aspects and each impact is associated with an outline of specific mitigation measures, which with proper implementation, monitoring and auditing, will serve to reduce the significance of the impact.

5.1. Vegetation and floristics

5.1.1. Loss of, and disturbance to indigenous vegetation

Source of the impact

Creation of drilling grids or roads and the clearing of vegetation for drill pads or geophysical surveys; vehicular movement.

Description of the impact

Prospecting activities on site will not significantly reduce the natural habitat for ecological systems to continue their operation. Light vehicle traffic might generate minimal dust which could slightly reduce the growth success and seed dispersal of some small plant species.

Significance of the impact

Severity	+	Spatial Scope	+	Duration	x	Probability	=	Significance
Minimal (1)		On-site (1)		Life of operation (2)		Possible but infrequent (7)		Low (28)

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of cleared areas.
- Encourage the growth of natural plant species.
- Ensure measures for the adherence to the speed limit.

5.1.2. Loss of flora with conservation concern

Source of the impact

Removal of listed or protected plant species; during the creation of drilling grids/roads and drill pads.

Description of the impact

It is possible that prospecting activities will destroy protected species and other species of conservation concern.

Significance of the impact

Severity	+	Spatial Scope	+	Duration	x	Probability	=	Significance
High (3)		On-site (2)		Life of operation (2)		Possible but infrequent (7)		Low (49)

Mitigation and monitoring

- Footprint areas of the prospecting activities must be scanned for Red Listed and protected plant species prior to excavations.
- It is recommended that these plants are identified and marked prior to intended activities.
- These plants should, where possible, be incorporated into the design layout and left in situ. However, if threatened by destruction, these plants should be removed (with the relevant permits from DAFF and/or DENC) and relocated if possible.
- A management plan should be implemented to ensure proper establishment of ex situ individuals, and should include a monitoring programme for at least two years after re-establishment in order to ensure successful translocation.
- The appointment of a full-time ECO must render guidance to the staff and contractors with respect to suitable areas for all related disturbance, and must ensure that all contractors and workers undergo environmental induction prior to commencing with work on site. The environmental induction should occur in the appropriate languages for the workers who may require translation.
- All those working on site must be educated about the conservation importance of the flora occurring on site.

5.1.3. Proliferation of alien vegetation

Source of the impact

Clearing of vegetation.

Description of the impact

The extent of alien invasive species in the area shows the moderate level of past disturbance interference in the natural ecosystem. While general clearing of the area and excavation activities destroy natural vegetation, invasive plants can increase due to their opportunistic nature in disturbed areas. If invasive plants establish in disturbed areas, it may cause an impact beyond the boundaries of the site. These alien invasive species are thus a threat to surrounding natural vegetation and can result in the decrease of biodiversity and ecological value of the area. Therefore, if alien invasive species are not controlled and managed, their propagation into new areas could have a high impact on the surrounding natural vegetation in the long term. With proper mitigation, the impacts can be substantially reduced.

Significance of the impact

Severity		Spatial Scope		Duration		Probability		Significance
Serious (3)	+	Regional (3)	+	Residual (4)	x	Possible during life of operation (9)	=	Medium - High (90)

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of cleared/disturbed areas.
- Encourage the growth of natural plant species.
- Mechanical methods of control to be implemented extensively.
- Annual follow-up operations to be implemented.

5.1.4. Encouragement of bush encroachment

Source of the impact

Clearing of vegetation.

Description of the impact

The extent of bush encroaching species on site shows the moderate level of past disturbance interference in the natural ecosystem, primarily through grazing and historic mining practises. While general clearing of the area destroy natural vegetation, bush encroaching plants can increase due to their opportunistic nature in disturbed areas. If encroaching plants establish in disturbed areas, it may lower the potential for future land use and decrease biodiversity. With proper mitigation, the impacts can be substantially reduced. However, the prospecting activities are not likely to have a substantial contribution to the current encroachment.

Significance of the impact

Severity		Spatial Scope		Duration		Probability		Significance
Medium (2)	+	Local (2)	+	Residual (4)	x	Low likelihood and infrequent (6)	=	Low (48)

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of disturbed areas.
- Encourage the growth of a diverse selection of natural plant species.
- Mechanical methods of control to be implemented selectively.
- Annual follow-up monitoring to be implemented.

5.2. Fauna

5.2.1. Loss, damage and fragmentation of natural habitats

Source of the impact

Clearance of vegetation.

Description of the impact

Prospecting activities and the creation of drilling roads and drill pads will result in minimal loss of connectivity and fragmentation of the natural habitat. It is not expected that these activities will have a substantial fragmentation effect that will lead to the loss of migration corridors, in turn resulting in degeneration of the affected population's genetic make-up.

Significance of the impact

Severity	+	Spatial Scope	+	Duration	x	Probability	=	Significance
High (3)		Regional (3)		Life of operation (2)		Low likelihood and infrequent (6)		Low (48)

Mitigation and monitoring

- All activities associated with the prospecting operation must be planned, where possible in order to encourage faunal dispersal and should minimise dissection or fragmentation of any important faunal habitat type.
- The extent of the earmarked area should be demarcated on site layout plans. No staff, contractors or vehicles may leave the demarcated area except those authorised to do so.
- Those pristine areas surrounding the earmarked area that are not part of the demarcated area should be considered as a no go zone for employees, machinery or even visitors.
- Employ sound rehabilitation measures to restore the characteristics of any potentially affected watercourses.

5.2.2. Disturbance, displacement and killing of fauna

Source of the impact

Vegetation clearing; increase in noise and vibration; human and vehicular movement on site resulting from prospecting activities.

Description of the impact

Transformation of natural habitats will result in the loss of habitat, affecting individual species and ecological processes. This will result in the displacement of faunal species dependent upon such habitat. Increased noise and vibration will disturb and possibly displace birds and other wildlife. Fast moving vehicles may lead to road kills of small mammals, birds, reptiles and amphibians. Intentional killing of snakes, reptiles, vultures and owls will have a negative effect on the local population and red listed species.

Significance of the impact

Severity		Spatial Scope		Duration		Probability		Significance
Medium (2)	+	Regional (3)	+	Life of operation (2)	x	Possible during life of operation (9)	=	Low – Medium (63)

Mitigation and monitoring

- Careful planning of the operation is needed in order to avoid the destruction of pristine habitats and minimise the overall disturbance footprint.
- The extent of the operation should be demarcated on site layout plans. No personnel or vehicles may leave the demarcated area except if authorised to do so. Those areas not included in the earmarked area should be regarded as no go zones.
- A full-time ECO must render guidance to the staff and contractors with respect to suitable areas for all related disturbance.
- Everyone working on site must undergo environmental induction to raise awareness about not harming or collecting species that are often persecuted out of superstition or other reasons. The conservation importance of fauna on site should be conversed.
- Reptiles and amphibians that are exposed during the clearing operations should be captured for later release or translocation by a qualified expert.
- Employ measures that ensure adherence to the speed limit.

5.3. Erosion and loss of soil fertility

5.3.1. Soil erosion

Source of the impact

Drilling grids, roads and drill pads; alterations of the watercourse characteristics.

Description of the impact

Areas where vegetation will be stripped in preparation for placement of any infrastructure, roads or drilling activities will be bare and susceptible to erosion. Any topsoil that is stripped and piled on surrounding areas can be eroded by wind or rain. The soil/sediments will be carried away during runoff.

Significance of the impact

Severity		Spatial Scope		Duration		Probability		Significance
Medium (2)	+	On-site (1)	+	Decommissioning (3)	x	Possible but infrequent (7)	=	Low (42)

Mitigation and monitoring

- Re-establishment of plant cover on disturbed areas must take place as soon as possible, once activities in the area have ceased.
- Ground exposure should be minimised in terms of the surface area and duration to limit potential for wind- or runoff erosion.
- Construction/clearings during the rainy season (November to March) should be monitored and controlled.
- Run-off from exposed ground should be controlled with flow retarding barriers.
- Stockpiled topsoil material are to be stored on the higher lying areas of the footprint area and not in any run-off channels or any other areas where it is likely to cause erosion, or where water would naturally accumulate.
- Regular audits must be carried out to identify areas where erosion is occurring (including linear activities such as roads); followed by appropriate remedial actions.

5.3.2. Loss of soil fertility

Source of the impact

During the removal of topsoil, roads.

Description of the impact

Regular vehicular traffic on roads and improper stockpiling of topsoil can lead to soil compaction, which in turn result in soil sterilisation. Leaching can also occur, resulting in the loss of nutrients.

Significance of the impact

Severity		Spatial Scope		Duration		Probability		Significance
Major (2)	+	On-site (1)	+	Residual (4)	x	Possible but infrequent (7)	=	Low (49)

Mitigation and monitoring

- Topsoil stockpiles must be kept as small as possible in order to prevent compaction and the formation of anaerobic conditions.
- Topsoil must be stockpiled for the shortest possible timeframes in order to ensure that the quality of the topsoil is not impaired.
- Topsoil must not be handled when the moisture content exceeds 12 %.
- The topsoil should be replaced as soon as possible on to the rehabilitated areas, thereby allowing for the re-growth of the seed bank contained within the topsoil.

5.4. Broadscale ecological processes

Source of the impact

The construction of roads and other necessary infrastructure; the clearing of vegetation for drilling grids and drill pads; alterations of characteristics of the watercourse.

Description of the impact

Transformation of intact habitat on a cumulative basis would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. The fragmentation of the riparian habitats will destroy valuable scientific information, while the disturbances of Kuruman Mountain Bushveld vegetation will affect area connectivity of vital ecological corridors and conservation targets within the municipality. Despite the large amount of mining activities in the area, the proposed prospecting activities are not envisaged to contribute substantially to the cumulative effect of these mining operations.

Significance of the impact

Severity		Spatial Scope		Duration		Probability		Significance
Major (4)	+	National (4)	+	Residual (4)	x	Low likelihood during life of operation (8)	=	Medium – High (96)

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of affected areas.
- Encourage the growth of natural plant species.
- Employ sound rehabilitation measures to restore the characteristics of any affected riparian habitats.

6. CONCLUSION, RECOMMENDATIONS AND OPINION REGARDING AUTHORISATION

Seven plant communities were identified on site of which the thornveld on historic mine footprint, shrubland on manganese ridges and woodland along the ephemeral stream are associated with the core prospecting area. These areas are considered to be of medium, high and very high sensitivity respectively. The most profound impacts are expected to be related to the possible accidental/intentional killing of fauna, proliferation of alien invasive species and contribution to the cumulative effects of other mining activities in the region. These impacts are however not considered to significant and can be well mitigated.

Species of conservation concern that are found in these earmarked habitats could potentially be damaged or removed. These specifically include *Boscia albitrunca*, which is widespread across the study area. A licence application regarding protected trees should be lodged with Department of Agriculture, Forestry and Fisheries prior to any potential disturbances to these trees. *Boscia albitrunca* is also protected in terms of the NCNCA, along with species like *Gymnosporia buxifolia*, *Olea europaea* subsp. *africana* and *Pelargonium minimum*, which also occur in the earmarked area. A permit application regarding protected flora as well as the harvesting of indigenous vegetation need to be lodged with the Northern Cape Department of Environment and Nature Conservation prior to any clearance of vegetation.

To conclude, the proposed prospecting activities will not have a major impact on the ecological integrity of Glosam, with associated impacts mainly considered to be low. Authorisation should nevertheless be granted on condition that the applicant commits to the adherence of effective avoidance, management, mitigation and rehabilitation measures.

7. REFERENCES

- ADU. 2016. *Summary Data of the Frogs of South Africa, Lesotho and Swaziland* [Online]. Available: http://adu.org.za/frog_atlas.php.
- ALEXANDER, G. and MARAIS, J. 2007. *A guide to the reptiles of southern Africa*. Struik Nature, Cape Town.
- BATES, F., BRANCH, W. R., BAUER, A. M., BURGER, M., MARAIS, J., ALEXANDER, G. J. and DE VILLIERS, M. S. 2014. *Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Suricata 1*. South African National Biodiversity Institute, Pretoria.
- BIRDLIFESA. 2015. *Important Bird Areas Map* [Online]. Available: <http://www.birdlife.org.za/conservation/important-bird-areas/iba-map>.
- BONGA, M. W. 2005. *An overview of the South African iron, manganese and steel industry during the period 1984 - 2003*. The Director: Mineral Economics, Pretoria.
- DU PREEZ, L. and CARRUTHERS, V. 2009. *A complete guide to the frogs of southern Africa*. Struik Nature, Cape Town.
- FRIEDMANN, Y. and DALY, B. 2004. *Red data book of the mammals of South Africa: a conservation assessment*. CBSG-EWT, Johannesburg.
- GIBBON, G. 2006. *Robert's Multimedia Birds of Southern Africa version 3*. Southern African Birding cc.
- IUCN. 2015. *IUCN Red List of Threatened Species. Version 2015.3* [Online]. Available: www.iucnredlist.org.
- MUCINA, L. and RUTHERFORD, M. C. 2006. *The Vegetation Map of South Africa, Lesotho and Swaziland*. SANBI, Pretoria, South Africa.
- MUCINA, L., RUTHERFORD, M. C. and POWRIE, L. W. 2005. *Vegetation Map of South Africa, Lesotho and Swaziland, 1:1 000 000 (2nd ed.)*. SANBI, Kirstenbosch, South Africa.
- SANBI. 2014. *Red List of South African Plants. Version 2014.1* [Online]. Available: <http://redlist.sanbi.org>.

STUART, C. T. and STUART, M. 2015. *Stuarts Field Guide to Mammals of southern Africa*. Struik Nature, Cape Town.

TAYLOR, M. R., PEACOCK, F. and WANLESS, R. M. 2015. *The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Dunkeld West.

VAN WYK, A. E. and SMITH, G. F. 2001. *Regions of floristic endemism in southern Africa*. Umdaus press, Hatfield.



APPENDICES

APPENDIX 1

Plant species list

Family	Scientific Name	Status	NFA	NCNCA
ACANTHACEAE	<i>Barleria rigida</i>	LC		
	<i>Blepharis marginata</i>	LC		
	<i>Justicia puberula</i>	LC		
	<i>Justicia thymifolia</i>	LC		
	<i>Monechma divaricatum</i>	LC		
AIZOACEAE	<i>Plinthus sp.</i>	LC		
AMARANTHACEAE	<i>Sericocoma avolans</i>	LC		
AMARYLLIDACEAE	<i>Boophone disticha</i>	Declining		S2
ANACARDIACEAE	<i>Schinus molle</i>	Nat ex		
	<i>Searsia burchellii</i>	LC		
	<i>Searsia ciliata</i>	LC		
	<i>Searsia lancea</i>	LC		
	<i>Searsia pyroides</i>	LC		
	<i>Searsia tridactyla</i>	LC		
	APOCYNACEAE	<i>Stapelia sp.</i>	-	
ASPARAGACEAE	<i>Asparagus sp.</i>	-		
ASTERACEAE	<i>Chrysocoma ciliata</i>	LC		
	<i>Cichorium intybus</i> subsp. <i>intybus</i>	Nat ex		
	<i>Dicoma capensis</i>	LC		
	<i>Eriocephalus ericoides</i>	LC		
	<i>Felicia fascicularis</i>	LC		
	<i>Felicia filifolia</i> subsp. <i>filifolia</i>	LC		
	<i>Geigeria sp.</i>	-		
	<i>Helichrysum zeyheri</i>	LC		
	<i>Kleinia longiflora</i>	LC		
	<i>Lopholaena cneorifolia</i>	LC		
	<i>Osteospermum oppositifolium</i>	LC		
	<i>Pegolettia retrofracta</i>	LC		
	<i>Pentzia calcarea</i>	LC		
	<i>Pentzia globosa</i>	LC		
	<i>Pentzia incana</i>	LC		
	<i>Pteronia undulata</i>	LC		
	<i>Tagetes minuta</i>	Nat ex		
	<i>Tarchonanthus camphoratus</i>	LC		
	<i>Tarchonanthus obovatus</i>	LC		
	BIGNONIACEAE	<i>Rhigozum obovatum</i>	LC	
<i>Rhigozum trichotomum</i>		LC		
BORAGINACEAE	<i>Ehretia alba</i>	LC		
BRASSICACEAE	<i>Capsella bursa-pastoris</i>	Nat ex		
	<i>Lepidium africanum</i> subsp. <i>divaricatum</i>	LC		
CACTACEAE	<i>Opuntia ficus-indica</i>	Nat ex		
	<i>Opuntia lindheimeri</i>	Nat ex		
CAPPARACEAE	<i>Boscia albitrunca</i>	LC	X	S2
	<i>Cadaba aphylla</i>	LC		
	<i>Cleome rubella</i>	LC		
CARYOPHYLLACEAE	<i>Pollichia campestris</i>	LC		

Family	Scientific Name	Status	NFA	NCNCA
CELASTRACEAE	<i>Gymnosporia buxifolia</i>	LC		S2
	<i>Putterlickia saxatilis</i>	LC		
CHENOPODIACEAE	<i>Chenopodium carinatum</i>	Nat ex		
	<i>Chenopodium schraderianum</i>	Nat ex		
	<i>Salsola geminiflora</i>	LC		
	<i>Salsola kali</i>	Nat ex		
COMMELINACEAE	<i>Commelina africana</i> var. <i>krebsiana</i>	LC		
CRASSULACEAE	<i>Crassula setulosa</i>	LC		S2
	<i>Kalanchoe rotundifolia</i>	LC		S2
CUCURBITACEAE	<i>Peponium caledonicum</i>	LC		
CYPERACEAE	<i>Bulbostylis humilis</i>	LC		
EBENACEAE	<i>Euclea crispa</i>	LC		
	<i>Euclea undulata</i>	LC		
EUPHORBIACEAE	<i>Acalypha indica</i> var. <i>indica</i>	LC		
	<i>Croton gratissimus</i> var. <i>gratissimus</i>	LC		
	<i>Euphorbia mauritanica</i> var. <i>mauritanica</i>	LC		S2
FABACEAE	<i>Calobota cuspidosa</i>	LC		
	<i>Lessertia frutescens</i>	LC		S1
	<i>Melolobium candicans</i>	LC		
	<i>Prosopis glandulosa</i>	Nat ex		
	<i>Rhynchosia totta</i> var. <i>totta</i>	LC		
	<i>Senegalia mellifera</i>	LC		
	<i>Vachellia erioloba</i>	LC	X	
	<i>Vachellia tortilis</i>	LC		
GERANIACEAE	<i>Pelargonium minimum</i>	LC		S1
HYACINTHACEAE	<i>Albuca</i> cf. <i>virens</i> subsp. <i>virens</i>	LC		
	<i>Massonia</i> sp.	-		
IRIDACEAE	<i>Freesia andersoniae</i>	LC		S2
LAMIACEAE	<i>Leonotis pentadentata</i>	LC		
	<i>Stachys burchelliana</i>	LC		
MALVACEAE	<i>Grewia flava</i>	LC		
	<i>Hermannia affinis</i>	LC		
	<i>Hermannia bryoniifolia</i>	LC		
	<i>Hermannia glabrata</i>	LC		
	<i>Hermannia</i> sp.	-		
	<i>Hermannia vestita</i>	LC		
MESEMBRYANTHEMACEAE	<i>Hereroa wilmaniae</i>	DDT		S2
MOLLUGINACEAE	<i>Pharnaceum viride</i>	LC		
MORACEAE	<i>Ficus cordata</i> subsp. <i>cordata</i>	LC		
MYRTACEAE	<i>Eucalyptus</i> sp.	Nat ex		
NYCTAGINACEAE	<i>Phaeoptilum spinosum</i>	LC		
OLEACEAE	<i>Olea europaea</i> subsp. <i>africana</i>	LC		S2
OXALIDACEAE	<i>Oxalis</i> sp.	-		S2
PEDALIACEAE	<i>Sesamum triphyllum</i>	LC		
PHYLLANTHACEAE	<i>Phyllanthus parvulus</i>	LC		

Family	Scientific Name	Status	NFA	NCNA
POACEAE	<i>Andropogon schirensis</i>	LC		
	<i>Anthephora pubescens</i>	LC		
	<i>Aristida adscensionis</i>	LC		
	<i>Aristida congesta</i> subsp. <i>barbicollis</i>	LC		
	<i>Aristida congesta</i> subsp. <i>congesta</i>	LC		
	<i>Aristida engleri</i> var. <i>ramosissima</i>	LC		
	<i>Aristida stipitata</i>	LC		
	<i>Aristida diffusa</i>	LC		
	<i>Brachiaria serrata</i>	LC		
	<i>Cenchrus ciliaris</i>	LC		
	<i>Chrysopogon serrulatus</i>	LC		
	<i>Cymbopogon pospischilii</i>	LC		
	<i>Digitaria eriantha</i>	LC		
	<i>Enneapogon cenchroides</i>	LC		
	<i>Enneapogon desvauxii</i>	LC		
	<i>Enneapogon scaber</i>	LC		
	<i>Enneapogon scoparius</i>	LC		
	<i>Eragrostis chloromelas</i>	LC		
	<i>Eragrostis echicochloidea</i>	LC		
	<i>Eragrostis lehmanniana</i>	LC		
	<i>Eragrostis nindensis</i>	LC		
	<i>Eragrostis obtusa</i>	LC		
	<i>Eragrostis rigidior</i>	LC		
	<i>Eragrostis rotifer</i>	LC		
	<i>Eragrostis trichophora</i>	LC		
	<i>Eustachys paspaloides</i>	LC		
	<i>Fingerhuthia africana</i>	LC		
	<i>Heteropogon contortus</i>	LC		
	<i>Melinis repens</i>	-		
	<i>Microchloa caffra</i>	LC		
	<i>Panicum arbusculum</i>	LC		
	<i>Panicum maximum</i>	LC		
	<i>Pogonarthria squarrosa</i>	LC		
	<i>Schmidtia kalahariensis</i>	LC		
	<i>Schmidtia pappophoroides</i>	LC		
	<i>Setaria verticillata</i>	LC		
	<i>Sporobolus fimbriatus</i>	LC		
<i>Stipagrostis obtusa</i>	LC			
<i>Stipagrostis uniplumis</i>	LC			
<i>Themeda triandra</i>	LC			
<i>Tragus sp.</i>	-			
PTERIDACEAE	<i>Pellaea calomelanos</i>	LC		
RHAMNACEAE	<i>Ziziphus mucronata</i>	LC		
SANTALACEAE	<i>Thesium lineatum</i>	LC		
	<i>Viscum rotundifolium</i>	LC		
SAPINDACEAE	<i>Dodonaea viscosa</i> var. <i>angustifolia</i>	LC		

Family	Scientific Name	Status	NFA	NCNA
SCROPHULARIACEAE	<i>Aptosimum marlothii</i>	LC		
	<i>Jamesbrittenia sp.</i>	-		S2
	<i>Peliostomum origanoides</i>	LC		
	<i>Selago sp.</i>	-		
	<i>Sutera griquensis</i>	LC		
SINOPTERIDACEAE	<i>Cheilanthes eckloniana</i>	LC		
SOLANACEAE	<i>Lycium sp.</i>	-		
	<i>Solanum sp.</i>	-		
VERBENACEAE	<i>Chascanum garipense</i>	LC		

APPENDIX 2

Faunal species list

LIST OF MAMMALS

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
CHIROPTERA	² <i>Eidolon helvum</i>	African Straw-coloured Fruit-bat	NT	Not listed	Wide habitat tolerance.	High
	² <i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	LC	LC	Wide habitat tolerance.	High
	² <i>Cistugo lesueuri</i>	Lesueur's Hairy Bat	LC	Not listed	Broken country with koppies and cliffs.	High
	² <i>Neoromicia capensis</i>	Cape Bat	LC	LC	Wide habitat tolerance, but often found in arid areas, grassland, bushveld and <i>Acacia</i> woodland. Animals roost under the bark of trees and similar vegetation.	High
	² <i>Nycteris thebaica</i>	Common Slit-faced Bat	LC	LC	Savanna species with wide habitat tolerance. Roosts in caves, mine adits, aardvark holes, rock crevices and hollow trees in open savanna woodland.	High
	² <i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	LC	NT	Wide habitat tolerance.	High
	² <i>Rhinolophus denti</i>	Dent's Horseshoe Bat	LC	NT	Savanna habitats.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CROSCOLIDIDAE	² <i>Macroselides proboscideus</i>	Karoo Round-eared Sengi	LC	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover.	High
	² <i>Elephantulus myurus</i>	Eastern Rock Sengi	LC	LC	Savanna and grassland on rocky outcrops or koppies that provide sufficient cracks and holes for shelter.	High
	² <i>Elephantulus rufescens</i>	Western Rock Sengi	LC	LC	Rocky koppies, rocky outcrops or piles of boulders where these offer sufficient holes and crannies for refuge.	High
TUBULENTATA	¹ <i>Orycteropus afer</i>	Aardvark	LC	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
HYRACOIDEA	² <i>Procavia capensis</i>	Rock Hyrax	LC	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies.	Confirmed
LAGOMORPHA	² <i>Lepus capensis</i>	Cape Hare	LC	LC	Dry, open regions, with palatable bush and grass.	Confirmed
	² <i>Lepus saxatilis</i>	Scrub Hare	LC	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	Moderate
	² <i>Pronolagus rupestris</i>	Smith's Red Rock Rabbit	LC	LC	Rocky slopes and the tops of rocky outcrops of mountains and hills, where grass or scrub vegetation occurs.	High
PHOLIDOTA	¹ <i>Manis temminckii</i>	Ground Pangolin	VU	VU	Prefers savanna woodland in low-lying regions with moderate to dense scrub; average annual rainfall of 250 to 1,400 mm.	Moderate

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
RODENTIA	² <i>Cryptomys hottentotus</i>	African Mole Rat	LC	LC	Wide substrate tolerance; sandy soils to heavier compact substrates, e.g. decomposed schists and stony soils.	High
	² <i>Hystrix africaeaustralis</i>	Cape Porcupine	LC	LC	Catholic in habitat requirements.	High
	² <i>Xerus inauris</i>	South African Ground Squirrel	LC	LC	Open terrain with a sparse bush cover and hard substrate.	High
	² <i>Pedetes capensis</i>	Springhare	LC	LC	Occurs widespread: open sandy ground, sandy scrub, overgrazed grassland, edges of vleis and dry river beds.	High
	² <i>Graphiurus ocellatus</i>	Spectacled Dormouse	LC	LC	Rocky habitats, but also trees.	High
	² <i>Rhabdomys pumilio</i>	Four-striped Grass Mouse	LC	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass cover.	High
	² <i>Mus minutoides</i>	Pygmy Mouse	LC	LC	Wide habitat tolerance.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
RODENTIA	³ <i>Mus musculus</i>	House Mouse	LC	Not listed	Wide habitat tolerance.	High
	² <i>Mastomys coucha</i>	Southern Multimammate Mouse	LC	LC	Wide habitat tolerance.	High
	² <i>Aethomys chrysophilus</i>	Red Rock Rat	LC	LC	Savanna habitats	High
	² <i>Aethomys namaquensis</i>	Namaqua Rock Rat	LC	LC	Catholic habitat requirements, but prefer rocky hills, outcrops or boulder-strewn hillsides.	High
	² <i>Parotomys brantsii</i>	Brants' Whistling Rat	LC	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	Low
	² <i>Parotomys littledalei</i>	Littledale's Whistling Rat	LC	NT	Riverine associations or associated with <i>Lycium</i> bushes or <i>Psilocalon absimile</i> .	Medium

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
RODENTIA	² <i>Otomys unisulcatus</i>	Karoo Bush Rat	LC	LC	Shrub and fynbos associations in areas with rocky outcrops Tend to avoid damp situations but exploit the semi-arid Karoo through behavioural adaptation.	High
	³ <i>Rattus rattus</i>	House Rat	LC	Not listed	Primarily commensal, but also found in a variety of natural and semi-natural habitats	High
	² <i>Saccostomus campestris</i>	Pouched Mouse	LC	LC	Savanna woodland.	Medium
	² <i>Desmodillus auricularis</i>	Cape Short-eared Gerbil	LC	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush.	High
	² <i>Gerbillurus paeba</i>	Hairy-footed Gerbil	LC	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover.	Low

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
RODENTIA	² <i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	LC	DD	Predominantly associated with light sandy soils or sandy alluvium.	High
	² <i>Gerbilliscus brantsii</i>	Highveld Gerbil	LC	LC	Sandy soils or sandy alluvium with some cover of grass, scrub or open woodland.	High
	² <i>Malacothrix typica</i>	Gerbil Mouse	LC	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	Low
PRIMATES	⁴ <i>Cercopithecus pygerythrus</i>	Vervet Monkey	LC	LC	Savanna and open woodland, but is extremely adaptable and versatile species able to persist in secondary and/or highly fragmented vegetation.	High
	⁴ <i>Papio ursinus</i>	Chacma Baboon	LC	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Confirmed

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
EULIPTYPLA	² <i>Crocidura cyanea</i>	Reddish-Grey Musk Shrew	LC	DD	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	High
ERINACEOMORPHA	¹ <i>Atelerix frontalis</i>	South African Hedgehog	LC	NT	Generally found in semi-arid and subtemperate environments with ample ground cover.	Moderate
CARNIVORA	¹ <i>Proteles cristata</i>	Aardwolf	LC	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes.	High
	⁴ <i>Caracal caracal</i>	Caracal	LC	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions.	High
	¹ <i>Felis silvestris</i>	Wild Cat	LC	LC	Wide habitat tolerance.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CARNIVORA	¹ <i>Felis nigripes</i>	Black-footed cat	VU	LC	Associated with arid country, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	Moderate
	² <i>Genetta genetta</i>	Common Genet	LC	LC	Occur in open arid habitats.	High
	² <i>Suricata suricatta</i>	Suricate	LC	LC	Open arid country with hard and stony substrate. Occur in Nama- and Succulent Karoo but also fynbos.	High
	² <i>Cynictis penicillata</i>	Yellow Mongoose	LC	LC	Semi-arid country on a sandy substrate.	High
	² <i>Herpestes sanguineus</i>	Slender mongoose	LC	LC	Wide habitat tolerance.	High
	² <i>Herpestes pulverulentus</i>	Cape Grey Mongoose	LC	LC	Wide habitat tolerance.	High
	² <i>Atilax paludinosus</i>	Marsh mongoose	LC	LC	Mainly restricted to riparian habitats, wherever there is suitable vegetation cover and water in close proximity.	Low

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CARNIVORA	¹ <i>Vulpes chama</i>	Cape Fox	LC	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub.	High
	⁴ <i>Canis mesomelas</i>	Black-backed Jackal	LC	LC	Wide habitat tolerance.	High
	¹ <i>Hyaena brunnea</i>	Brown Hyena	NT	NT	Found in dry areas, generally with annual rainfall of 100 - 700 mm, particularly along the coast, semi-desert, open scrub and open woodland savanna.	Low
	¹ <i>Otocyon megalotis</i>	Bat-eared Fox	LC	LC	Open country with mean annual rainfall of 100-600 mm.	High
	¹ <i>Ictonyx striatus</i>	Striped Polecat	LC	LC	Widely distributed throughout the sub-region.	High
	¹ <i>Mellivora capensis</i>	Honey Badger	LC	NT	Wide habitat tolerance.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CETARTIODACTYLA	² <i>Oreotragus oreotragus</i>	Klipspringer	LC	LC	Rocky and mountainous terrain	High
	² <i>Raphicerus campestris</i>	Steenbok	LC	LC	Inhabits open country.	High
	² <i>Sylvicapra grimmia</i>	Common Duiker	LC	LC	Presence of bushes are important.	Confirmed
	² <i>Thagelaphus strepticeros</i>	Greater Kudu	LC	LC	Mixed scrub woodland on lowlands, hills, and mountains.	High

LIST OF REPTILES

Reptiles protected according to NCNCA are indicated with their respective Schedule no. in superscript.

Family	Scientific name	Common name	Status
AGAMIDAE	³ <i>Agama aculeata aculeata</i>	Western Ground Agama	LC
	³ <i>Agama atra</i>	Southern Rock Agama	LC
AMPHISBAENIDAE	³ <i>Monopeltis capensis</i>	Cape Worm Lizard	LC
	³ <i>Monopeltis infuscata</i>	Dusky Worm Lizard	LC
	³ <i>Zygaspis quadrifrons</i>	Kalahari Dwarf Lizard	LC
CHAMAELEONIDAE	¹ <i>Chamaeleo dilepis</i>	Flap-necked Chamaeleon	LC
COLUBRIDAE	³ <i>Dispholidus typus</i>	Boomslang	LC
	² <i>Philothamnus semivariegatus</i>	Spotted Bush Snake	LC
CORDYLIDAE	¹ <i>Karusasaurus polyzonus</i>	Southern Karusa Lizard	LC
ELAPIDAE	³ <i>Naja nivea</i>	Cape Cobra	LC
GEKKONIDAE	³ <i>Chondrodactylus bibronii</i>	Bibron's Gecko	LC
	³ <i>Pachydactylus capensis</i>	Cape Gecko	LC
	³ <i>Pachydactylus mariquensis</i>	Common Banded Gecko	LC
	³ <i>Ptenopus garrulus garrulus</i>	Common Barking Gecko	LC
GERRHOSAURIDAE	³ <i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	LC
LACERTIDAE	² <i>Heliobolus lugubris</i>	Bushveld Lizard	LC
	² <i>Nucras intertexta</i>	Spotted Sandveld Lizard	LC
	² <i>Pedioplanis lineocellata lineocellata</i>	Spotted Sand Lizard	LC
	² <i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	LC
LAMPROPHIIDAE	² <i>Boaedon capensis</i>	Common House Snake	LC
	² <i>Lamprophis aurora</i>	Aurora House Snake	LC
	³ <i>Psammophis trinasalis</i>	Fork-marked Sand Snake	LC
	³ <i>Psammophylax tritaeniatus</i>	Striped Grass Snake	LC
	² <i>Pseudaspis cana</i>	Mole Snake	LC
LEPTOTYPHLOPIDAE	³ <i>Leptotyphlops scutifrons scutifrons</i>	Peters' Thread Snake	LC
PELOMEDUSIDAE	³ <i>Pelomedusa subrufa</i>	Marsh Terrapin	LC
SCINCIDAE	³ <i>Trachylepis capensis</i>	Cape Skink	LC
	³ <i>Trachylepis sulcata sulcata</i>	Western Rock Skink	LC
	³ <i>Trachylepis variegata</i>	Variegated Skink	LC
TESTUDINIDAE	² <i>Homopus femoralis</i>	Greater Dwarf Tortoise	LC
	² <i>Psammobates oculifer</i>	Serrated Tent Tortoise	LC
	² <i>Psammobates tentorius</i>	Tent Tortoise	LC
	² <i>Stigmochelys pardalis</i>	Leopard Tortoise	LC
TYPHLOPIDAE	³ <i>Rhinotyphlops lalandei</i>	Delalande's Beaked Blind Snake	LC
VARANIDAE	² <i>Varanus albigularis albigularis</i>	Southern Rock Monitor	LC
VIPERIDAE	³ <i>Bitis arietans arietans</i>	Puff Adder	LC

LIST OF AMPHIBIANS

Amphibians protected according to NCNCA are indicated with their respective Schedule no. in superscript

Family	Scientific name	Common name	IUCN status
BUFONIDAE	² <i>Amietophrynus garmani</i>	Eastern Olive Toad	LC
	² <i>Amietophrynus gutturalis</i>	Guttural Toad	LC
	² <i>Amietophrynus poweri</i>	Western Olive Toad	LC
	² <i>Bufo gariensis</i>	Karoo Toad	LC
HYPEROLIIDAE	² <i>Kassina senegalensis</i>	Bubbling Kassina	LC
MICROHYLIDAE	² <i>Breviceps adspersus</i>	Bushveld Rain Frog	LC
PIPIDAE	² <i>Xenopus laevis</i>	Common Platanna	LC
PYXICEPHALIDAE	² <i>Amietia queketti</i>	Common River Frog	LC
	² <i>Cacosternum boettgeri</i>	Boettger's Caco	LC
	¹ <i>Pyxicephalus adspersus</i>	Giant Bullfrog	NT
	² <i>Tomopterna cryptotis</i>	Tremolo Sand Frog	LC
	² <i>Tomopterna tandyi</i>	Tandy's Sand Frog	LC

LIST OF BIRDS

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript

Scientific name	Common name	IUCN status	SA Bird Atlas
¹ <i>Accipiter badius</i>	Shikra	LC	LC
² <i>Acrocephalus baeticatus</i>	African Reed-Warbler	Not listed	LC
² <i>Actitis hypoleucos</i>	Common Sandpiper	LC	LC
² <i>Alcedo cristata</i>	Malachite Kingfisher	LC	LC
² <i>Alopochen aegyptiacus</i>	Egyptian Goose	LC	LC
² <i>Amadina erythrocephala</i>	Red-headed Finch	LC	LC
² <i>Amaurornis flavirostris</i>	Black Crake	LC	LC
² <i>Anas capensis</i>	Cape Teal	LC	LC
² <i>Anas erythrorhyncha</i>	Red-billed Teal	LC	LC
² <i>Anas smithii</i>	Cape Shoveller	LC	LC
² <i>Anas sparsa</i>	African Black Duck	LC	LC
² <i>Anas undulata</i>	Yellow-billed Duck	LC	LC
² <i>Anhinga rufa</i>	African Darter	LC	LC
² <i>Anthoscopus minutus</i>	Cape Penduline-Tit	LC	LC
² <i>Anthropoides paradiseus</i>	Blue Crane	VU	NT
² <i>Anthus cinnamomeus</i>	African Pipit	Not listed	LC
² <i>Anthus crenatus</i>	African Rock Pipit	LC	NT
² <i>Anthus vaalensis</i>	Buffy Pipit	LC	LC
² <i>Apus affinis</i>	Little Swift	LC	LC
² <i>Apus apus</i>	Common Swift	LC	LC
² <i>Apus bradfieldi</i>	Bradfield's Swift	LC	LC
² <i>Apus caffer</i>	White-rumped Swift	LC	LC
² <i>Apus horus</i>	Horus Swift	LC	LC
² <i>Aquila rapax</i>	Tawny Eagle	LC	EN
² <i>Aquila verreauxii</i>	Verreaux's Eagle	LC	VU
² <i>Ardea cinerea</i>	Grey Heron	LC	LC
² <i>Ardea melanocephala</i>	Black-headed Heron	LC	LC
² <i>Ardea purpurea</i>	Purple Heron	LC	LC
² <i>Ardeotis kori</i>	Kori Bustard	NT	NT
² <i>Batis pririt</i>	Pririt Batis	LC	LC
² <i>Bostrychia hagedash</i>	Hadedda Ibis	LC	LC
² <i>Bradornis infuscatus</i>	Chat Flycatcher	LC	LC
² <i>Bradornis mariquensis</i>	Marico Flycatcher	LC	LC
² <i>Bubalornis niger</i>	Red-billed Buffalo-Weaver	LC	LC
¹ <i>Bubo africanus</i>	Spotted Eagle-Owl	LC	LC
¹ <i>Bubo lacteus</i>	Verreaux's Eagle Owl	LC	LC
² <i>Bubulcus ibis</i>	Cattle Egret	LC	LC
² <i>Burhinus capensis</i>	Spotted Thick-knee	LC	LC
¹ <i>Buteo rufofuscus</i>	Jackal Buzzard	LC	LC
¹ <i>Buteo vulpinus</i>	Steppe Buzzard	Not listed	LC
² <i>Calandrella cinerea</i>	Red-capped Lark	LC	LC
² <i>Calendulauda africanoides</i>	Fawn-coloured Lark	LC	LC

LIST OF BIRDS (continued)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript

Scientific name	Common name	IUCN status	SA Bird Atlas
² <i>Calendulauda bradfieldi</i>	Bradfield's Lark	Not listed	LC
² <i>Calendulauda sabota</i>	Sabota Lark	LC	LC
² <i>Calidris alba</i>	Sanderling	LC	LC
² <i>Calidris ferruginea</i>	Curlew Sandpiper	LC	LC
² <i>Calidris minuta</i>	Little Stint	LC	LC
² <i>Campethera abingoni</i>	Golden-tailed Woodpecker	LC	LC
¹ <i>Caprimulgus europaeus</i>	European Nightjar	LC	LC
¹ <i>Caprimulgus rufigena</i>	Rufous-cheeked Nightjar	LC	LC
¹ <i>Caprimulgus tristigma</i>	Freckled Nightjar	LC	LC
² <i>Cercomela familiaris</i>	Familiar Chat	LC	LC
² <i>Cercotrichas coryphoeus</i>	Karoo Scrub-Robin	Not listed	LC
² <i>Cercotrichas paena</i>	Kalahari Scrub-Robin	LC	LC
² <i>Ceryle rudis</i>	Pied Kingfisher	LC	LC
² <i>Charadrius asiaticus</i>	Caspian Plover	LC	LC
² <i>Charadrius pallidus</i>	Chestnut-banded Plover	NT	NT
² <i>Charadrius pecuarius</i>	Kittlitz's Plover	LC	LC
² <i>Charadrius tricollaris</i>	Three-banded Plover	LC	LC
² <i>Chersomanes albofasciata</i>	Spike-heeled Lark	LC	LC
² <i>Chlidonias hybridus</i>	Whiskered Tern	LC	LC
² <i>Chlidonias leucopterus</i>	White-winged Tern	LC	LC
² <i>Chrysococcyx caprius</i>	Diderick Cuckoo	LC	LC
² <i>Ciconia abdimii</i>	Abdim's Stork	LC	NT
² <i>Ciconia ciconia</i>	White Stork	LC	LC
¹ <i>Ciconia nigra</i>	Black Stork	LC	VU
² <i>Cinnyris fusca</i>	Dusky Sunbird	LC	LC
² <i>Cinnyris mariquensis</i>	Marico Sunbird	LC	LC
¹ <i>Circaetus pectoralis</i>	Black-chested Snake-Eagle	LC	LC
¹ <i>Circus maurus</i>	Black Harrier	VU	NT
¹ <i>Circus pygargus</i>	Montagu's Harrier	LC	LC
¹ <i>Circus ranivorus</i>	African Marsh-Harrier	LC	EN
² <i>Cisticola aridulus</i>	Desert Cisticola	LC	LC
² <i>Cisticola fulvicapillus</i>	Neddicky	LC	LC
² <i>Cisticola juncidis</i>	Zitting Cisticola	LC	LC
² <i>Cisticola subruficapillus</i>	Grey-backed Cisticola	LC	LC
² <i>Cisticola tinniens</i>	Levaillant's Cisticola	LC	LC
² <i>Clamator glandarius</i>	Great Spotted Cuckoo	LC	LC
² <i>Clamator jacobinus</i>	Jacobin Cuckoo	LC	LC
³ <i>Colius colius</i>	White-backed Mousebird	LC	LC
² <i>Columba guinea</i>	Speckled Pigeon	LC	LC
² <i>Columba livia</i>	Rock Pigeon	LC	LC
² <i>Coracias caudata</i>	Lilac-breasted Roller	LC	LC
² <i>Coracias garrulus</i>	European Roller	NT	NT
² <i>Coracias naevia</i>	Purple Roller	LC	LC

LIST OF BIRDS (continued)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript

Scientific name	Common name	IUCN status	SA Bird Atlas
³ <i>Corvus albus</i>	Pied Crow	LC	LC
³ <i>Corvus capensis</i>	Black Crow	LC	LC
² <i>Cossypha caffra</i>	Cape Robin-Chat	LC	LC
² <i>Coturnix coturnix</i>	Common Quail	LC	LC
² <i>Creatophora cinerea</i>	Wattled Starling	LC	LC
² <i>Cuculus clamosus</i>	Black Cuckoo	LC	LC
² <i>Cuculus gularis</i>	African Cuckoo	LC	LC
² <i>Cursorius rufus</i>	Burchell's Courser	LC	VU
² <i>Cursorius temminckii</i>	Temminck's Courser	LC	LC
² <i>Cypsiurus parvus</i>	African Palm-Swift	LC	LC
² <i>Dendrocygna viduata</i>	White-faced Duck	LC	LC
² <i>Dendropicos fuscescens</i>	Cardinal Woodpecker	LC	LC
² <i>Dicrurus adsimilis</i>	Fork-tailed Drongo	LC	LC
² <i>Egretta alba</i>	Great Egret	LC	LC
² <i>Egretta garzetta</i>	Little Egret	LC	LC
² <i>Egretta intermedia</i>	Yellow-billed Egret	LC	LC
¹ <i>Elanus caeruleus</i>	Black-shouldered Kite	LC	LC
² <i>Emberiza capensis</i>	Cape Bunting	LC	LC
² <i>Emberiza flaviventris</i>	Golden-breasted Bunting	LC	LC
² <i>Emberiza impetuani</i>	Lark-like Bunting	LC	LC
² <i>Emberiza tahapisi</i>	Cinnamon-breasted Bunting	LC	LC
² <i>Eremomela icteropygialis</i>	Yellow-bellied Eremomela	LC	LC
² <i>Eremopterix verticalis</i>	Grey-backed Sparrowlark	LC	LC
² <i>Estrilda astrild</i>	Common Waxbill	LC	LC
² <i>Estrilda erythronotos</i>	Black-faced Waxbill	LC	LC
³ <i>Euplectes afer</i>	Yellow-crowned Bishop	LC	LC
³ <i>Euplectes orix</i>	Southern Red Bishop	LC	LC
² <i>Eupodotis afraoides</i>	Northern Black Korhaan	LC	LC
² <i>Eupodotis ruficrista</i>	Red-crested Korhaan	LC	LC
¹ <i>Falco biarmicus</i>	Lanner Falcon	LC	VU
¹ <i>Falco chicquera</i>	Red-necked Falcon	NT	LC
¹ <i>Falco naumanni</i>	Lesser Kestrel	LC	LC
¹ <i>Falco peregrinus</i>	Peregrine Falcon	LC	LC
¹ <i>Falco rupicolis</i>	Rock Kestrel	Not listed	LC
¹ <i>Falco rupicoloides</i>	Greater Kestrel	LC	LC
² <i>Fulica cristata</i>	Red-knobbed Coot	LC	LC
² <i>Gallinago nigripennis</i>	African Snipe	LC	LC
¹ <i>Gallinula chloropus</i>	Common Moorhen	LC	LC
¹ <i>Glareola nordmanni</i>	Black-winged Pratincole	NT	NT
¹ <i>Glaucidium perlatum</i>	Pearl-spotted Owlet	LC	LC
² <i>Granatina granatina</i>	Violet-eared Waxbill	LC	LC
¹ <i>Gyps africanus</i>	White-backed Vulture	CR	CR
¹ <i>Gyps coprotheres</i>	Cape Vulture	EN	EN

LIST OF BIRDS (continued)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript

Scientific name	Common name	IUCN status	SA Bird Atlas
² <i>Halcyon chelicuti</i>	Striped Kingfisher	LC	LC
¹ <i>Haliaeetus vocifer</i>	African Fish-Eagle	LC	LC
² <i>Hieraaetus pennatus</i>	Booted Eagle	LC	LC
² <i>Himantopus himantopus</i>	Black-winged Stilt	LC	LC
² <i>Hippolais icterina</i>	Icterine Warbler	LC	LC
² <i>Hirundo albigularis</i>	White-throated Swallow	LC	LC
² <i>Hirundo cucullata</i>	Greater Striped Swallow	LC	LC
² <i>Hirundo dimidiata</i>	Pearl-breasted Swallow	LC	LC
² <i>Hirundo fuligula</i>	Rock Martin	LC	LC
² <i>Hirundo rustica</i>	Barn Swallow	LC	LC
² <i>Hirundo semirufa</i>	Red-breasted Swallow	LC	LC
² <i>Hirundo spilodera</i>	South African Cliff-Swallow	LC	LC
² <i>Indicator indicator</i>	Greater Honeyguide	LC	LC
² <i>Ixobrychus minutus</i>	Little Bittern	LC	LC
² <i>Lagonosticta senegala</i>	Red-billed Firefinch	LC	LC
² <i>Lamprotornis nitens</i>	Cape Glossy-starling	LC	LC
² <i>Laniarius atrococcineus</i>	Crimson-breasted Shrike	LC	LC
² <i>Lanius collaris</i>	Common Fiscal	LC	LC
² <i>Lanius collurio</i>	Red-backed Shrike	LC	LC
² <i>Lanius minor</i>	Lesser Grey Shrike	LC	LC
² <i>Larus cirrocephalus</i>	Grey-headed Gull	LC	LC
¹ <i>Leptoptilos crumeniferus</i>	Marabou Stork	LC	NT
² <i>Malcorus pectoralis</i>	Rufous-eared Warbler	LC	LC
² <i>Megaceryle maxima</i>	Giant Kingfisher	LC	LC
¹ <i>Melierax canorus</i>	Southern Pale Chanting Goshawk	LC	LC
¹ <i>Melierax gabar</i>	Gabar Goshawk	LC	LC
² <i>Merops apiaster</i>	European Bee-eater	LC	LC
² <i>Merops hirundineus</i>	Swallow-tailed Bee-eater	LC	LC
² <i>Milvus aegyptius</i>	Yellow-billed Kite	Not listed	LC
¹ <i>Milvus migrans</i>	Black Kite	LC	LC
² <i>Mirafra fasciolata</i>	Eastern Clapper Lark	Not listed	LC
² <i>Mirafra passerina</i>	Monotonous Lark	LC	LC
² <i>Monticola brevipes</i>	Short-toed Rock-Thrush	LC	LC
² <i>Motacilla capensis</i>	Cape Wagtail	LC	LC
² <i>Muscicapa striata</i>	Spotted Flycatcher	LC	LC
² <i>Myrmecocichla formicivora</i>	Anteating Chat	LC	LC
¹ <i>Neotis ludwigii</i>	Ludwig's Bustard	EN	EN
² <i>Netta erythrophthalma</i>	Southern Pochard	LC	LC
² <i>Nilaus afer</i>	Brubru	LC	LC
² <i>Numenius phaeopus</i>	Common Whimbrel	LC	LC
² <i>Numida meleagris</i>	Helmeted Guineafowl	LC	LC
² <i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	LC	LC
² <i>Oena capensis</i>	Namaqua Dove	LC	LC
² <i>Oenanthe monticola</i>	Mountain Wheatear	LC	LC

LIST OF BIRDS (continued)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript

Scientific name	Common name	IUCN status	SA Bird Atlas
² <i>Oenanthe pileata</i>	Capped Wheatear	LC	LC
² <i>Onychognathus nabouroup</i>	Pale-winged Starling	LC	LC
² <i>Oriolus oriolus</i>	Eurasian Golden Oriole	LC	LC
² <i>Ortygospiza atricollis</i>	African Quailfinch	LC	LC
² <i>Oxyura maccoa</i>	Maccoa Duck	NT	NT
² <i>Parisoma layardi</i>	Layard's Tit-Babbler	LC	LC
² <i>Parisoma subcaeruleum</i>	Chestnut-vented Tit-Babbler	LC	LC
² <i>Parus cinerascens</i>	Ashy Tit	LC	LC
² <i>Passer diffusus</i>	Southern Grey-headed Sparrow	LC	LC
³ <i>Passer domesticus</i>	House Sparrow	LC	LC
³ <i>Passer melanurus</i>	Cape Sparrow	LC	LC
² <i>Passer motitensis</i>	Great Sparrow	LC	LC
² <i>Phalacrocorax africanus</i>	Reed Cormorant	LC	LC
² <i>Phalacrocorax lucidus</i>	White-breasted Cormorant	LC	LC
² <i>Philetairus socius</i>	Sociable Weaver	LC	LC
² <i>Philomachus pugnax</i>	Ruff	LC	LC
¹ <i>Phoenicopterus minor</i>	Lesser Flamingo	NT	NT
¹ <i>Phoenicopterus ruber</i>	Greater Flamingo	LC	NT
² <i>Phylloscopus trochilus</i>	Willow Warbler	LC	LC
² <i>Platalea alba</i>	African Spoonbill	LC	LC
² <i>Plectropterus gambensis</i>	Spur-winged Goose	LC	LC
² <i>Plegadis falcinellus</i>	Glossy Ibis	LC	LC
² <i>Plocepasser mahali</i>	White-browed Sparrow-Weaver	LC	LC
³ <i>Ploceus velatus</i>	Southern Masked-Weaver	LC	LC
² <i>Podiceps cristatus</i>	Great Crested Grebe	LC	LC
² <i>Podiceps nigricollis</i>	Black-necked Grebe	LC	LC
¹ <i>Polemaetus bellicosus</i>	Martial Eagle	VU	EN
¹ <i>Polihierax semitorquatus</i>	Pygmy Falcon	LC	LC
¹ <i>Polyboroides typus</i>	African Harrier-Hawk	LC	LC
² <i>Porphyrio madagascariensis</i>	African Purple Swampphen	LC	LC
² <i>Prinia flavicans</i>	Black-chested Prinia	LC	LC
² <i>Psophocichla litsipsirupa</i>	Groundscraper Thrush	LC	LC
² <i>Pternistis adspersus</i>	Red-billed Francolin	LC	LC
² <i>Pterocles bicinctus</i>	Double-banded Sandgrouse	LC	LC
² <i>Pterocles burchelli</i>	Burchell's Sandgrouse	LC	LC
² <i>Pterocles namaqua</i>	Namaqua Sandgrouse	LC	LC
¹ <i>Ptilopsis granti</i>	Southern White-faced Scops-Owl	LC	LC
³ <i>Pycnonotus nigricans</i>	African Red-eyed Bulbul	LC	LC
² <i>Pytilia melba</i>	Green-winged Pytilia	LC	LC
³ <i>Quelea quelea</i>	Red-billed Quelea	LC	LC
² <i>Rallus caerulescens</i>	African Rail	LC	LC
² <i>Recurvirostra avosetta</i>	Pied Avocet	LC	LC
² <i>Rhinopomastus cyanomelas</i>	Common Scimitarbill	LC	LC
² <i>Rhinoptilus africanus</i>	Double-banded Courser	LC	LC

LIST OF BIRDS (continued)

Birds protected according to NCNCA are indicated with their respective Schedule no. in superscript

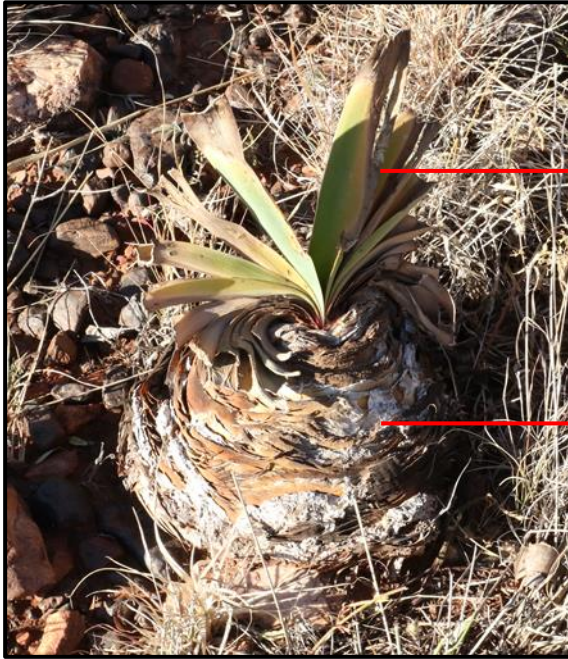
Scientific name	Common name	IUCN status	SA Bird Atlas
² <i>Riparia paludicola</i>	Brown-throated Martin	LC	LC
² <i>Riparia riparia</i>	Sand Martin	LC	LC
¹ <i>Sagittarius serpentarius</i>	Secretarybird	VU	VU
² <i>Scleroptila gutturalis</i>	Orange River Francolin	LC	LC
² <i>Scopus umbretta</i>	Hamerkop	LC	LC
² <i>Serinus albogularis</i>	White-throated Canary	LC	LC
² <i>Serinus atrogularis</i>	Black-throated Canary	LC	LC
² <i>Serinus flaviventris</i>	Yellow Canary	LC	LC
² <i>Sigelus silens</i>	Fiscal Flycatcher	LC	LC
² <i>Spizocorys conirostris</i>	Pink-billed Lark	LC	LC
² <i>Sporopipes squamifrons</i>	Scaly-feathered Finch	LC	LC
² <i>Spreo bicolor</i>	Pied Starling	LC	LC
² <i>Stenostira scita</i>	Fairy Flycatcher	LC	LC
² <i>Streptopelia capicola</i>	Cape Turtle-Dove	LC	LC
² <i>Streptopelia semitorquata</i>	Red-eyed Dove	LC	LC
² <i>Streptopelia senegalensis</i>	Laughing Dove	LC	LC
² <i>Struthio camelus</i>	Common Ostrich	LC	LC
² <i>Sylvia borin</i>	Garden Warbler	LC	LC
² <i>Sylvietta rufescens</i>	Longbilled Crombec	LC	LC
² <i>Tachybaptus ruficollis</i>	Little Grebe	LC	LC
² <i>Tachymarptis melba</i>	Alpine Swift	LC	LC
² <i>Tadorna cana</i>	South African Shelduck	LC	LC
² <i>Tchagra australis</i>	Brown-crowned Tchagra	LC	LC
² <i>Telophorus zeylonus</i>	Bokmakierie	LC	LC
² <i>Threskiornis aethiopicus</i>	African Sacred Ibis	LC	LC
² <i>Tockus leucomelas</i>	Southern Yellow-billed Hornbill	LC	LC
² <i>Tockus nasutus</i>	African Grey Hornbill	LC	LC
¹ <i>Torgos tracheliotus</i>	Lappet-faced Vulture	EN	EN
² <i>Tricholaema leucomelas</i>	Acacia Pied Barbet	LC	LC
² <i>Tringa glareola</i>	Wood Sandpiper	LC	LC
² <i>Tringa nebularia</i>	Common Greenshank	LC	LC
² <i>Tringa stagnatilis</i>	Marsh Sandpiper	LC	LC
² <i>Turdus smithi</i>	Karoo Thrush	Not listed	LC
² <i>Turnix sylvatica</i>	Small Buttonquail	LC	LC
¹ <i>Tyto alba</i>	Barn Owl	LC	LC
² <i>Upupa epops</i>	African Hoopoe	LC	LC
³ <i>Urocolius indicus</i>	Red-faced Mousebird	LC	LC
² <i>Vanellus armatus</i>	Blacksmith Lapwing	LC	LC
² <i>Vanellus coronatus</i>	Crowned Lapwing	LC	LC
² <i>Vidua chalybeata</i>	Village Indigobird	LC	LC
² <i>Vidua macroura</i>	Pin-tailed Whydah	LC	LC
² <i>Vidua regia</i>	Shaft-tailed Whydah	LC	LC
² <i>Zosterops pallidus</i>	Orange River White-eye	LC	LC

APPENDIX 3

**A photographic guide for species of conservation concern known to occur
on site**

Boophane disticha

Declining



Fan-shape leaves

Bulb protruding from the ground.

Hereroa wilmaniae

Data Deficient – Taxonomically Problematic



Lessertia frutescens

All *Lessertia* spp. are protected under Schedule 1 of NCNCA



- Small shrublet with leaves being:
 - Hairy
 - Imparipinnate; i.e. leaflets arranged on either side of the stem, typically in pairs opposite each other, with a single leaflet at the apex.
- Pods are membranous, slightly inflated or compressed
- Typical pea flowers

Pelargonium minimum

Pelargonium spp. are protected under Schedule 1 of NCNCA



***Stapelia* sp.**

APOCYNACEAE spp. are protected under Schedule 2 of NCNCA



Freesia andersoniae

IRIDACEAE spp. are protected under Schedule 2 of NCNCA



Crassula setulosa

CRASSULACEAE spp. are protected under Schedule 2 of NCNCA



Kalanchoe rotundifolia

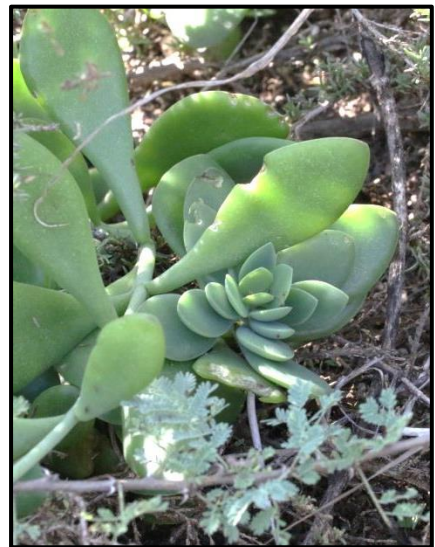
CRASSULACEAE spp. are protected under Schedule 2 of NCNCA



Orange-Pink tubular flowers on a long and slender stem

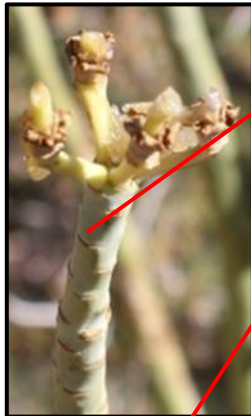


Dry flower heads



Small, rounded/lobed, brittle fleshy leaves

Euphorbia mauritanica* var. *mauritanica
***Euphorbia* spp. are protected under Schedule 2 of the NCNCA**



Leaf scars

Fruit



***Jamesbrittenia* sp.**
***Jamesbrittenia* spp. are protected under Schedule 2 of the NCNCA**



Gymnosporia buxifolia

Gymnosporia spp. are protected under Schedule 2 of the NCNCA



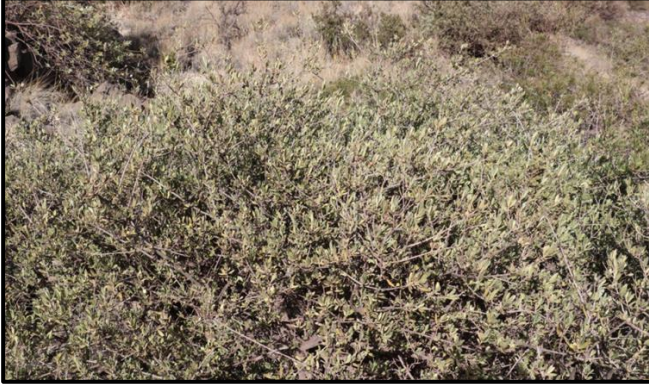
Spiny shrub or small tree.
Leaves in tufts, obovate,
toothed above. Highly
ariable

Many white flowers with
an unpleasant smell in
axillary cymes.

Olea europaea subsp. africana

Protected under Schedule 2 of the NCNCA





Boscia albitrunca

Protected under the NFA and Schedule 2 of the NCNCA



Vachellia erioloba
Protected under the NFA



Pods are thickened and velvety

Spines are often swollen and fused at the base