



September 2015

ESKOM

# Terrestrial Ecology Screening Study for the Proposed 66kV Network Upgrade Project, Kuruman

**Submitted to:**  
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REPORT

**Report Number:** 1417112-13485-1

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### 1.0 INTRODUCTION

Golder Associates Africa (Pty) Ltd was appointed by Zitholele Consulting to conduct a Terrestrial Ecology Screening Study of proposed activities associated with Eskom's 66 kV Power Line Upgrade Project, in the Kuruman district of the Northern Cape, South Africa.

The study focused on presenting a high level ecological characterisation of the proposed project site, with a view to identifying and assessing potential negative ecological impacts associated with the proposed project activities. This report details the findings and recommendations of the ecological screening study.

### 1.1 Project Location

The project is located in the Northern Cape, and extends from the mining town Hotazel in the north to Kuruman, and then runs in a south-westward direction to Kathu (Figure 1). Apart from the aforementioned towns, various other residential settlements and occasional mines, the area remains in a natural, relatively undisturbed condition. A prominent feature in the region is the Kuruman Mountain chain, which runs on a north-west to south-east axis through the study area. Refer to Figure 2 for an aerial image of the study area showing the various power line route alternatives.

### 1.2 Project Description

The proposed electricity infrastructure upgrade project includes the following components:

- Upgrade of the existing 66 kV network to a 132 kV network between Hotazel Substation and Valley Substation south of Kuruman. Upgrading will include:
  - Construction of a 132kV Eldoret, Riries, Moffat and Valley substation next to existing 66kV substations;
  - Expansion of the existing Hotazel Substation;
  - Construction of a new Gamohaam substation between Riries substation and existing Mothibistad switching station;
  - Construction of a 132kV Mothibistad substation next to existing Mothibistad switching station;
  - Construction of 132kV power line between Hotazel Substation and Valley Substation.
- Construction of a new 132 kV power line between the Valley Substation to the newly authorised Sekgame Switching Station, just south of Kathu.
- Decommission the existing 66kV network between Hotazel and Valley Substations. This will include decommissioning of:
  - Existing 66kV infrastructure at the Hotazel substation;
  - Existing 66kV Eldoret, Riries, Asbes, Moffat and Valley substations;
  - Existing Mothibistad switching station;
  - Existing 66kV wooden pole power lines between Hotazel and Valley substations.

It is noted that in order to continue power supply, the exiting 66 kV power lines will only be decommissioned after the installation of the upgraded 132 kV power lines. As such, it has been indicated that the proposed power lines will not necessarily be located within or immediately adjacent to the existing power line servitudes.

Table 1 provides the naming protocol of the different power line stretches and routes alternatives adopted for the environmental authorisation project.



**Table 1: Power line corridor naming protocol**

No.	Power line Sections	Naming of alternatives between substations
1.	Upgrade - Hotazel Substation to Eldoret Substation	Hot-Eldo Alt 1 (16 km) Hot-Eldo Alt 2 (15 km)
2.	Upgrade - Eldoret Substation to Riries Substation	Eldo-Rir Alt 1 (19 km) Eldo-Rir Alt 2 (17 km) Eldo-Rir Alt 3 (27 km)
3.	Upgrade - Riries Substation to Gamohaam Substation	Rir-Gamo Alt 1 (18 km) Rir-Gamo Alt 2 (21 km)
4.	Upgrade - Gamohaam Substation to Mothibistat Substation	Gamo-Mothi Alt 1 (14 km) Gamo-Mothi Alt 2 (13 km)
5.	Upgrade - Mothibistat Substation to Moffat Substation	Mothi-Moffat Alt 1 (11 km) Mothi-Moffat Alt 2 (13 km)
6.	Upgrade - Moffat Substation to Valley Substation	Moffat-Valley Alt 1 (38 km) Moffat-Valley Alt 2 (30 km)
7.	New - Valley Substation to Sekgame Substation	Valley-Sekg Alt 1 (40 km) Valley-Sekg Alt 2 (41 km) Valley-Sekg Alt 3 (21 km) Valley-Sekg Alt 4 (40 km)

## 1.2.1 Construction Activities - Assumptions

Zitholele Consulting have indicated that the following assumptions have been made viz. construction phase activities. These have been considered during the impact assessment component:

- Construction camps will be sited in areas where least disturbance to potentially sensitive environments will be caused;
- Where no existing access tracks exist, access tracks will be clearly demarcated. Vegetation within the demarcated access tracks will be removed, to allow large construction vehicles to gain access the proposed servitude.
- The proposed route corridors are 1 km wide, of which a 31 meter wide servitude is required for the proposed 132kV power line. Trees and shrubs will be cleared where required along the entire length of the servitude for access, erection of the pylons and stringing of the conductor;
- During construction the route will be surveyed, pegged and the soil nominations undertaken for each of the potential pylon foundations;
- Foundations will be laid for the footings of the pylons. The foundations for the pylons will be excavated followed by the reinforcing thereof and finally the concreting of the foundations. The concrete will have to be transported by concrete cement mixer trucks to the required locations.
- The towers will be erected in stages. After the foundations and footings have been installed the construction team will transport the various steel parts of the towers to the site and start erection of the pylons. This process requires manual labour to layout and assemble the towers on the ground. Mobile cranes are used to lift and erect the towers onto their foundations;
- Following the placement of the towers, the conductors and the earth or shield wire will be strung between the towers. Subsequent to completing the stringing of the power line, the power line will be tested prior to being commissioned.



## **2.0 TERMS OF REFERENCE**

The principle aim of the screening study is to provide a high level ecological characterisation of the proposed project site. Specific objectives are therefore to:

- Provide a broad baseline ecological description of the study area;
- Identify habitats (e.g. ridge) or species (e.g. Red Data and protected) of conservation importance or sensitivity;
- Identify potential direct and indirect environmental impacts, associated with the proposed power line, and recommend relevant mitigation and management measures; and
- Provide recommendations for additional, more targeted specialist ecology assessments if required.





# TERRESTRIAL ECOLOGY SCREENING STUDY

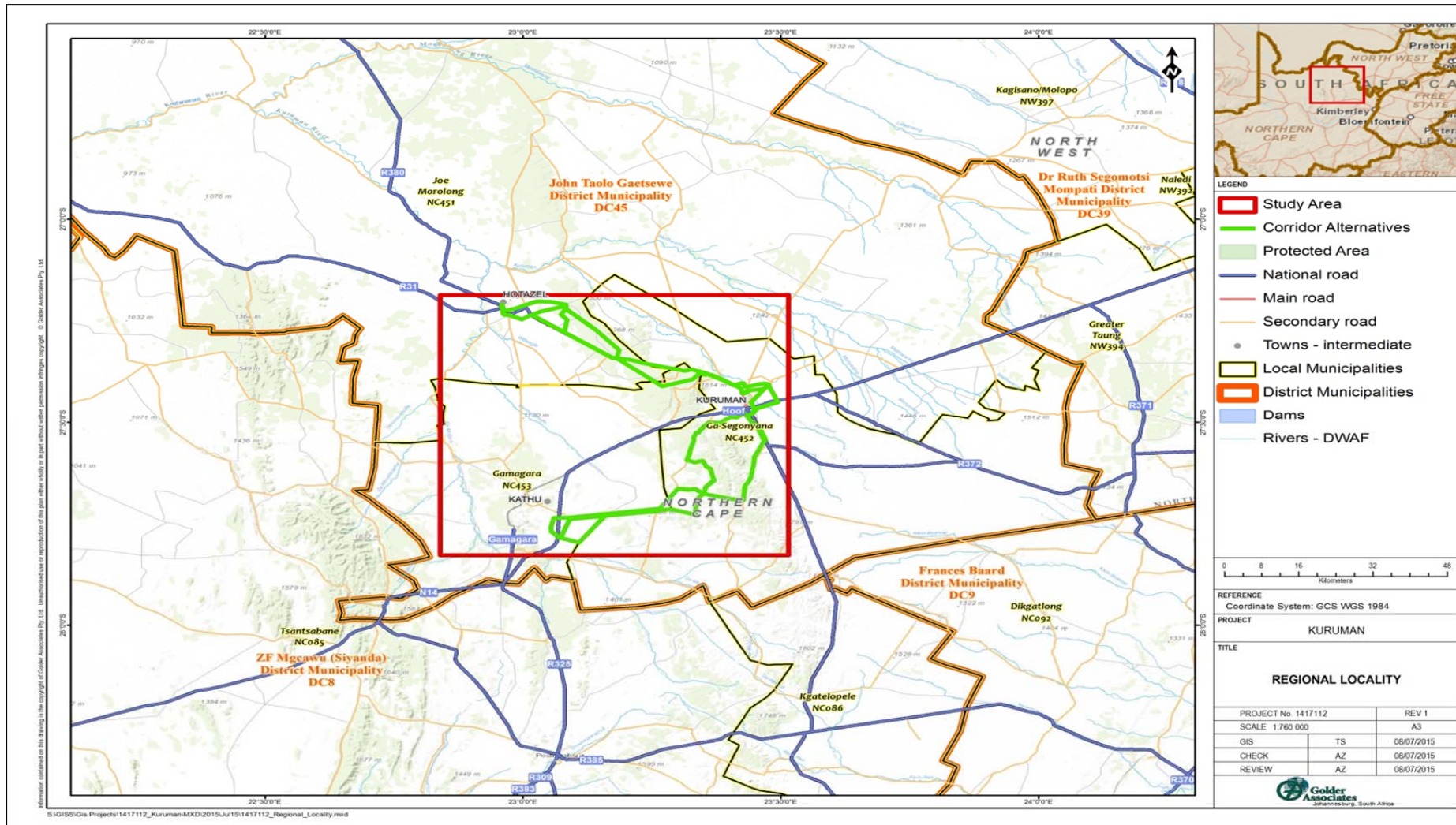


Figure 1: Regional location of the study area



# TERRESTRIAL ECOLOGY SCREENING STUDY

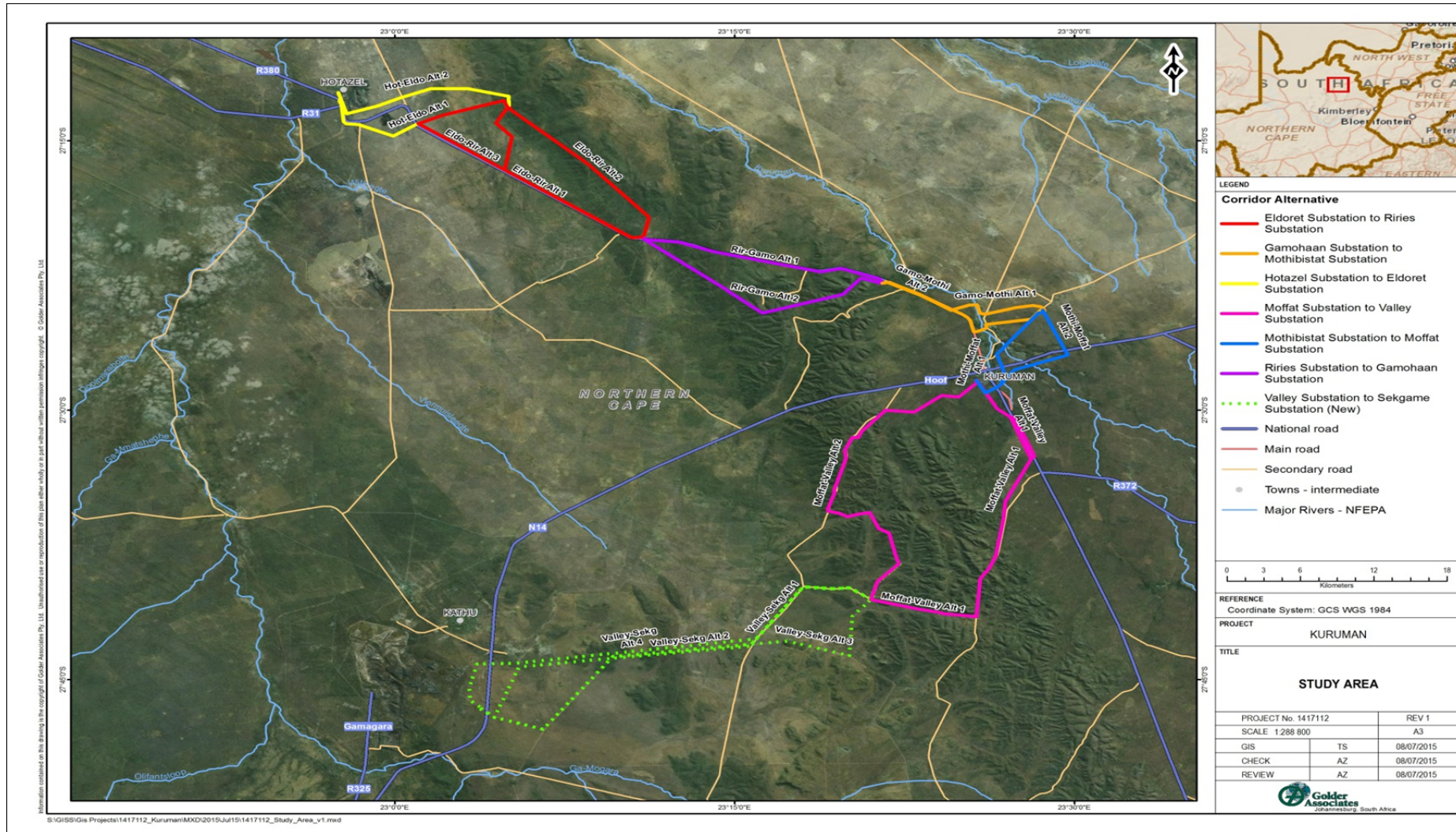


Figure 2: Aerial image of the study area and surrounding landscape, showing the various power line alternatives



### 3.0 LEGISLATIVE FRAMEWORK

The following national and provincial legislation were consulted during the completion of the Terrestrial Ecology Screening Study:

- National Environmental Management Act (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA), specifically with reference to:
  - Threatened or Protected Species List (April 2013);
  - Alien and Invasive Species Lists (August 2014);
  - National List of Ecosystems that are Threatened and in need of Protection (December 2011);
- Environmental Conservation Act (CARA) (Act No. 73 of 1989);
- National Forests Act (Act No. 84 of 1998); and
- Northern Cape Conservation Act (Act No. 9 of 2009), specifically concerning Specially Protected and Protected flora and fauna species as listed under Schedule 1 and 2 of Chapter 12.

### 4.0 METHODOLOGY

The terrestrial ecology screening study consisted of three components; a desktop literature review or screening component, a field programme and an impact assessment component. The tasks associated with each component are summarised below (see Section 5.0: Limitations of Study):

#### 4.1 Literature Review Component

To establish a baseline ecological characterisation of the study area, the following tasks were undertaken at a desktop level prior to undertaking a field visit:

##### 4.1.1 Vegetation Types and Flora Species

- A biome level description was obtained from Scholes & Walker (1993). General vegetation type descriptions relevant to the study area were obtained by consulting Mucina & Rutherford (2006).;
- The formal conservation context of the region at a national level was established in terms of the National List of Threatened Ecosystems (NEMBA, 2011); and
- Potential flora species likely to occur in the study area were based on existing records for the 2722BB, 2723AA, 2723AC, 2723AD, 2723CB, 2723CA, and 2723CC Quarter Degree Squares (QDS) as presented by South African National Biodiversity Institute's (SANBI) Plant of South Africa (POSA) database.

*For full references for the cited literature and databases, refer to Section 9.0.*

##### 4.1.2 Fauna Characterisation

###### Mammals

A list of expected mammal species was compiled by consulting Stuart & Stuart (2007) and MammalMAP (Animal Demographic Unit, 2011).

###### Birds

A list of expected bird species was compiled based on the South African Bird Atlas Project 2 (SABAP 2) list of birds previously recorded in relevant QDS's.



### Herpetofauna (reptiles and amphibians)

Expected reptile and amphibian species lists were compiled by consulting various field guides including Branch (1994), Alexander & Marais (2010) and Bates *et al.* (2014) for reptiles and Minter *et al.* (2004) and Du Preez & Carruthers (2009) for amphibian species. Data were also sourced from the Animal Demographic Unit's (2011) ReptileMAP and FrogMAP.

*For full references for the cited literature and databases, refer to Section 9.0.*

#### 4.1.3 Alien Invasive Species

South African legislation concerning exotic invasive species that were considered for this study includes:

- The Conservation of Agricultural Resources Act (CARA) (No. 43 of 1983) as amended; and
- The National Environmental Management: Biodiversity Act (NEMBA) (2004) (No. 10 of 2004), 1<sup>st</sup> August 2014 listings.

#### 4.1.4 Species of Conservation Importance

- International Union for the Conservation of Nature (IUCN) Red List of Threatened Species – Regional/National Statuses, as per:
  - Red List of South African Plants Version (SANBI, version 2014.1, online);
  - Red Data Book of Mammals of South Africa (Friedmann & Daly 2004);
  - Regional Red List for Birds of South Africa, Lesotho and Swaziland (Birdlife South Africa, 2014, online);
  - Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates, et al., 2014);
  - Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (Minter *et al.* 2004).
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004) - Threatened or Protected Species List (Notice 389 of 2013) (NEMBA TOPS List 2013);
- National Forests Act (Act No. 84 of 1998) – List of Protected Tree Species; and
- Northern Cape Conservation Act (Act No. 9 of 2009) - Lists of Specially Protected and Protected Species.

### 4.2 Field Screening Methodology

Considering the extent of the study area, the field visit focused on a conducting high-level screening assessment of the project area to augment the findings of the desktop literature review. Primary aspects that were considered include general habitat characteristics and condition. The field visit was conducted from the 30<sup>th</sup> March to 3<sup>rd</sup> April 2015, and the following field screening techniques were followed:

- Points along the various proposed power line corridors were visited for field screening. Sampling points were chosen based on accessibility and to ground-truth potential representative habitat forms, as identified using satellite imagery
- At each sampling point, a transect line was walked and flora species encountered were recorded and general notes on dominance/abundance and vegetation structure were made. Notes on topography, soil condition and habitat condition, including disturbances were also recorded.
- Fauna screening was limited to passive surveying only. Fauna species presence was based on:
  - Opportunistic encounters in the study area;



- Evidence of their presence in the form of feeding signs, spoor, burrows, nests faeces; and
- Anecdotal evidence provided by local farmers and land users.

**4.2.1 Habitat Unit Sensitivity Analysis**

Habitat sensitivity was determined by subjectively assessing the ecological integrity/vulnerability and conservation importance/irreplaceability of identified habitat units in the study area, based on the results of the field programme and on information gathered during the literature review. The indices and attributes described in Table 2 were developed by Golder Associates Africa and used to guide the analysis.

**Table 2: Rating of habitat sensitivity**

	Ecological Integrity / Vulnerability	Conservation Importance / Irreplaceability
<b>HIGH</b>	<p>Habitats of high ecological integrity have compositional, structural and functional characteristics that are close to the natural/sustainable state (i.e. reference conditions). As such, they have a combination of the following attributes:</p> <ul style="list-style-type: none"> <li>■ Key flora and faunal indicators are present or highly likely to be present.</li> <li>■ Large habitat patch that is mostly unfragmented and has a high level of connectivity to adjacent natural habitat patches.</li> <li>■ Has little to no evidence of anthropogenic disturbances (pollution, earth works, etc.).</li> <li>■ Little or no alien invasive species establishment</li> </ul>	<p>Habitats of high conservation importance or irreplaceability have one or a combination of the following attributes:</p> <ul style="list-style-type: none"> <li>■ Pristine or relatively undisturbed habitat displaying high species richness.</li> <li>■ Areas playing an important functional role in ecological processes at a landscape scale (e.g. high levels of connectivity, source patches, water attenuation, etc.).</li> <li>■ Niche or relatively rare/unique habitat within the landscape which contributes to overall habitat heterogeneity.</li> <li>■ Areas designated by provincial or national authorities as of high conservation importance, sensitivity or irreplaceability.</li> <li>■ Areas with confirmed presence or high probability of occurrence of Red List and/or protected species.</li> </ul>
<b>MODERATE</b>	<p>Habitats of moderate ecological integrity have a combination of the following attributes:</p> <ul style="list-style-type: none"> <li>■ Moderate levels of anthropogenic disturbance.</li> <li>■ Despite disturbances, habitat maintains much of the same functional attributes as areas in a natural/sustainable state.</li> </ul>	<p>Habitats of moderate conservation importance have a combination of the following attributes:</p> <ul style="list-style-type: none"> <li>■ Intermediate levels of species richness.</li> <li>■ No or low probability of Red List and/or protected species as determined by critical habitat assessments.</li> <li>■ Disturbed areas that are situated adjacent to habitat of high ecological integrity and/or conservation importance and therefore may play a role as an ecological support area.</li> </ul>
<b>LOW</b>	<p>Habitats of low ecological integrity have a combination of the following attributes:</p> <ul style="list-style-type: none"> <li>■ Severely modified from natural state as a consequence of anthropogenic activities, with poor species richness and all or most key flora and fauna indicators absent.</li> <li>■ Highly fragmented areas, with little or no connectivity to adjacent natural habitat.</li> <li>■ High incidence of alien species establishment.</li> <li>■ Successful rehabilitation may restore some degree of habitat integrity.</li> </ul>	<p>Habitats of low conservation importance are typically transformed or highly disturbed, with little or no ecological integrity. These areas are species poor and in their current form play little role in ecological processes and thus cannot contribute toward biodiversity conservation.</p>
<b>Negligible</b>	<p>Completely transformed or developed areas with no natural habitat remaining and no scope for rehabilitation.</p>	<p>Completely transformed or developed areas with no natural habitat remaining and no scope for rehabilitation.</p>



### 5.0 LIMITATIONS OF STUDY

The terrestrial ecology screening report should be read with the following limitations in mind:

- The field visit comprised one screening visit only. This was undertaken during the early dry season when many plants are dormant or not readily identifiable; and
- No intensive quantitative flora and fauna sampling was undertaken as part of the work scope. The field visit was aimed at ground-truthing the findings of the desktop literature review and to provide a high-level ecological characterisation of the study area and identify any specific sites/species of potential concern.

### 6.0 BASELINE ECOLOGICAL CHARACTERISATION

#### 6.1 General Biophysical Environment

The study area is located in the savanna biome and comprises elements of five vegetation types, as delineated by Mucina & Rutherford (2006); namely Kuruman Thornveld (Mapping Unit SVk9), Kuruman Mountain Bushveld (Mapping Unit SVk10), Kathu Bushveld (Mapping Unit SVk12) (Figure 3). The characteristics of the savanna biome and the relevant vegetation types are discussed below:

##### 6.1.1 Savanna Biome

The savanna biome is the largest in South Africa, covering approximately 35% of the country's land surface (Scholes & Walker, 1993). Savannas are characterised by a dominant grass layer, over-topped by a discontinuous, but distinct woody plant layer. Compositionally, Africa's savannas are distinguished as either fine-leaved savannas or broad-leaved savannas, based primarily on the fertility of the underlying substrate (Scholes & Walker, 1993).

Fine-leaved savannas typically occur on nutrient rich soils and are dominated by microphyllous woody species of the *Mimosaceae* family (common genera; *Acacia* & *Albizia*) and a productive, diverse herbaceous layer, dominated by grasses (Scholes & Walker, 1993). These savannas can support a high population of grazing and browsing herbivores. Conversely, broad-leaved savannas usually occur on nutrient poor soils and are dominated by macrophyllous woody species, from the *Combretaceae* family (common genera; *Combretum* & *Terminalia*). Compared to fine-leaved savannas, broad-leaved savannas are less productive and support a lower herbivore biomass (Scholes & Walker, 1993).

Primary determinants of savanna composition, structure and functioning include fire, a distinct seasonal climate, substrate type, as well as browsing and grazing by large herbivores (Scholes & Walker, 1993).

##### 6.1.2 Kuruman Thornveld (Mapping Unit SVk9)

Kuruman Thornveld extends on the flats to the west of the Kuruman Hills, from Danielskuil in the south to Tsing and Dewar in the north (Mucina & Rutherford, 2006).

##### *Vegetation and landscape features*

Topography is characterised flat rocky plains with sloping hills and according to Mucina & Rutherford (2006), Kuruman Thornveld comprises a well-developed, closed shrub layer and a defined, yet open tree stratum.

##### *Climate*

Rain falls mainly in summer and autumn and ranges from 300 – 450 mm per year. Frost is frequent in winters, with temperatures dropping to -3.3°C. The average maximum day-time temperature for Kuruman is 35.9 (Mucina & Rutherford, 2006).

##### *Important plant taxa*

Based on Mucina & Rutherford's (2006) vegetation classification, important plant taxa are those species that have a high abundance, a frequent occurrence (not being particularly abundant) or are prominent in the landscape within a particular vegetation type. They note the following species are important taxa in the Ngongoni Veld vegetation type:



**Trees:** *Acacia erioloba*, *Acacia mellifera* and *Boscia albitrunca*.

**Shrubs:** *Grewia flava*, *Lycium hirsutum*, *Tarchonanthus camphoratus*, *Gymnosporia buxifolia*, *Acacia hebeclada*, *Monechma divaricatum*, *Gnidia polycephala*, *Helichrysum zeyheri*, *Hermannia comosa*, *Pentzia calcarea*, *Plinthus sericeus* and *Elephantorrhiza elephantina*.

**Grasses:** *Aristida meridionalis*, *Aristida stipata*, *Eragrostis lehmanniana*, *Eragrostis echinochloidea*, *Melinis repens*.

**Herbs:** *Dicoma schinzii*, *Gisekia africana*, *Harpagophytum procumbens*, *Indigofera daleoides*, *Limeum fenestratum*, *Nolletia ciliaris*, *Seddera capensis*, *Tripteris aghillana* and *Vahlia capensis*.

### 6.1.3 Kuruman Mountain Bushveld (Mapping Unit SVk9)

Kuruman Mountain Bushveld occurs from the Abestos Mountains to the south- and north-west of Griekwastad, along the Kuruman Mountains past Kuruman town and re-emerging as isolated hills around Pomfret. (Mucina & Rutherford, 2006).

#### **Vegetation and landscape features**

The vegetation is characterised by open shrubveld, with a well-developed grass layer. Topography comprises generally shallow rolling hills and hill pediment areas (Mucina & Rutherford, 2006).

#### **Important plant taxa**

The following species are important taxa in Kuruman Mountain Bushveld, as per Mucina & Rutherford (2006):

**Trees and Shrubs:** *Rhus lancea*, *Diospyros austro-africana*, *Euclea crispa*, *Euclea undulata*, *Olea europaea*, *Rhus pyroides*, *Rhus tridactyla*, *Tarchonanthus camphoratus*, *Tephrosia longipes*, *Rhus ciliata*, *Amphiglossa triflora*, *Anthospermum rigidum*, *Gomphocarpus fruticosus*, *Helichrysum zeyheri*, *Lantana rugosa* and *Wahlenbergia nodosa*.

**Grasses:** *Andropogon chinensis*, *Andropogon schirensis*, *Anthephora pubescens*, *Aristida congesta*, *Digitaria eriantha*, *Themeda triandra*, *Triraphis andropogonooides*, *Aristida diffusa*, *Brachiaria nigropedata*, *Cymbopogon caesius*, *Diheteropogon amplexans*, *Elionurus muticus*, *Eragrostis chloromelas*, *Heteropogon contortus*, *Schizachyrium sanguineum* and *Melinis repens*.

**Herbs:** *Dicoma anomala*, *Dicoma schinzii*, *Geigeria ornativa*, *Helichrysum cerastioides*, *Heliotropium strigosum*, *Hibiscus marlothianus*, *Kohautia cynanchica*, *Kyphocarpa angustifolia*, *Boophane disticha* and *Pallaea calomelanos*.

**Endemic taxa:** *Euphorbia planiceps*

### 6.1.4 Kathu Bushveld (Mapping Unit SVk12)

This vegetation type occurs on the plains from Kathu and Dibeng through to Hotazel and onward to the Botswana border (Mucina & Rutherford, 2006).

#### **Vegetation and Landscape features**

Kathu Bushveld comprises medium to tall tree savanna, mostly consisting of *Acacia erioloba* and *Boscia albitrunca*. The shrub layer is dominated by *Acacia mellifera*, *Diospyros lycioides* and *Lycium hirsutum*, while the field layer is noticeably variable in cover (Mucina & Rutherford, 2006).

#### **Important Plant Taxa**

The following are important taxa in the Kathu Bushveld vegetation type, as per Mucina & Rutherford (2006):

**Trees:** *Acacia erioloba*, *Acacia mellifera*, *Terminalia sericea* and *Boscia albitrunca*



**Shrubs:** *Diospyros lycioides*, *Dichrostachys cinerea*, *Grewia flava*, *Gymnosporia buxifolia*, *Rhigozum brevispinosum*, *Aptosimum decumbens*, *Grewia retinervis*, *Nolletia arenosa*, *Sida cordifolia* and *Tragia dioica*.

**Grasses:** *Aristida meridionalis*, *Brachiaria nigropedata*, *Centropodia glauca*, *Eragrostis lehmanniana*, *Schmidtia pappophoroides*, *Stipagrostis ciliata*, *Aristida congesta*, *Eragrostis biflora*, *Eragrostis chloromelas*, *Eragrostis heteromera*, *Eragrostis pallens*, *Melinis repens*, *Schmidtia kalahariensis*, *Stipagrostis uniplumis* and *Tragus berteronianus*.

**Herbs:** *Acrotome inflata*, *Erlangea misera*, *Gisekia africana*, *Heliotropium ciliatum*, *Hermbsstaedtia fleckii*, *Hermbsstaedtia odorata*, *Limeum fenestratum*, *Limeum viscosum*, *Leonotis platycarpa*, *Senna italica* and *Tribulus terrestris*.





# TERRESTRIAL ECOLOGY SCREENING STUDY

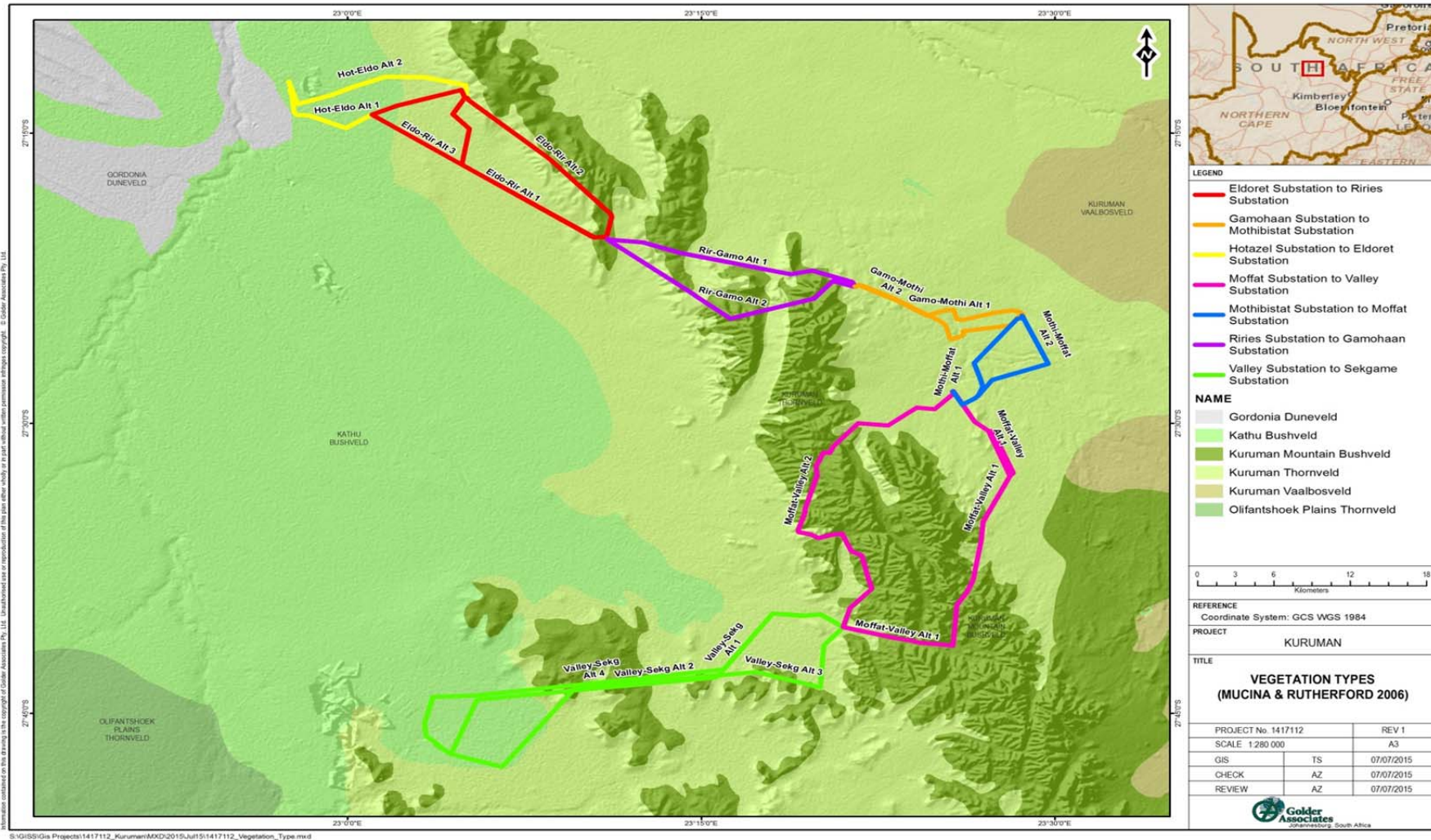


Figure 3: Study area in relation to the Mucina & Rutherford (2006) vegetation types



## 6.2 Conservation Context

According to Mucina & Rutherford (2006), the conservation status of Kuruman Thornveld, Kuruman Mountain Bushveld, Kathu Bushveld are all listed as Least Threatened.

From a flora perspective, the broader region falls under the Griqualand West Centre of Endemism<sup>1</sup>. The centre comprises the Ghaap Plateau, Asbestos Hills, Kuruman Hills and Langeberg, and is considered a conservation priority at a provincial level as little is formally conserved.

Kathu Forest is located to the north of the town of Kathu. The forest is approximately 4000 ha and is characterised by a unique, almost closed-canopy woodland dominated by large *Acacia erioloba* trees. *Acacia erioloba* is a species of conservation importance (refer to Section 6.4.3) and the forest has been declared a protected woodland under Section 12 (1) (c) of the National Forests Act (Act No. 84 of 1998). Kathu Forest does not fall within any of the proposed power line corridors.

## 6.3 General Ecological Setting

### 6.4 Flora Screening

#### 6.4.1 General synopsis

With an arid climate (< 100 mm to 400 mm rainfall per annum) limiting wide-scale crop production, much the Northern Cape Province remains undisturbed and comprises natural arid savanna (Anderson, 2000). The towns of Kuruman, Kathu and Hotazel are the main urban/commercial centres in the region, although several smaller human settlements are also present. Apart from the towns and settlements, mining operations around Kathu and Hotazel are only other sites of prominent habitat transformation in the landscape.

Outside of these areas, the study area comprises natural habitat partitioned into various farms. Farms are generally very large (>5000 ha - Anderson, 2000), and are actively managed. The most common land use activities are small livestock (goats and sheep) and game farming. Farms are typically enclosed and internally partitioned by fencing, which, most often takes the form of a standard livestock fence (height: 1.5 m) but can take the form of taller game fencing (height: 2.25 - 2.4 m).

Farmers manage their respective farms independently and control factors such as *inter alia* animal stocking rates, species mixes, grazing frequency and intensity, water provision and veld burning (*sensu* Tainton, 1999). Although the precise causal factors leading to bush encroachment remain poorly understood (*sensu* Ward 2005), it is generally agreed that these 'controlled' factors, in conjunction with rainfall and soils, act at varying intensities and combinations to drive and shape vegetation characteristics across the landscape. As such, the ecological drivers from one farm to the next potentially differ, which can result in significant variations in vegetation characteristics between farms and between the different management 'camps' on a single farm.

<sup>1</sup> A centre of endemism is an area containing a particularly high number of range restricted species.



This phenomenon is often most noticeable at fence-lines, where a defined contrast exists between vegetation on either side of a fence – see Figure 4. Although this has significance at a fine scale, at a broader landscape scale these variations are less defining or important. However, they do limit the resolution at which detailed vegetation communities can be delineated across a large region, such as the study area. Be that as it may, 2014 land cover data recognises three main natural land covers in the study area, namely grassland, low shrubland and dense/open bush – these are shown in Figure 5.



*Figure 4: Classic fence-line contrast resulting from different land management practices*



# TERRESTRIAL ECOLOGY SCREENING STUDY

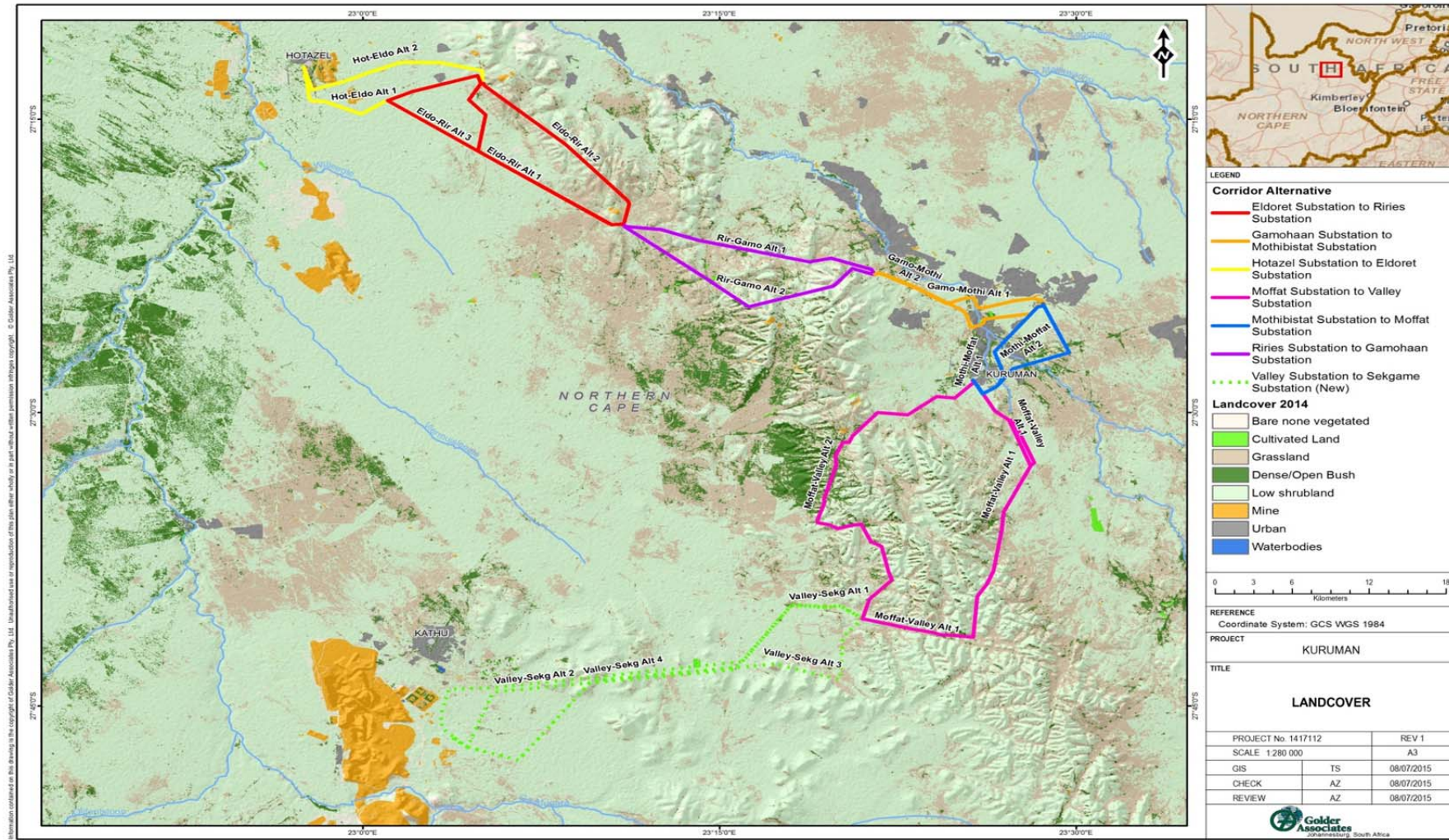


Figure 5: Study area in relation to 2014 land cover data



The field visit indicated that the vegetation growing below existing medium-sized power lines is generally in similar condition to adjacent vegetation (see Figure 6). This indicates that there was either a low level of disturbance when these power lines were erected, or alternatively, that vegetation recovered well after construction. Vegetation growing below large power line, however, is noticeably different from adjacent vegetation and characterised by dearth of woody vegetation, which has been cleared to prevent arcing (Figure 7).



*Figure 6: Vegetation growing under medium-sized power lines*



*Figure 7: Vegetation growing under large-sized power line*

### 6.4.2 Habitat Units

Notwithstanding inherent variations in vegetation between and within individual farms in the study area, three broad habitat units are recognised for the study area, namely:

- Open & Closed Thicket and Bushland;
- Open & Closed Mountain Shrubland; and
- Riparian Corridor.

A map showing the indicative spatial extent of the identified habitat units is provide in Figure 8 and high-level descriptions of each unit is provided in Sections 6.4.2.1 to 6.4.2.3.



# TERRESTRIAL ECOLOGY SCREENING STUDY

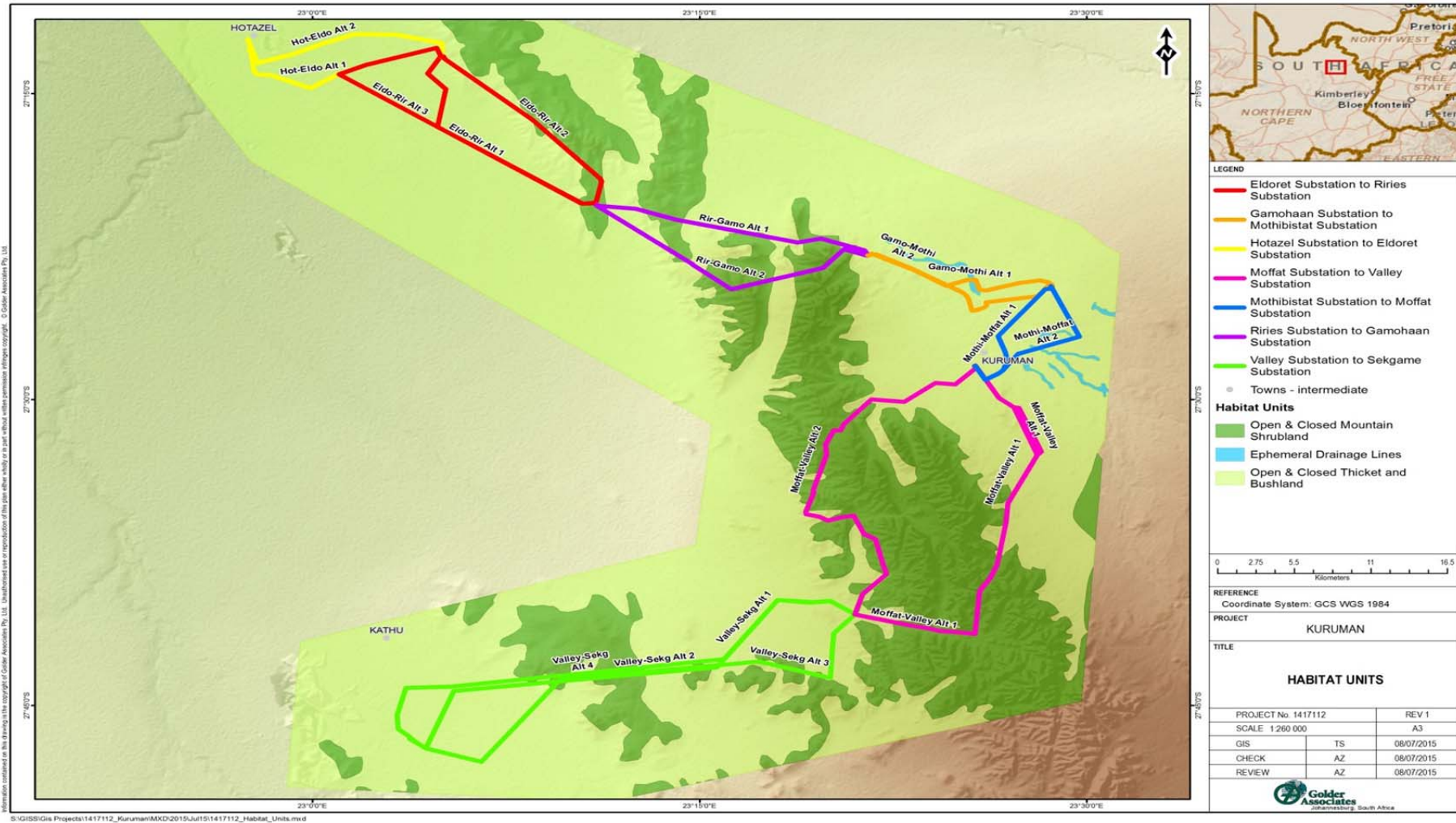


Figure 8: Broad habitat units recognised in the study area. Based on the delineations presented by Mucina & Rutherford (2006)



### 6.4.2.1 Open & Closed Thicket and Bushland

This habitat unit characterises the flat and undulating plains of the study area. The underlying soils tend to be deep, reddish brown wind-blown sands, with occasional calcrete extrusions. Structurally, this is a highly variable habitat unit, ranging from open grassland with sparse, scattered woody species to closed short-canopy thicket or tall canopy woodland. The most common form however, is an intermediate characterised by short open to closed bushland.

Refer to Figure 9 to Figure 12 for photos showing the various structural forms constituting the Open & Closed Thicket and Bushland habitat unit

In terms of composition, both broad-leaf and fine-leaf species co-dominate the woody component. Common broad-leaf species include *Tarchonanthus camphoratus* and *Grewia flava*, while *Acacia mellifera* and to a lesser extent *Acacia erioloba* are common fine-leaf species. The former two species grow as small trees or shrubs, typically between 2 to 3 m in height, while *Acacia erioloba* generally grow as medium to large trees that are often the sole species represented in the tall-tree size class.

Other woody species recorded during the field survey in this habitat unit include *Acacia haematoxylon*, *Acacia hebeclada* var. *hebeclada*, *Acacia karroo*, *Aloe grandidentata*, *Asparagus suaveolens*, *Asparagus* sp., *Boscia albitrunca*, *Diospyros lycioides*, *Ehretia rigida*, *Elephantorrhiza elephantina*, *Eucalyptus* sp., *Gymnosporia buxifolia*, *Lebeckia macrantha*, *Opuntia ficus-indica*, *Prosopis glandulosa*\*, *Rhigozum obovatum*, *Rhigozum trichotomum*, *Searsia burchellii*, *Searsia ciliata*, *Searsia lancea*, *Terminalia sericea* and *Ziziphus mucronata*.

The herbaceous layer in this habitat unit is generally well-developed and dominated by grasses. Areas with little herbaceous were noted and these are attributed to heavy grazing. Grasses recorded include a mixture of tall and medium sized species such as *inter alia*, *Aristida adscensionis*, *Aristida congesta* var. *congesta*, *Aristida diffusa*, *Aristida meridionalis*, *Cenchrus ciliaris*, *Eragrostis echinocloidea*, *Eragrostis lehmanniana*, *Eragrostis pallens*, *Eragrostis rigidior*, *Eragrostis trichophora*, *Fingerhuthia africana*, *Cymbopogon* sp., *Melinis repens*, *Pogonarthria squarrosa*, *Schmidtia pappophoroides*, *Sporobolus fimbriatus*, *Stipagrostis ciliata*, *Stipagrostis uniplumis* and *Themeda triandra*.

Forbs recorded include amongst others *Barleria* sp., *Blepharis marginata*, *Blepharis* sp., *Boophane disticha*, *Cleome* sp., *Cucumis* sp., *Geigeria ornativa*, *Gomphocarpus fruticosus*, *Gomphrena celosioides*, *Harpagophytum procumbens*, *Helichrysum aureonitens*, *Helichrysum zeyheri*, *Heliotropium* sp., *Hermannia comosa*, *Hermbstaedia fleckii*, *Indigofera daleoides*, *Kyphocarpa angustifolia*, *Ledebouria* sp., *Melhania virescens*, *Nolletia ciliaris*, *Pentzia calcarea*, *Salsola aphylla*, *Sarcostemma pearsonii*, *Schkuhria pinnata*\*, *Selago densiflora*, *Senna italica*, *Sida cordifolia*, *Solanum* sp., *Tribulus terrestris* and *Verbesina encelioides*.

Species of conservation importance recorded in the habitat unit include *Acacia erioloba*, *Acacia haematoxylon*, *Boscia albitrunca* and *Boophane disticha* – refer to Section 4.1.4: Species of Conservation Importance. *Acacia erioloba* were recorded common in this habitat unit throughout the study area. *Boscia albitrunca* was also fairly widespread, but was only noticeably prevalent along the Eldo-Rir Alternative routes, while *Acacia haematoxylon* was generally only abundant around Hotazel.

Apart from localised sites of disturbance and numerous farm fences that partition the landscape, the Open & Closed Thicket and Bushland habitat unit remains in good ecological condition, with a high level of habitat connectivity high. These areas provide valuable habitat for flora and fauna. Accordingly, the ecological integrity and conservation importance of this habitat unit are both High.



Figure 9: Open grassland form



Figure 10: Open bushveld form



Figure 11: Short, closed thicket form, dominated by *Tarchonanthus camphoratus*



Figure 12: Woodland form – note tall *Acacia erioloba* trees

### 6.4.2.2 Open & Closed Mountain Shrubland

The Open & Closed Mountain Shrubland habitat unit is found on the rolling hills and slopes of the Kuruman Mountains. These mountains run on a north-west to south-east orientation and dominate the central axis of the study area. Soils tend to be shallow, dark red and brown, and are typically very rocky. Like the Open & Closed Thicket and Bushland habitat unit, this habitat unit has a highly variable structure, grading from relatively open short grassland (Figure 13) to densely-closed thicket or shrubland, with an average height of about 2.5 to 3 m (Figure 14).

Common woody species in this habitat unit also include *Acacia mellifera*, *Grewia flava* and *Tarchonanthus camphoratus*. Other woody species recorded in this habitat unit include *Acacia erioloba*, *Acacia hebeclada* var. *hebeclada*, *Acacia karroo*, *Aloe hereroensis*, *Asparagus* spp., *Boscia albitrunca*, *Diospyros austro-africana*, *Diospyros lycioides*, *Ehretia rigida*, *Euclea crispa*, *Euclea undulata*, *Elephantorrhiza elephantina*, *Ficus cordata*, *Gymnosporia buxifolia*, *Lantana rugosa*, *Lebeckia macrantha*, *Opuntia ficus-indica*\*, *Prosopis glandulosa*\*, *Rhigozum brevispinosum*, *Rhigozum obovatum*, *Rhigozum trichotomum*, *Searsia burchellii*, *Searsia ciliata* and *Ziziphus mucronata*.

The herbaceous layer in this habitat unit is generally poorly developed and these areas are probably quickly overgrazed. Grasses recorded include *inter alia*, *Aristida adscensionis*, *Aristida congesta* var. *barbicollis*, *Aristida congesta* var. *congesta*, *Aristida diffusa*, *Aristida meridionalis*, *Brachiaria nigropedata*, *Cenchrus ciliaris*, *Chrysopogon serrulatus*, *Digitaria* sp., *Elionurus muticus*, *Enneapogon cenchroides*, *Eragrostis lehmanniana*, *Eragrostis trichophora*, *Diheteropogon amplexans*, *Fingerhuthia africana*, *Cymbopogon* sp., *Cymbopogon excavatus*, *Melinis repens*, *Microchloa caffra*,





*Pogonarthria squarrosa*, *Schmidtia pappophoroides*, *Stipagrostis uniplumis*, *Themeda triandra*, *Tricholaena grandiglumis* and *Triraphis andropogonoides*. Forbs recorded include *Blepharis marginata*, *Blepharis* sp., *Chamaecrista* sp., *Chascanum pinnatifidum*, *Crassula* sp., *Cucumis* sp., *Geigeria ornativa*, *Gisekia africana* var. *africana*, *Gomphocarpus fruticosus*, *Gomphrena celosioides*, *Helichrysum aureonitens*, *Helichrysum zeyheri*, *Heliotropium* spp., *Hermannia comosa*, *Hermannia* sp., *Indigofera daleoides*, *Kohautia cynanchica*, *Kyphocarpa angustifolia*, *Ledebouria* sp., *Nolletia ciliaris*, *Pentzia calcarea*, *Sarcostemma pearsonii*, *Senna italica*, *Sida cordifolia* and *Tribulus terrestris*.

The Open & Closed Mountain Shrubland habitat unit is in good ecological condition and provides valuable habitat for flora and fauna. Species of conservation importance recorded include *Acacia erioloba* and *Boscia albitrunca*. The ecological integrity and conservation importance of this habitat unit are both High.



Figure 13: Relatively open grassland with scattered woody species.



Figure 14: Short closed shrubland occurring on rocky hillsides.

### 6.4.2.3 Ephemeral Drainage Lines

Several drainage lines are located in the vicinity of Kuruman. They are generally characterised by an open, flat channel, dominated by short grasses and fringed by tall (>5 m) woody vegetation (Figure 15). The transition from tall drainage corridor woody vegetation to dry terrestrial shrubland is generally abrupt. For the most part the drainage lines appear to be ephemeral, and probably only exhibit surface flow after heavy rains. This notwithstanding, flowing surface water was noted along a well-channelled stream that exits Kuruman to the north (Figure 16).

The creeping grass *Cynodon dactylon* dominates the vegetation of the inner drainage line corridor. In some areas heavy grazing by cattle, goats and sheep have created very short, grazing lawns. Other less abundant herbaceous species recorded in the drainage channel include the grass *Imperata cylindrica* and various *Cyperaceae* species. Woody vegetation forming the woodland fringe includes many of the same species that were noted in adjacent upland areas, such as *Acacia karroo*, *Acacia hebeclada* var. *hebeclada*, *Acacia mellifera*, *Grewia flava*, *Rhus lancea*, *Tarchonanthus camphoratus* and *Ziziphus mucronata*.

Drainage lines in residential areas were generally disturbed and often artificially canalised and used for crop growing. Alien invasive vegetation, such as *Melia azedarach* was common along the canalised portions of the natural drainage lines (Figure 16). The ecological integrity of this habitat unit is Moderate, but considering the role drainage lines have in the landscape their conservation importance is High.



Figure 15: Open, flat grass dominated drainage line fringed by trees



Figure 16: A flowing section of stream, exiting Kuruman to the north, is fringed by reeds and exotic invasive vegetation

### 6.4.3 Flora Species of Conservation Importance

Four plant species of conservation importance were recorded in the study area during the field survey. These are the trees *Acacia erioloba*, *Boscia albitrunca* and *Acacia haematoxylon* and the toxic bulb *Boophane disticha*. Refer to Figure 17 to Figure 20 for photos of species of conservation importance encountered in the study area.

All three tree species are listed as protected according to the National Forest Act (Act No. 84 of 1998), and *Acacia erioloba* and *Boophane disticha* are both listed as Declining on the regional IUCN Red List (2009) (Table 3). *Acacia erioloba* is particularly abundant throughout the entire the study area, while *Boscia albitrunca* and *Acacia haematoxylon* were most abundant in the vicinity of Hotazel. *Boophane disticha* was only recorded at a few localities in the study area.

As per the South African Biodiversity Institute's POSA database of species recorded in the relevant QDS, an additional three species of conservation importance may potentially occur in the study area – see Table 3. For a list of all species recorded in the relevant QDS as per the POSA database refer to APPENDIX A.

**Table 3: Flora species of conservation importance potentially occurring in the study area**

Species	IUCN (2009) – Regional Status	NEMBA TOPS List (2013)	Protected Tree Species (National Forest Act No. 84 of 1998)	Northern Cape – Specially Protected Species (1999)
<i>Acacia erioloba</i>	Declining	-	Protected	-
<i>Cleome conrathii</i>	Near Threatened	-	-	-
<i>Drimia sanguinea</i>	Near Threatened	-	-	-
<i>Boscia albitrunca</i>	-	-	Protected	-
<i>Acacia haematoxylon</i>	-	-	Protected	-
<i>Pelargonium myrrhifolium</i> var. <i>myrrhifolium</i>	-	-	-	Specially Protected
<i>Boophane disticha</i>	Declining	-	-	-



Figure 17: *Boscia albitrunca*



Figure 18: *Acacia haematoxylon*



Figure 19: *Boophane disticha*



Figure 20: *Acacia erioloba* trees

### 6.4.4 Alien Invasive Flora Species

Exotic or alien plants are species that occur outside their historic geographic range. In most instances they have been introduced by humans owing to their economic and/or ornamental value. Although many exotic species such as common agricultural and garden plants, are unable to propagate without human intervention (Bromilow, 2010), certain species are able to survive and reproduce under natural conditions. These 'naturalised' species once established, are able to reproduce rapidly and eventually out-compete indigenous vegetation, creating large, almost monospecific stands (Bromilow, 2010). Such infestations can lead to a loss of indigenous biodiversity and a contingent reduction in ecosystems functioning. Exotic invasive plants are consequently responsible for widespread habitat loss and degradation throughout South Africa and adversely affect both the environment and economy.

#### 6.4.4.1 Legislative Framework

South African legislation concerning alien invasive species comprises the Conservation of Agricultural Resources Act (CARA) (No. 43 of 1983) as amended, and the National Environmental Management: Biodiversity Act (2004) (No. 10 of 2004). Both sets of regulations have been development to control



the spread of alien invasive species. It is incumbent on all land owners to assess their properties for listed species and take the necessary measures to comply with the legislation.

### **National Environmental Management: Biodiversity Act (Act No. 10 of 2004)**

The NEMBA regulations categorise species into one of four categories; 1a, 1b, 2 and 3:

#### **NEMBA Category 1a and 1b**

Category 1a listed species are considered emerging invasive species. These species require immediate control by all landowners. Category 1b species on the other hand are established invasive species. The need regarding these species is to ensure that coherent control programmes are implemented and that existing control programmes are maintained (Invasive Species South Africa, 2012, online).

#### **NEMBA Category 2**

Category 2 listed species are those that have economic or aesthetic value, yet which can become invasive and have negative ecological consequences. Provision has thus been made to control these species, yet provide mechanisms to continue derive benefit from them (Invasive Species South Africa, 2012, online).

#### **NEMBA Category 3**

Category 3 species are those that have the potential to become invasive and must be managed and contained accordingly (Invasive Species South Africa, 2012, online).

### **Conservation of Agricultural Resources Act (Act No. 43 of 1983)**

The 2001 revision of the CARA recognises three categories of invasive plant, namely: Category 1 - declared weeds, Category 2 - declared invader plants with a commercial or utility value, and Category 3 - ornamental plants. These are listed in Regulations 15 and 16 of CARA. The regulations pertaining to each category are summarised below:

#### **CARA Category 1: Declared weeds**

Category 1 listed plants have no economic value and possess characteristics harmful to humans, animals or the environment. These species tend to produce high volumes of seed, are wind or bird dispersed, or have efficient vegetative reproduction, and are thus highly invasive causing substantial environmental degradation. As such, Category 1 listed plants may not be planted or propagated in rural and urban areas, and the trade in their seeds, cuttings and other propagatory material is prohibited. Moreover, it is recommended that active measures be taken to control and eradicate populations of these species (ARC, 2010, internet).

#### **CARA Category 2: Declared invader plants with commercial or utility value**

Although Category 2 listed plants are invasive species, they do have beneficial properties and general utility. They are permitted in demarcated areas (as granted by the Executive Officer) under controlled conditions, and in bio control reserves. Seed and propagative material may only be sold to, and acquired by land users of areas demarcated for that particular species, as determined by the Executive Officer. These species may not occur within 30 m of the 1:50 year flood line of a water course or wetland, except under authorisation in terms of the National Water Act (No. 36 of 1998) (ARC, 2010, internet).

#### **CARA Category 3: Mostly ornamental plants**

These are alien plants that are generally popular ornamental and garden species but show high invasive potential and frequently encroach into natural areas. Existing plants may remain provided they do not occur within 30 m from the 1:50 year flood line of a water course or wetland, and provided all reasonable steps are taken to limit the further spread of that species. No further planting or trade in propagative material is permitted (ARC, 2010, internet).



**6.4.4.2 Listed alien species recorded in the study area**

Several listed alien invasive plants were recorded during the field survey. Although scattered alien plants were occasionally noted in natural, undisturbed areas, most were recorded in close proximity to habitation or at sites of noticeable anthropogenic disturbance. An inventory of alien invasive plants listed under CARA and/or NEMBA that were recorded in the study area is provided in Table 4.

**Table 4: CARA and/or NEMBA listed alien invasive species recorded in the study area**

Scientific name	Common name	NEMBA Category	CARA Category
<i>Cirsium vulgare</i>	Scotch Thistle	1b	1
<i>Datura ferox</i>	Large Thorn Apple	1b	1
<i>Eucalyptus</i> spp.	Gum tree	-	2
<i>Melia azedarach</i>	Syringa	1b or 3	3
<i>Opuntia ficus-indica</i>	Sweet Prickly Pear	1b	1
<i>Prosopis glandulosa</i>	Honey Mesquite	3	2
<i>Schinus molle</i>	Pepper Tree	-	X3
<i>Echinopsis spachiana</i>	Torch cactus	1b	1

**6.5 Fauna Assessment**

**6.5.1 Mammals**

The presence of twenty one mammal species was noted during the field survey, and considering the extent of natural habitat across the entire the study area and surrounding landscape, it is expected that the region has a rich and almost intact mammal assemblage.

Species recorded during the field survey include Steenbok (*Raphicerus campestris*) (Figure 22), Kudu (*Tragelaphus strepsiceros*), Aardvark (*Orycteropus afer*) (Figure 21), Yellow Mongoose (*Cynictis penicillata*), Striped polecat (*Ictonyx striatus*), Black-backed Jackal (*Canis mesomelas*), Porcupine (*Hystrrix africae australis*), Springhare (*Pedetes capensis*), Ground Squirrel (*Xerus inauris*), Hare species, (*Lepus* sp.), Chacma baboon (*Papio cynocephalus ursinus*), Sengi species (*Elephantus* sp.).

Anecdotal evidence from local land-users also indicates the presence of predators such as Leopard (*Panthera pardus*), Caracal (*Caracal caracal*), Brown Hyaena (*Parahyaena brunnea*), Aardwolf (*Proteles cristatus*) and various ungulates, such as Warthog (*Phacochoerus africanus*), Common Duiker (*Sylvicapra grimmia*) (Figure 22), Springbok (*Antidorcas marsupialis*), Red Hartebeest (*Alcelaphus buselaphus*) and Gemsbok (*Oryx gazelle*). Unlike the Kudu, it was noted that Springbok, Red Hartebeest & Gemsbok are generally part of actively managed populations and are not free-range.

An additional 40 mammal species potentially occur in the region, as per the distribution maps presented in Stuart & Stuart (2007) – refer to APPENDIX B. Of these, fourteen are listed under NEMBA or the IUCN regional Red List as of conservation importance, while several additional species are further listed as either protected or specially protected under the Northern Cape Conservation Act (Act No. 9 of 2009) (see APPENDIX B for the status of those listed at a provincial level).



Figure 21: Aardvark (*Orycteropus afer*) burrow recorded in study area



Figure 22: Small antelope pellets, either Steenbok (*Raphicerus campestris*) or Common Duiker (*Sylvicapra grimmia*) recorded in study area

Table 5: Red List and protected mammals occurring or potentially occurring in the study area

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Probability of Occurrence
<i>Atelerix frontalis</i>	Southern African Hedgehog	Near Threatened	-	
<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe bat	Near Threatened	-	
<i>Miniopterus schreibersii</i>	Schreibers long-fingered Bat	Near Threatened	-	
<i>Manis temminckii</i>	Pangolin	Vulnerable	Vulnerable	
<i>Vulpes chama</i>	Cape Fox	-	Protected	
<i>Tocyon megalotis</i>	Bat-eared Fox	-	Protected	
<i>Mellivora capensis</i>	Honey Badger	Near Threatened	-	
<i>Parahyaena brunnea</i>	Brown Hyaena	-	Protected	Recorded
<i>Felis nigripes</i>	Small-spotted Cat	-	Protected	
<i>Acinonyx jubatus</i>	Cheetah	Vulnerable	Vulnerable	
<i>Panthera pardus</i>	Leopard	-	Protected	Recorded
<i>Orycteropus afer</i>	Aardvark	-	Protected	Recorded
<i>Oryx gazella</i>	Gemsbok	-	Protected	Recorded
<i>Oreotragus oreotragus</i>	Klipspringer	-	Protected	

### 6.5.2 Birds

The SABAP2 lists 244 birds for the general region in which the study area is located (see APPENDIX C), while 500 birds species have been recorded for the entire Northern Cape Province (AndersonAfrica, 2008). Listed birds are typical arid bushveld species and most are common throughout their natural range.

Birds recorded during passive, opportunistic encounters while traversing the study area include *inter alia*, African Red-eyed Bulbul (*Pycnonotus nigricans*), African Grey Hornbill (*Tockus nasutus*), Swallow-tailed Bee-eater (*Merops hirundineus*), European Bee-eater (*Merops apiaster*), Lilac-breasted Roller (*Coracias caudatus*), Pearl-spotted Owlet (*Glaucidium perlatum*), Red-eyed Dove (*Streptopelia semitorquata*), Common Scimitarbill (*Rhinopomastus cyanomelas*), Pied Crow (*Corvus albus*), Helmeted guineafowl (*Numida meleagris*), Redcrested Korhaan (*Eupodotis ruficrista*), Blacksmith Plover (*Vanellus armatus*), Fork-tailed Drongo (*Dicrurus adsimilis*), Crimson-breasted



Shrike (*Laniarius atrococcineus*), Hadeda Ibis (*Bostrychia hagedash*), Jackal Buzzard (*Buteo rufofuscus*), Namaqua Sandgrouse (*Pterocles namaqua*), White-backed Mousebird (*Colius colius*), Kalahari Robin (*Erythropygia paena*), Melba finch (*Pytilia melba*), Whitebrowed Sparrow-weaver (*Plocepasser mahali*), Sociable Weaver (*Philetairus socius*), and Shaft-tailed Whydah (*Vidua regia*).

Raptors are of particular importance in the Northern Cape, with 51 species listed for the region (Anderson, 2000). Thirty five of these are resident species and 21 are considered common (Anderson, 2000). Raptors populations in the province are decreasing as a result of habitat loss, a reduction in food supply, and direct and indirect persecution. A notable concern viz. the proposed project, is that a number of raptors use electricity pylons for nesting, and are frequently killed by phase-to-phase or phase-to-earth electrocutions (Anderson, 2000).

Based on the relevant SABAP2 lists, 16 bird species of conservation importance potentially occur in the study area. These are listed in Table 6.

BirdLife SA’s Wind Farm Sensitivity Map identifies sites and bird species sensitive to wind farm developments. Although these guidelines specifically concern wind farm developments, they do have applicability to other types of power generation projects and associated infrastructure, such as power lines. The BirdLife sensitivity map in relation to the study area is shown in Figure 23.

**Table 6: Red List and protected birds potentially occurring in the study area**

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Aquila rapax</i>	Tawny Eagle	Endangered	-	Specially Protected
<i>Aquila verreauxii</i>	Verreaux's Eagle	Vulnerable	-	Specially Protected
<i>Ardeotis kori</i>	Kori Bustard	Near Threatened	Protected	Protected
<i>Ciconia abdimii</i>	Abdim's Stork	Near Threatened	-	Protected
<i>Ciconia nigra</i>	Black Stork	Vulnerable	-	Specially Protected
<i>Cursorius rufus</i>	Burchell's Courser	Vulnerable	-	Protected
<i>Falco biarmicus</i>	Lanner Falcon	Vulnerable	-	Specially Protected
<i>Gyps africanus</i>	White-backed Vulture	Endangered	Protected	Protected
<i>Neotis ludwigii</i>	Ludwig's Bustard	Endangered	Endangered	Specially Protected
<i>Oxyura maccoa</i>	Maccoa Duck	Near Threatened	-	Protected
<i>Phoenicopterus minor</i>	Lesser Flamingo	Near Threatened	-	Specially Protected
<i>Phoenicopterus ruber</i>	Greater Flamingo	Near Threatened	-	Protected
<i>Polemaetus bellicosus</i>	Martial Eagle	Endangered	Vulnerable	Specially Protected
<i>Rhinoptilus africanus</i>	Double-banded Courser	Near Threatened	-	Protected
<i>Sagittarius serpentarius</i>	Secretarybird	Vulnerable	-	Specially Protected
<i>Threskiornis aethiopicus</i>	African Sacred Ibis	-	Protected	Protected

Source: SABAP2



# TERRESTRIAL ECOLOGY SCREENING STUDY

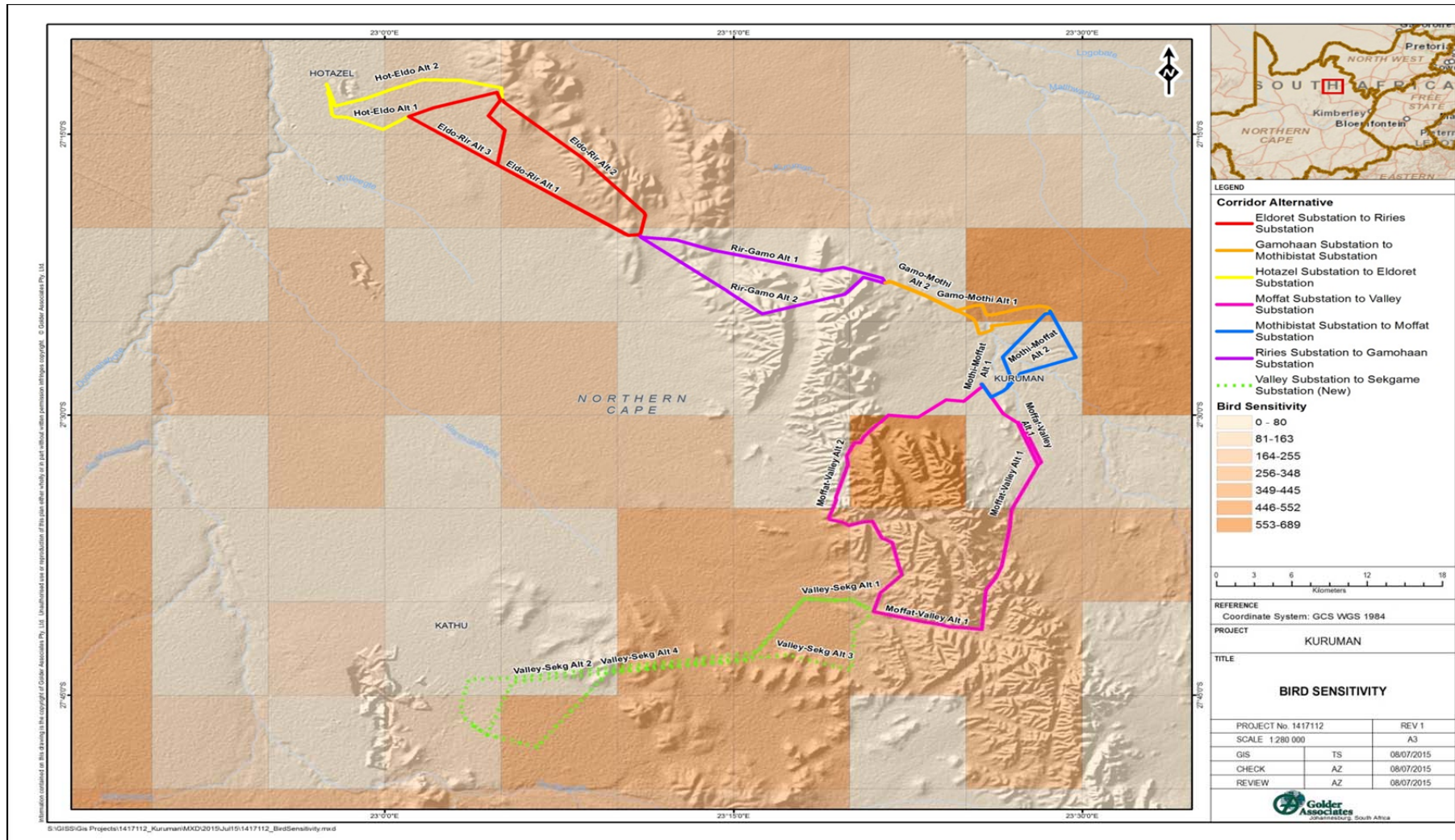


Figure 23: Power line alternatives in relation to BirdLife South Africa's Bird Sensitivity Map





### 6.5.3 Herpetofauna

A combination of summer rainfall, coupled with warm temperatures and high humidity promote a high degree of reptile and amphibian diversity in southern Africa's savannas (Carruthers, 2001, Alexander & Marais 2010). This is less so in the far Northern Cape which is characterised by arid savannas, with little standing water.

The distribution maps presented in Bates, *et al.* (2014) and indicate that 58 reptile species have been previously recorded in the region, while Minter *et al.* (2004) and Du Preez & Carruthers (2009) indicate the about 14 amphibians are potentially present. Of these, only two reptiles and one amphibian are of national conservation importance. These are the Horned Adder (*Bitis caudalis*) and Southern African Python (*Python natalensis*), both of which are listed as Protected under NEMBA (2013), and the Giant Bullfrog (*Pyxicephalus adspersus*) which has a regional IUCN Red List status of Near Threatened. A number of other species of both reptiles and amphibian are listed as either protected or specially protected according to the Northern Cape Conservation Act (Act No. 9 of 2009) (Table 7).

Horned Adder's favour dry sandy habitats and are widespread throughout the arid western regions of South Africa (Alexander & Marais, 2010). Southern African Pythons occur in savanna and forest habitats and are mostly found in eastern and north-eastern parts of South Africa. There are however records of Pythons in the north-eastern part of the Northern Cape (Bates, *et al.*, 2014). The Giant bullfrog remains buried for much of the year in grassland and savanna areas, emerging after rain to breed in shallow, temporary streams and pans (Carruthers 2001). It is therefore possible that this species is present in the study area. These species are all threatened due to habitat transformation and fragmentation.

Refer to APPENDIX D and Table 8 for a list of all reptile and amphibians potentially occurring in the study area, respectively.

**Table 7: Red List and protected reptiles potentially occurring in the study area**

Scientific Name	Common Name	IUCN Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Bitis caudalis</i>	Horned Adder	-	Protected	-
<i>Chamaeleo namaquensis</i>	Namaqua Chameleon	-	-	Specially Protected
<i>Dasypeltis scabra</i>	Rhombic Egg-eater	-	-	Protected
<i>Heliobolus lugubris</i>	Bushveld Lizard	-	-	Protected
<i>Lycophidion capense capense</i>	Cape Wolf Snake	-	-	Protected
<i>Meroles squamulosus</i>	Savanna Lizard	-	-	Protected
<i>Meroles suborbitalis</i>	Spotted Desert Lizard	-	-	Protected
<i>Nucras intertexta</i>	Spotted Sandveld Lizard	-	-	Protected
<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	-	-	Protected
<i>Pelomedusa subrufa</i>	Marsh Terrapin	-	-	-
<i>Philothamnus semivariiegatus</i>	Spotted Bush Snake	-	-	Protected
<i>Prosymna sundervallii</i>	Sundevall's Shovel-Snout	-	-	Protected
<i>Psammobates oculifer</i>	Serrated Tent Tortoise	-	-	Protected
<i>Pseudaspis cana</i>	Mole Snake	-	-	Protected
<i>Python natalensis</i>	Southern African Python	-	Protected	Specially Protected
<i>Stigmochelys pardalis</i>	Leopard Tortoise	-	-	Protected
<i>Varanus albigularis albigularis</i>	Southern Rock Monitor	-	-	Protected

Source: Bates *et al.* (2014)



**Table 8: Amphibians potentially occurring in the study area**

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Amieta angolensis</i>	Common River Frog	-	-	Protected
<i>Amieta fuscigula</i>	Cape River Frog	-	-	Protected
<i>Amietophrynus garmani</i>	Eastern Olive Toad	-	-	Protected
<i>Amietophrynus gutturalis</i>	Guttural Toad	-	-	Protected
<i>Amietophrynus poweri</i>	Western Olive Toad	-	-	Protected
<i>Breviceps adspersus</i>	Bushveld Rain Frog	-	-	Protected
<i>Cacosternum boettgeri</i>	Boettger’s Caco	-	-	Protected
<i>Kassina senegalensis</i>	Bubbling Kassina	-	-	Protected
<i>Pyxicephalus adspersus</i>	Giant Bullfrog	Near Threatened	-	Specially Protected
<i>Schismaderma carens</i>	Red Toad	-	-	Protected
<i>Tomopterna cryptotis</i>	Tremolo Sand Frog	-	-	Protected
<i>Tomopterna tandyi</i>	Tandy’s Sand Frog	-	-	Protected
<i>Vandijkophrynus gariepensis</i>	Karoo Toad	-	-	Protected
<i>Xenopus laevis</i>	Common Platanna	-	-	Protected

Source: Minter *et al.* (2004), Du Preez & Carruthers (2009)



Figure 24: Puff Adder (*Bitis arietans*) recorded in study area in close proximity to the Moffat Substation to Valley Substation power line route alternatives



Figure 25: A dead Rock Monitor (*Varanus albigularis*) noted along the R31 in study area



## 7.0 IMPACT ASSESSMENT

### 7.1 Impact Assessment Methodology

The impacts will be ranked according to the methodology described below. Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria, as discussed below:

#### 7.1.1 Extent of the impact

Extent intends to assess the footprint of the impact. The larger the footprint, the higher the impact rating will be. The table below provides the descriptors and criteria for assessment.

**Table 9: Criteria for the assessment of the extent of the impact**

Extent Descriptor	Definition	Rating
Site	Impact footprint remains within the boundary of the site.	1
Local	Impact footprint extends beyond the boundary of the site to the adjacent surrounding areas.	2
Regional	Impact footprint includes the greater surrounds and may include an entire municipal or provincial jurisdiction.	3
National	The scale of the impact is applicable to the Republic of South Africa.	4
Global	The impact has global implications	5

#### 7.1.2 Duration of the impact

The duration of the impact is the period of time that the impact will manifest on the receiving environment. Importantly, the concept of reversibility is reflected in the duration rating. The longer the impact endures, the less likely it is to be reversible. See Table 10 for the criteria for rating duration of impacts.

**Table 10: Criteria for the rating of the duration of an impact**

Duration Descriptor	Definition	Rating
Construction / Decommissioning phase only	The impact endures for only as long as the construction or the decommissioning period of the project activity. This implies that the impact is fully reversible.	1
Short term	The impact continues to manifest for a period of between 3 and 5 years beyond construction or decommissioning. The impact is still reversible.	2
Medium term	The impact continues between 6 and 15 years beyond the construction or decommissioning phase. The impact is still reversible with relevant and applicable mitigation and management actions.	3
Long term	The impact continues for a period in excess of 15 years beyond construction or decommissioning. The impact is only reversible with considerable effort in implementation of rigorous mitigation actions.	4
Permanent	The impact will continue indefinitely and is not reversible.	5



**7.1.3 Potential intensity of the impact**

The concept of the potential intensity of an impact is the acknowledgement at the outset of the project of the potential significance of the impact on the receiving environment. For example, SO<sub>2</sub> emissions have the potential to result in significant adverse human health effects, and this potential intensity must be accommodated within the significance rating. The importance of the potential intensity must be emphasised within the rating methodology to indicate that, for an adverse impact to human health, even a limited extent and duration will still yield a significant impact.

Within potential intensity, the concept of irreplaceable loss is taken into account. Irreplaceable loss may relate to losses of entire faunal or floral species at an extent greater than regional, or the permanent loss of significant environmental resources. Potential intensity provides a measure for comparing significance across different specialist assessments. This is possible by aligning specialist ratings with the potential intensity rating provided here. This allows for better integration of specialist studies into the environmental impact assessment. See Table 11 and Table 12 below:

**Table 11: Criteria for impact rating of potential intensity of a negative impact**

Potential Intensity Descriptor	Definition of negative impact	Rating
High	Significant impact to human health linked to mortality/loss of a species/endemic habitat.	16
Moderate-High	Significant impact to faunal or floral populations/loss of livelihoods/individual economic loss.	8
Moderate	Reduction in environmental quality/loss of habitat/loss of heritage/loss of welfare amenity	4
Moderate-Low	Nuisance impact	2
Low	Negative change with no associated consequences.	1

**Table 12: Criteria for the impact rating of potential intensity of a positive impact**

Potential Intensity Descriptor	Definition of positive impact	Rating
Moderate-High	Net improvement in human welfare	8
Moderate	Improved environmental quality/improved individual livelihoods.	4
Moderate-Low	Economic development	2
Low	Positive change with no other consequences.	1

It must be noted that there is no HIGH rating for positive impacts under potential intensity, as it must be understood that no positive spinoff of an activity can possibly raise a similar significance rating to a negative impact that affects human health or causes the irreplaceable loss of a species.

**7.1.4 Likelihood of the impact**

This is the likelihood of the impact potential intensity manifesting. This is not the likelihood of the activity occurring. If an impact is unlikely to manifest then the likelihood rating will reduce the overall significance. Table 13 provides the rating methodology for likelihood.

The rating for likelihood is provided in fractions in order to provide an indication of percentage probability, although it is noted that mathematical connotation cannot be implied to numbers utilised for ratings.



**Table 13: Criteria for the rating of the likelihood of the impact occurring**

Likelihood Descriptor	Definition	Rating
Improbable	The possibility of the impact occurring is negligible and only under exceptional circumstances.	0.1
Unlikely	The possibility of the impact occurring is low with a less than 10% chance of occurring. The impact has not occurred before.	0.2
Probable	The impact has a 10% to 40% chance of occurring. Only likely to happen once in every 3 years or more.	0.5
Highly Probable	It is most likely that the impact will occur and there is a 41% to 75% chance of occurrence.	0.75
Definite	More than a 75% chance of occurrence. The impact will occur regularly.	1

### 7.1.5 Cumulative Impacts

Cumulative impact are reflected in the in the potential intensity of the rating system. In order to assess any impact on the environment, cumulative impacts must be considered in order to determine an accurate significance. Impacts cannot be assessed in isolation. An integrated approach requires that cumulative impacts be included in the assessment of individual impacts.

The nature of the impact should be described in such a way as to detail the potential cumulative impact of the activity.

### 7.1.6 Significance Assessment

The significance assessment assigns numbers to rate impacts in order to provide a more quantitative description of impacts for purposes of decision making. Significance is an expression of the risk of damage to the environment, should the proposed activity be authorised.

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, which takes cognisance of extent, duration, potential intensity and likelihood.

**Impact Significance** = (extent + duration + potential intensity) x likelihood

Table 14 provides the resulting significance rating of the impact as defined by the equation as above.

**Table 14: Significance rating formulas**

Score	Rating	Implications for Decision-making
< 3	Low	Project can be authorised with low risk of environmental degradation
3 - 9	Moderate	Project can be authorised but with conditions and routine inspections. Mitigation measures must be implemented.
10 - 20	High	Project can be authorised but with strict conditions and high levels of compliance and enforcement. Monitoring and mitigation are essential.
21 - 26	Fatally Flawed	Project cannot be authorised



### 7.2 Impact Identification

- The primary project related concern is the **disturbance and fragmentation of natural habitat** that will result from woody vegetation clearing to allow for power line construction and operation.
- Other secondary concerns that may arise from the proposed project include
  - **Killing or injuring of fauna in the study area**; and
  - **Increased harvesting of flora products**;

These primary and secondary concerns are characterised in Section 7.3 and rated for environmental risk in Table 15.

### 7.3 Impact Characterisation

#### 7.3.1 Primary Impact - Disturbance and fragmentation of natural habitat

- All vegetation at proposed substation sites and where pylons will be erected will also be cleared to facilitate construction;
- Woody vegetation may need to be cleared during construction to provide vehicle access to portions of the existing power line servitudes for decommissioning activities and proposed power line servitudes for construction activities;
- During the operational phase woody vegetation under the new power lines will also need to be cleared to mitigate arcing risks;

Vegetation clearing may cause habitat disturbance and fragmentation as follows:

- In natural, undisturbed areas vegetation clearing will result in habitat loss, disturbance (alteration), and fragmentation. These impacts will be an ecological impact of concern; and
- In areas already disturbed by anthropogenic activities, such as around towns/settlements and immediately adjacent to major roads or existing power line servitudes, the resulting habitat loss, disturbance and fragmentation will not be ecological impact of major concern;
- It is likely that plant species of conservation importance, such as *Acacia erioloba*, *Boscia albitrunca* and *Acacia haematoxylon* that occur within the proposed power line servitude will need to be cleared to prevent arcing.

#### 7.3.2 Secondary Impacts

##### Killing or injuring of fauna

Savanna areas in South Africa provide habitat for a rich assemblage of fauna. In natural areas fauna species can be killed or injured during the construction and operational phases of development projects. Common causes of death and injury include:

- Electrocution and collision of birds on power lines – Anderson (2000) highlights the electrocution and collision of raptors and large Bustards and Cranes on power lines as being a major form of direct impact on birds in the Northern Cape. Smaller capacity power lines, such as those proposed to be developed, (11kV to 132 kV) have been reported to be particularly lethal for raptor electrocutions (Endangered Wildlife Trust);
- Direct death/injury during woody vegetation clearing and earth works - particularly reptiles and nesting birds (e.g. Sociable Weaver *Philetairus socius* – see Figure 26); and
- Hunting and snaring by construction workers.



Figure 26: Sociable Weaver (*Philetairus socius*) nest recorded during the field screening. These are sensitive features and should be avoided during vegetation clearing

### Increased natural resource utilisation

Construction activities in undeveloped natural areas can provide access to previously inaccessible sites. This in turn can result in increased levels of natural resource utilisation by construction workers and local inhabitants. Commonly, this can take the form of poaching, wood collecting and medicinal plant harvesting.

Of particular concern *viz.* the proposed project is the potential increase in harvesting / collecting of *Acacia erioloba* wood products. The wood of *Acacia erioloba* is hard and heavy and makes exceptional firewood and is readily harvested throughout its range (Smit 1999, Seymour & Milton 2003).



## TERRESTRIAL ECOLOGY SCREENING STUDY

**Table 15: Assessment scoring of ecological impacts identified for the construction phase**

CONSTRUCTION PHASE							
Activity	Nature of Impact	Impact type	Extent	Duration	Potential Intensity	Likelihood	Rating
Vegetation clearing/disturbance during construction	Direct Impact:	Existing					
	Loss, disturbance and fragmentation of natural habitat, caused by vegetation clearing	Cumulative	2	3	8	1	13 - HIGH
		Residual	2	3	4	1	9 - MOD
Earth works and vegetation clearing, hunting/snaring	Killing or injuring of fauna in the study area	Existing					
		Cumulative	2	1	4	0.75	5 - MOD
		Residual	1	1	2	0.5	2 - LOW
Wood collecting and medicinal plant harvesting	Increased harvesting of flora products	Existing					
		Cumulative	2	1	8	0.5	6 - MOD
		Residual	2	1	4	0.2	1 - LOW





## TERRESTRIAL ECOLOGY SCREENING STUDY

**Table 16: Assessment scoring of ecological impacts identified for the operational phase**

OPERATIONAL PHASE							
Activity	Nature of Impact	Impact type	Extent	Duration	Potential Intensity	Likelihood	Rating
Woody vegetation maintenance	<u>Direct Impact:</u>	Existing					
	Disturbance and fragmentation of natural habitat, caused by the continued clearing of woody vegetation in powerline servitude	Cumulative	2	3	8	1	13 - HIGH
		Residual	2	3	4	1	9 - MOD
Power line electrocutions	Killing or injuring of fauna (specifically raptors) in the study area	Existing					
		Cumulative	1	4	8	0.75	10 - HIGH
		Residual	1	4	4	0.5	5 - MOD



## TERRESTRIAL ECOLOGY SCREENING STUDY

**Table 17: Assessment scoring of ecological impacts identified for the decommissioning phase**

DECOMMISSIONING PHASE							
Activity	Nature of Impact	Impact type	Extent	Duration	Potential Intensity	Likelihood	Rating
Vegetation clearing/disturbance	<u>Direct Impact:</u>	Existing					
	Disturbance of natural habitat, caused by decommissioning activities	Cumulative	1	1	4	0.5	3 - MOD
		Residual	1	1	2	0.5	2 - LOW
Hunting/snaring and habitat destruction	Killing or injuring of fauna (specifically nesting birds) occurring on/along power line infrastructure	Existing					
		Cumulative	1	1	8	0.5	5 - MOD
		Residual	1	1	4	0.2	1 - LOW



### 7.4 Comparative Corridor Evaluation

Habitat around towns and along roads is more disturbed than adjacent farmland areas, but apart from these and other relatively small-scale variations, the type of arid savanna across the entire study area is generally uniform and no specific sites of pronounced ecological sensitivity or importance were noted at the high-level at which this screening study was undertaken.

Flora species of conservation importance were noted throughout the study area, and it is likely that a number of these, particularly *Acacia erioloba* trees, may need to be cleared regardless of which route alternatives are ultimately selected.

To determine the 'preferred' routes from an ecological perspective, a desktop evaluation of the alternatives using the course-grain criteria described below was undertaken:

- **Length of proposed routes in relation to existing linear disturbances/ infrastructure** - Corridors that are closely aligned to existing linear disturbances/ infrastructure, such as roads and large power lines, will cause less habitat disturbance and fragmentation as the disturbance footprint can be aligned to overlap. Routes overlap closely aligned to existing linear infrastructure are also easier to access.
- **Proposed routes in relation to BirdLife South Africa's Sensitivity Map** - The BirdLife sensitivity map in relation to the study area is shown in Figure 23.

A two point scoring system was used, with 2 points been awarded for a route option that is more closely aligned to existing linear infrastructure than its alternatives, which receives 1 point. Similarly, if a proposed route bisects a pentad that contains a higher bird sensitivity score than its alternative, it receives a score of 1 and the other alternative a score of 2. In the event that there is no difference in between route alternatives of a particular criterion, then both alternatives are assigned a score of 1. A scoring matrix is provided in Table 18 and a scoring rationale provided below.

#### Hot-Eldo Alt 1 and Hot-Eldo Alt 2

Both routes traverse through areas with the same bird sensitivity scores, with a highest score of 134. Hot-Eldo Alt 2 is just under a kilometre shorter than Hot-Eldo Alt 1 (13.7 km and 14.6 km, respectively) and traverses along or in close proximity to existing linear infrastructure for a greater distance (approx. 8.9 km). Accordingly, **Hot-Eldo Alt 2** is the preferred option for the power line between the Hotazel Substation and the Eldoret Substation.

#### Eldo-Rir Alt 1, Eldo-Rir Alt 2 and Eldo-Rir Alt 3

The Eldo-Rir routes all traverse through areas with the same bird sensitivity scores, with a highest score of 208. Eldo-Rir Alt 2 is located in the hilly, natural vegetation to the north of the R31 arterial road and is therefore not a preferred option. Eldo-Rir Alt 1 and Eldo-Rir Alt 3 are both aligned to the R31 arterial road – a major linear disturbance - for much of their length. Ecologically these routes are very similar and achieve the same evaluation score. However, **Eldo-Rir Alt 1** is shorter than Eldo-Rir Alt 3 and is therefore the preferred option.

#### Rir-Gamo Alt 1 and Rir-Gamo Alt 2

Both routes traverse through areas with the same bird sensitivity scores, with a highest score of 208. Rir-Gamo Alt 1 is shorter (16 km) than Rir-Gamo Alt 2 (21 km) and is closely aligned to R31 arterial road for most of its length. Rir-Gamo Alt 2 on the other hand traverses through the natural mountainous habitat to the south of the R31. **Rir-Gamo Alt 1** is the preferred option for the power line between Gamohaam Substation and the proposed Mothibistat Substation.

#### Gamo-Mothi Alt 1 and Gamo-Mothi Alt 2

These proposed routes are very similar, and are both closely aligned to R31 arterial road for much of their length. Both routes also traverse through pentads containing the same bird sensitivity scores, with a bird highest score of 622. Gamo-Mothi Alt 2 however, traverses through the 622 scoring pentad for longer than stretch than Gamo-Mothi Alt 1. **Gamo-Mothi Alt 1** is thus the preferred option.



### **Mothi-Moffat Alt 1 and Mothi-Moffat Alt 2**

Mothi-Moffat Alt 1 is 11 km long and Mothi-Moffat Alt 2 is 13 km long. Both are centred in the disturbed footprint of Kuruman town and surrounding residential areas. Mothi-Moffat Alt 1 however, is more direct and closely aligned with an existing road. These routes also traverse through areas with the same bird sensitivity scores. **Mothi-Moffat Alt 1** is the preferred option.

### **Moffat –Valley Alt 1 and Moffat –Valley Alt 2**

Moffat –Valley Alt 1 is aligned to both the R31 arterial road and a smaller gravel district road for much of its proposed length. Moffat –Valley Alt 2 on the other hand, traverses through areas of relatively undisturbed mountainous and savanna habitat. Moffat –Valley Alt 2 also traverses through a pentad with a higher bird sensitivity score (622) than the Moffat –Valley Alt 1. Accordingly, **Moffat –Valley Alt 1** is the preferred option.

### **Valley-Sekg Alt 1, Valley-Sekg Alt 2, Valley-Sekg Alt 3 and Valley-Sekg Alt 4**

The proposed route alternatives for this section are very similar. They all traverse through the same pentads and thus have the same bird sensitivity. Valley-Sekg Alt 4 is more direct and aligned to existing disturbance corridors in the form of farm roads. **Valley-Sekg Alt 4** is thus the preferred option.



## TERRESTRIAL ECOLOGY SCREENING STUDY

**Table 18: Corridor Evaluation**

	Hot-Eldo Alt 1	Hot-Eldo Alt 2	Eldo-Rir Alt 1	Eldo-Rir Alt 2	Eldo-Rir Alt 3	Rir-Gamo Alt 1	Rir-Gamo Alt 2	Gamo-Mothi Alt 1	Gamo-Mothi Alt 2	Mothi-Moffat Alt 1	Mothi-Moffat Alt 2	Moffat-Valley Alt 1	Moffat-Valley Alt 2	Valley-Sekg Alt 1	Valley-Sekg Alt 2	Valley-Sekg Alt 3	Valley-Sekg Alt 4
Length of proposed route in relation to existing linear disturbances/ infrastructure	1	2	2	1	2	2	1	1	1	2	1	2	1	1	1	2	2
Corridor alignments in relation to BirdLife South Africa's Sensitivity Map	1	1	1	1	1	1	1	2	1	1	1	2	1	1	1	1	1
Total	2	3	3	2	3	3	2	3	2	3	2	4	2	2	2	3	3
	.	Preferred	Preferred	.	.	Preferred	.	Preferred	.	Preferred	.	Preferred	.	.	.	.	Preferred



## 7.5 Proposed Mitigation Measures

Table 19 provides a list of potential mitigation and monitoring measures recommended for inclusion into the environmental management programme. Mitigation measures were based on *inter alia*:

- Standard best practises for development projects in natural areas;
- Specific recommendations concerning the management of potential birds impacts from BirdLife South Africa<sup>2</sup> and Anderson (2000)

**Table 19: Impacts and recommended mitigation measures**

Impact	Proposed mitigation measure
Disturbance and fragmentation of natural habitat	<ul style="list-style-type: none"> <li>■ The clearing of vegetation at proposed substation sites and at pylon footprints should be keep to a minimum necessary for construction. No unnecessary clearing should be permitted outside of these areas.</li> <li>■ Where proposed power line corridors lie adjacent to existing linear infrastructure/disturbances (e.g. power lines and roads) these new corridors should be as closely aligned to the existing corridors.</li> <li>■ The width of the power line corridors where woody vegetation is actively maintained during the operational phase must be kept to an absolute minimum that permits safe operation of the power line.</li> <li>■ The powerline servitudes within each of the preferred corridors should be aligned to avoid sensitive ecological features. A walkdown of each preferred power line corridor, prior to servitude finalisation, thus needs to be undertaken by an ecological specialist to identify sensitive ecological features and to guide the alignment the actual power line servitude to avoid these features. Sensitive ecological features may <i>inter alia</i> include:               <ul style="list-style-type: none"> <li>■ Large protected tree specimens;</li> <li>■ Prominent protected tree patches, specifically <i>Acacia erioloba</i> woodland patches;</li> <li>■ Raptor nests and large Sociable Weaver nests;</li> </ul> </li> <li>■ If clearing of plant species of conservation importance is unavoidable, a removal permit from the relevant authority must be obtained. For species listed under the provinces ordinances, the relevant authority is the Northern Cape Department of Environment and Nature Conservation. For protected trees, the National Department of Agriculture, Forestry and Fisheries is the relevant authority. For regional Red List species and those listed under NEMBA the National Department of Environmental Affairs is the relevant authority.</li> <li>■ An ECO needs to be appointed during construction to oversee the recommendations provided by the ecological specialist following the corridor walkdown regarding, <i>inter alia</i>, power line alignment in relation to sensitive features and obtaining removal/relocation permits.</li> </ul>
Killing or injuring of fauna in the study area	<ul style="list-style-type: none"> <li>■ An ECO or trained individual should be available during the construction phase to manage any wildlife-human interactions.</li> <li>■ A low speed limit should be enforced on site to reduce wildlife-collisions.</li> <li>■ Employees and contractors should be made aware of the presence of, and rules regarding fauna and the prohibition of hunting through suitable induction training.</li> <li>■ No clearing of large Sociable Weaver nests or raptor nests should be</li> </ul>

<sup>2</sup> Position statement on the effect of solar power facilities on birds.



Impact	Proposed mitigation measure
	<p>permitted. New power lines should be aligned to avoid the clearing of trees containing Sociable Weaver and raptor nests.</p> <ul style="list-style-type: none"> <li>■ Power lines should be designed to be 'raptor friendly' Devices/designs that could be considered include staggered insulators, raptor-protectors and/or perch deterrents. The Endangered Wildlife Trust's (EWT) Birds of Prey Programme should be consulted in this regard.</li> <li>■ Periodic monitoring along operational power lines should be undertaken by an ornithologist to ensure that raptor friendly devices installed on power lines are effective.</li> </ul>
Increased harvesting of flora products	<ul style="list-style-type: none"> <li>■ Employees and contractors should be prevented from harvesting natural products.</li> <li>■ Alternative wood fuel should be supplied to employees and contractors to prevent the collecting of <i>Acacia erioloba</i> wood for fuel.</li> </ul>

## 8.0 CONCLUSIONS AND RECOMMENDATIONS

The majority of the study area comprises natural, relatively undisturbed vegetation that provides habitat for a potentially rich assemblage of fauna and flora. It is therefore important that efforts are made during all phases of the proposed project to mitigate negative impacts on flora and fauna communities.

Wherever possible, it is recommended that power line servitudes be closely aligned to existing linear disturbances, such as roads and existing powerlines. This will limit additional habitat fragmentation and disturbance.

It is further recommended that upon confirmation of the preferred power line alternatives, a specialist ecologist conduct a corridor walk-down along the entire length of each route to identify particular sites of ecological sensitivity (specifically mature clusters of protected trees) and to guide the actual power line servitude alignment to avoid these sensitivity features.

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# APPENDIX A

Plant species recorded in the relevant QDS according to  
SANBI's POSA Database



## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
ACANTHACEAE	<i>Cheilanthes hirta</i> Sw. var. <i>brevipilosa</i> W.& N.Jacobsen
ACANTHACEAE	<i>Chironia palustris</i> Burch. subsp. <i>palustris</i>
ACANTHACEAE	<i>Chrysocoma ciliata</i> L.
ACANTHACEAE	<i>Chrysopogon serrulatus</i> Trin.
ACANTHACEAE	<i>Cineraria vallis-pacis</i> Dinter ex Merxm.
ACANTHACEAE	<i>Coccinia sessilifolia</i> (Sond.) Cogn.
ACANTHACEAE	<i>Coelachyrum yemenicum</i> (Schweinf.) S.M.Phillips
ACANTHACEAE	<i>Portulaca kermesina</i> N.E.Br.
ACANTHACEAE	<i>Prosopis glandulosa</i> Torr. var. <i>glandulosa</i>
ACANTHACEAE	<i>Prosopis velutina</i> Wooton
ACANTHACEAE	<i>Solanum lichtensteinii</i> Willd.
ACANTHACEAE	<i>Solanum supinum</i> Dunal var. <i>supinum</i>
ACANTHACEAE	<i>Tephrosia lupinifolia</i> DC.
ACANTHACEAE	<i>Tephrosia purpurea</i> (L.) Pers. subsp. <i>leptostachya</i> (DC.) Brummitt var. <i>leptostachya</i>
AIZOACEAE	<i>Pavonia burchellii</i> (DC.) R.A.Dyer
AMARANTHACEAE	<i>Amellus tridactylus</i> DC. subsp. <i>arenarius</i> (S.Moore) Rommel
AMARANTHACEAE	<i>Anacampseros filamentosa</i> (Haw.) Sims subsp. <i>filamentosa</i>
AMARANTHACEAE	<i>Anchusa riparia</i> A.DC.
AMARANTHACEAE	<i>Anthehora argentea</i> Gooss.
AMARANTHACEAE	<i>Anthehora pubescens</i> Nees
AMARANTHACEAE	<i>Pulicaria scabra</i> (Thunb.) Druce
AMARANTHACEAE	<i>Searsia lancea</i> (L.f.) F.A.Barkley
AMARANTHACEAE	<i>Searsia rigida</i> (Mill.) F.A.Barkley var. <i>rigida</i>
AMARANTHACEAE	<i>Searsia tridactyla</i> (Burch.) Moffett
AMARANTHACEAE	<i>Seddera capensis</i> (E.Mey. ex Choisy) Hallier f.
AMARANTHACEAE	<i>Seddera suffruticosa</i> (Schinz) Hallier f.
AMARANTHACEAE	<i>Selago mixta</i> Hilliard
AMARANTHACEAE	<i>Tragus racemosus</i> (L.) All.
APIACEAE	<i>Cleome conrathii</i> Burt Davy
APIACEAE	<i>Heliotropium strigosum</i> Willd.
APIACEAE	<i>Hermannia comosa</i> Burch. ex DC.
APOCYNACEAE	<i>Crotalaria leubnitziana</i> Schinz
APOCYNACEAE	<i>Pteronia mucronata</i> DC.
APOCYNACEAE	<i>Ptychlobium biflorum</i> (E.Mey.) Brummitt subsp. <i>biflorum</i>
ASPARAGACEAE	<i>Brassica tournefortii</i> Gouan
ASPARAGACEAE	<i>Buddleja saligna</i> Willd.
ASPARAGACEAE	<i>Bulbine abyssinica</i> A.Rich.



## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
ASPARAGACEAE	<i>Bulbostylis burchellii</i> (Ficalho & Hiern) C.B. Clarke
ASPARAGACEAE	<i>Bulbostylis hispidula</i> (Vahl) R.W. Haines subsp. <i>pyriformis</i> (Lye) R.W. Haines
ASPHODELACEAE	<i>Andropogon chinensis</i> (Nees) Merr.
ASPHODELACEAE	<i>Andropogon schirensis</i> Hochst. ex A. Rich.
ASPHODELACEAE	<i>Cucumis africanus</i> L.f.
ASPHODELACEAE	<i>Cucumis heptadactylus</i> Naudin
ASPLENIACEAE	<i>Cenchrus ciliaris</i> L.
ASPLENIACEAE	<i>Chaenostoma halimifolium</i> Benth.
ASTERACEAE	<i>Anthospermum rigidum</i> Eckl. & Zeyh. subsp. <i>pumilum</i> (Sond.) Puff
ASTERACEAE	<i>Chamaecrista biensis</i> (Steyaert) Lock
ASTERACEAE	<i>Cleome angustifolia</i> Forssk. subsp. <i>diandra</i> (Burch.) Kers
ASTERACEAE	<i>Cleome kalachariensis</i> (Schinz) Gilg & Gilg-Ben.
ASTERACEAE	<i>Diospyros lycioides</i> Desf. subsp. <i>lycioides</i>
ASTERACEAE	<i>Dipcadi viride</i> (L.) Moench
ASTERACEAE	<i>Hermannia modesta</i> (Ehrenb.) Mast.
ASTERACEAE	<i>Hermannia tomentosa</i> (Turcz.) Schinz ex Engl.
ASTERACEAE	<i>Hermibstaedtia fleckii</i> (Schinz) Baker & C.B. Clarke
ASTERACEAE	<i>Hermibstaedtia odorata</i> (Burch.) T. Cooke var. <i>odorata</i>
ASTERACEAE	<i>Heteropogon contortus</i> (L.) Roem. & Schult.
ASTERACEAE	<i>Hibiscus engleri</i> K. Schum.
ASTERACEAE	<i>Indigastrum argyraeum</i> (Eckl. & Zeyh.) Schrire
ASTERACEAE	<i>Indigofera alternans</i> DC. var. <i>alternans</i>
ASTERACEAE	<i>Melinis nerviglumis</i> (Franch.) Zizka
ASTERACEAE	<i>Melolobium candicans</i> (E. Mey.) Eckl. & Zeyh.
ASTERACEAE	<i>Ornithoglossum vulgare</i> B. Nord.
ASTERACEAE	<i>Oropetium capense</i> Stapf
ASTERACEAE	<i>Osteospermum leptolobum</i> (Harv.) Norl.
ASTERACEAE	<i>Osteospermum microphyllum</i> DC.
ASTERACEAE	<i>Osteospermum muricatum</i> E. Mey. ex DC. subsp. <i>muricatum</i>
ASTERACEAE	<i>Otoptera burchellii</i> DC.
ASTERACEAE	<i>Parkinsonia africana</i> Sond.
ASTERACEAE	<i>Pegolettia retrofracta</i> (Thunb.) Kies
ASTERACEAE	<i>Pelargonium myrrhifolium</i> (L.) L'Hér. var. <i>myrrhifolium</i>
ASTERACEAE	<i>Peliostomum leucorrhizum</i> E. Mey. ex Benth.
ASTERACEAE	<i>Pellaea calomelanos</i> (Sw.) Link var. <i>calomelanos</i>
ASTERACEAE	<i>Pentzia argentea</i> Hutch.
ASTERACEAE	<i>Pentzia calcarea</i> Kies



## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
ASTERACEAE	<i>Pentzia quinquefida</i> (Thunb.) Less.
ASTERACEAE	<i>Pergularia daemia</i> (Forssk.) Chiov. subsp. <i>daemia</i>
ASTERACEAE	<i>Phyllanthus maderaspatensis</i> L.
ASTERACEAE	<i>Phyllanthus parvulus</i> Sond. var. <i>garipensis</i> (E.Mey. ex Drège) Radcl.-Sm.
ASTERACEAE	<i>Phyllanthus parvulus</i> Sond. var. <i>parvulus</i>
ASTERACEAE	<i>Piранthus decipiens</i> (N.E.Br.) Bruyns
ASTERACEAE	<i>Plagiochasma rupestre</i> (J.R. & G.Forst.) Steph. var. <i>rupestre</i>
ASTERACEAE	<i>Plinthus karoocicus</i> I. Verd.
ASTERACEAE	<i>Pseudognaphalium luteo-album</i> (L.) Hilliard & B.L. Burt
ASTERACEAE	<i>Rhigozum obovatum</i> Burch.
ASTERACEAE	<i>Rhigozum trichotomum</i> Burch.
ASTERACEAE	<i>Rhynchosia confusa</i> Burt Davy
ASTERACEAE	<i>Rhynchosia holosericea</i> Schinz
ASTERACEAE	<i>Rhynchosia totta</i> (Thunb.) DC. var. <i>totta</i>
ASTERACEAE	<i>Rhynchosia venulosa</i> (Hiern) K. Schum.
ASTERACEAE	<i>Riccia albolimbata</i> S.W. Arnell
ASTERACEAE	<i>Rosenia humilis</i> (Less.) K. Bremer
ASTERACEAE	<i>Salsola kali</i> L.
ASTERACEAE	<i>Salsola patentipilosa</i> Botsch.
ASTERACEAE	<i>Salsola rabieana</i> I. Verd.
ASTERACEAE	<i>Sida ovata</i> Forssk.
ASTERACEAE	<i>Solanum burchellii</i> Dunal
ASTERACEAE	<i>Tolpis capensis</i> (L.) Sch. Bip.
ASTERACEAE	<i>Trachyandra laxa</i> (N.E.Br.) Oberm. var. <i>laxa</i>
ASTERACEAE	<i>Vahlia capensis</i> (L.f.) Thunb. subsp. <i>vulgaris</i> Bridson var. <i>vulgaris</i>
BORAGINACEAE	<i>Aptosimum elongatum</i> Engl.
BORAGINACEAE	<i>Ipomoea suffruticosa</i> Burch.
BORAGINACEAE	<i>Sarcostemma viminale</i> (L.) R.Br. subsp. <i>viminale</i>
BORAGINACEAE	<i>Scabiosa columbaria</i> L.
BORAGINACEAE	<i>Schizachyrium sanguineum</i> (Retz.) Alston
BORAGINACEAE	<i>Schmidtia kalahariensis</i> Stent
BRASSICACEAE	<i>Crotalaria orientalis</i> Burt Davy ex I. Verd. subsp. <i>orientalis</i>
BRASSICACEAE	<i>Melolobium exudans</i> Harv.
BRASSICACEAE	<i>Salvia stenophylla</i> Burch. ex Benth.
BRYACEAE	<i>Crotalaria spartioides</i> DC.
BRYACEAE	<i>Crotalaria sphaerocarpa</i> Perr. ex DC. subsp. <i>sphaerocarpa</i>
BUDDLEJACEAE	<i>Croton gratissimus</i> Burch. var. <i>gratissimus</i>



## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
CAPPARACEAE	<i>Enneapogon cenchroides</i> (Licht. ex Roem. & Schult.) C.E.Hubb.
CAPPARACEAE	<i>Enneapogon desvauxii</i> P.Beauv.
CAPPARACEAE	<i>Enneapogon scoparius</i> Stapf
CAPPARACEAE	<i>Equisetum ramosissimum</i> Desf. subsp. <i>ramosissimum</i>
CARYOPHYLLACEAE	<i>Hermannia jacobefolia</i> (Turcz.) R.A.Dyer
CELASTRACEAE	<i>Putterlickia saxatilis</i> (Burch.) M.Jordaan
CELASTRACEAE	<i>Raphionacme velutina</i> Schltr.
CELASTRACEAE	<i>Requienia sphaerosperma</i> DC.
CHENOPODIACEAE	<i>Chascanum adenostachyum</i> (Schauer) Moldenke
CHENOPODIACEAE	<i>Dimorphotheca cuneata</i> (Thunb.) Less.
CHENOPODIACEAE	<i>Dimorphotheca zeyheri</i> Sond.
COMMELINACEAE	<i>Eragrostis echinochloidea</i> Stapf
COMMELINACEAE	<i>Eragrostis nindensis</i> Ficalho & Hiern
COMMELINACEAE	<i>Eragrostis pallens</i> Hack.
COMMELINACEAE	<i>Eragrostis rigidior</i> Pilg.
COMMELINACEAE	<i>Eragrostis trichophora</i> Coss. & Durieu
COMMELINACEAE	<i>Eriocephalus glandulosus</i> M.A.N.Müll.
CONVOLVULACEAE	<i>Eriospermum corymbosum</i> Baker
CONVOLVULACEAE	<i>Erlangea misera</i> (Oliv. & Hiern) S.Moore
CONVOLVULACEAE	<i>Erucastrum strigosum</i> (Thunb.) O.E.Schulz
CONVOLVULACEAE	<i>Nolletia ciliaris</i> (DC.) Steetz
CONVOLVULACEAE	<i>Ocimum americanum</i> L. var. <i>americanum</i>
CONVOLVULACEAE	<i>Ocimum filamentosum</i> Forssk.
CONVOLVULACEAE	<i>Striga gesnerioides</i> (Willd.) Vatke
CONVOLVULACEAE	<i>Sutera griquensis</i> Hiern
CONVOLVULACEAE	<i>Sutherlandia frutescens</i> (L.) R.Br.
CRASSULACEAE	<i>Euphorbia mauritanica</i> L. var. <i>mauritanica</i>
CRASSULACEAE	<i>Terminalia sericea</i> Burch. ex DC.
CRASSULACEAE	<i>Tetragonia calycina</i> Fenzl
CRASSULACEAE	<i>Thesium hystricoides</i> A.W.Hill
CUCURBITACEAE	<i>Aerva leucura</i> Moq.
CUCURBITACEAE	<i>Ehretia alba</i> Retief & A.E.van Wyk
CUCURBITACEAE	<i>Eragrostis barrelieri</i> Daveau
CUCURBITACEAE	<i>Eragrostis biflora</i> Hack. ex Schinz
CUCURBITACEAE	<i>Eragrostis capensis</i> (Thunb.) Trin.
CUCURBITACEAE	<i>Euclea crispa</i> (Thunb.) Gürke subsp. <i>ovata</i> (Burch.) F.White
CUCURBITACEAE	<i>Felicia namaquana</i> (Harv.) Merxm.



## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
CUCURBITACEAE	<i>Fingerhuthia africana</i> Lehm.
CUCURBITACEAE	<i>Fissidens erosulus</i> (Müll.Hal.) Paris
CUCURBITACEAE	<i>Thesium hystrix</i> A.W.Hill
CYPERACEAE	<i>Commelina africana</i> L. var. <i>barberae</i> (C.B.Clarke) C.B.Clarke
CYPERACEAE	<i>Cyamopsis serrata</i> Schinz
CYPERACEAE	<i>Cymbopogon pospischilii</i> (K.Schum.) C.E.Hubb.
CYPERACEAE	<i>Gnidia polycephala</i> (C.A.Mey.) Gilg
CYPERACEAE	<i>Gomphocarpus fruticosus</i> (L.) Aiton f. subsp. <i>fruticosus</i>
CYPERACEAE	<i>Gomphocarpus tomentosus</i> Burch. subsp. <i>tomentosus</i>
CYPERACEAE	<i>Gomphrena celosioides</i> Mart.
CYPERACEAE	<i>Grewia flava</i> DC.
CYPERACEAE	<i>Gymnosporia buxifolia</i> (L.) Szyszyl.
CYPERACEAE	<i>Helichrysum argyrosphaerum</i> DC.
CYPERACEAE	<i>Helichrysum caespitium</i> (DC.) Harv.
CYPERACEAE	<i>Helichrysum cerastioides</i> DC. var. <i>cerastioides</i>
CYPERACEAE	<i>Helichrysum lineare</i> DC.
CYPERACEAE	<i>Helichrysum nudifolium</i> (L.) Less. var. <i>nudifolium</i>
CYPERACEAE	<i>Helichrysum spiciforme</i> DC.
CYPERACEAE	<i>Helichrysum zeyheri</i> Less.
CYPERACEAE	<i>Helinus spartioides</i> (Engl.) Schinz ex Engl.
CYPERACEAE	<i>Heliophila suavissima</i> Burch. ex DC.
CYPERACEAE	<i>Heliotropium nelsonii</i> C.H.Wright
CYPERACEAE	<i>Tragus berteronianus</i> Schult.
EBENACEAE	<i>Indigofera comosa</i> N.E.Br.
EBENACEAE	<i>Indigofera daleoides</i> Benth. ex Harv. var. <i>daleoides</i>
EBENACEAE	<i>Indigofera flavicans</i> Baker
EBENACEAE	<i>Melolobium humile</i> Eckl. & Zeyh.
EBENACEAE	<i>Melolobium macrocalyx</i> Dummer var. <i>macrocalyx</i>
EBENACEAE	<i>Melolobium microphyllum</i> (L.f.) Eckl. & Zeyh.
ELATINACEAE	<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai
ELATINACEAE	<i>Clematis brachiata</i> Thunb.
EQUISETACEAE	<i>Kyphocarpa angustifolia</i> (Moq.) Lopr.
ERIOSPERMACEAE	<i>Melinis repens</i> (Willd.) Zizka subsp. <i>grandiflora</i> (Hochst.) Zizka
EUPHORBIACEAE	<i>Felicia muricata</i> (Thunb.) Nees subsp. <i>cinerascens</i> Grau
EUPHORBIACEAE	<i>Merremia verecunda</i> Rendle
EUPHORBIACEAE	<i>Microlooma armatum</i> (Thunb.) Schltr. var. <i>burchellii</i> (N.E.Br.) Bruyns
EUPHORBIACEAE	<i>Monechma divaricatum</i> (Nees) C.B.Clarke



## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
EUPHORBIACEAE	<i>Monechma genistifolium</i> (Engl.) C.B.Clarke subsp. <i>australe</i> (P.G.Mey.) Munday
EUPHORBIACEAE	<i>Monechma incanum</i> (Nees) C.B.Clarke
EUPHORBIACEAE	<i>Monsonia angustifolia</i> E.Mey. ex A.Rich.
EUPHORBIACEAE	<i>Montinia caryophyllacea</i> Thunb.
FABACEAE	<i>Acacia erioloba</i> E.Mey.
FABACEAE	<i>Acacia haematoxylon</i> Willd.
FABACEAE	<i>Acacia hereroensis</i> Engl.
FABACEAE	<i>Acacia karroo</i> Hayne
FABACEAE	<i>Achyranthes aspera</i> L. var. <i>aspera</i>
FABACEAE	<i>Achyranthes aspera</i> L. var. <i>pubescens</i> (Moq.) C.C.Towns.
FABACEAE	<i>Commelina livingstonii</i> C.B.Clarke
FABACEAE	<i>Cyperus capensis</i> (Steud.) Endl.
FABACEAE	<i>Deverra burchellii</i> (DC.) Eckl. & Zeyh.
FABACEAE	<i>Dianthus namaensis</i> Schinz var. <i>dinteri</i> (Schinz) S.S.Hooper
FABACEAE	<i>Euphorbia peplus</i> L.
FABACEAE	<i>Euphorbia pseudotuberosa</i> Pax
FABACEAE	<i>Euphorbia wilmaniae</i> Marloth
FABACEAE	<i>Eustachys paspaloides</i> (Vahl) Lanza & Mattei
FABACEAE	<i>Evolvulus alsinoides</i> (L.) L.
FABACEAE	<i>Felicia clavipilosa</i> Grau subsp. <i>clavipilosa</i>
FABACEAE	<i>Felicia fascicularis</i> DC.
FABACEAE	<i>Felicia filifolia</i> (Vent.) Burt Davy subsp. <i>filifolia</i>
FABACEAE	<i>Foveolina dichotoma</i> (DC.) Källersjö
FABACEAE	<i>Galenia meziana</i> K.Müll.
FABACEAE	<i>Jamesbrittenia atropurpurea</i> (Benth.) Hilliard subsp. <i>atropurpurea</i>
FABACEAE	<i>Jamesbrittenia integerrima</i> (Benth.) Hilliard
FABACEAE	<i>Solanum tomentosum</i> L. var. <i>tomentosum</i>
FABACEAE	<i>Sonchus oleraceus</i> L.
FABACEAE	<i>Spergularia media</i> (L.) C.Presl
FABACEAE	<i>Sphedamnocarpus pruriens</i> (A.Juss.) Szyszyl. subsp. <i>pruriens</i>
FABACEAE	<i>Sporobolus acinifolius</i> Stapf
FABACEAE	<i>Sporobolus fimbriatus</i> (Trin.) Nees
FABACEAE	<i>Sporobolus ioclados</i> (Trin.) Nees
FABACEAE	<i>Stachys burchelliana</i> Launert
FABACEAE	<i>Stachys spathulata</i> Burch. ex Benth.
FABACEAE	<i>Stipagrostis ciliata</i> (Desf.) De Winter var. <i>capensis</i> (Trin. &





## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
	<i>Rupr.) De Winter</i>
FABACEAE	<i>Stipagrostis obtusa (Delile) Nees</i>
FABACEAE	<i>Stipagrostis uniplumis (Licht.) De Winter var. neesii (Trin. &amp; Rupr.) De Winter</i>
FABACEAE	<i>Striga bilabiata (Thunb.) Kuntze subsp. bilabiata</i>
FABACEAE	<i>Striga elegans Benth.</i>
FISSIDENTACEAE	<i>Panicum maximum Jacq.</i>
GENTIANACEAE	<i>Diospyros austro-africana De Winter var. microphylla (Burch.) De Winter</i>
GISEKIACEAE	<i>Plinthus sericeus Pax</i>
GISEKIACEAE	<i>Pogonarthria squarrosa (Roem. &amp; Schult.) Pilg.</i>
GISEKIACEAE	<i>Pollichia campestris Aiton</i>
GISEKIACEAE	<i>Polygala leptophylla Burch. var. armata (Chodat) Paiva</i>
GISEKIACEAE	<i>Polygala seminuda Harv.</i>
GISEKIACEAE	<i>Pomaria lactea (Schinz) B.B.Simpson &amp; G.P.Lewis</i>
HYACINTHACEAE	<i>Indigofera hololeuca Benth. ex Harv.</i>
HYACINTHACEAE	<i>Indigofera sessilifolia DC.</i>
HYACINTHACEAE	<i>Indigofera vicioides Jaub. &amp; Spach var. vicioides</i>
HYACINTHACEAE	<i>Ipomoea obscura (L.) Ker Gawl. var. obscura</i>
HYACINTHACEAE	<i>Triraphis andropogonoides (Steud.) E.Phillips</i>
IRIDACEAE	<i>Chascanum hederaceum (Sond.) Moldenke var. hederaceum</i>
IRIDACEAE	<i>Chascanum pinnatifidum (L.f.) E.Mey. var. pinnatifidum</i>
IRIDACEAE	<i>Portulaca hereroensis Schinz</i>
IRIDACEAE	<i>Tribulus terrestris L.</i>
IRIDACEAE	<i>Tribulus zeyheri Sond. subsp. zeyheri</i>
IRIDACEAE	<i>Tricholaena monachne (Trin.) Stapf &amp; C.E.Hubb.</i>
IRIDACEAE	<i>Trichoneura grandiglumis (Nees) Ekman</i>
JUNCACEAE	<i>Tarchonanthus obovatus DC.</i>
JUNCACEAE	<i>Tephrosia burchellii Burt Davy</i>
JUNCACEAE	<i>Tephrosia longipes Meisn. subsp. longipes var. longipes</i>
LAMIACEAE	<i>Urochloa panicoides P.Beauv.</i>
LAMIACEAE	<i>Urochloa stolonifera (Gooss.) Chippind.</i>
LAMIACEAE	<i>Ursinia nana DC. subsp. nana</i>
LAMIACEAE	<i>Utricularia gibba L.</i>
LOBELIACEAE	<i>Wahlenbergia nodosa (H.Buek) Lammers</i>
LOBELIACEAE	<i>Withania somnifera (L.) Dunal</i>
LOBELIACEAE	<i>Xenostegia tridentata (L.) D.F.Austin &amp; Staples subsp. angustifolia (Jacq.) Lejoly &amp; Lisowski</i>
LOPHIOCARPACEAE	<i>Euclea undulata Thunb.</i>



## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
LOPHIOCARPACEAE	<i>Euphorbia duseimata</i> R.A.Dyer
MALVACEAE	<i>Abutilon austro-africanum</i> Hochr.
MALVACEAE	<i>Abutilon betschuanicum</i> Ulbr.
MALVACEAE	<i>Abutilon dinteri</i> Ulbr.
MALVACEAE	<i>Abutilon rehmannii</i> Baker f.
MALVACEAE	<i>Euphorbia inaequilatera</i> Sond. var. <i>inaequilatera</i>
MALVACEAE	<i>Pupalia lappacea</i> (L.) A.Juss. var. <i>lappacea</i>
MALVACEAE	<i>Putterlickia pyracantha</i> (L.) Szyszyl.
MALVACEAE	<i>Schmidtia pappophoroides</i> Steud.
MALVACEAE	<i>Scirpoides dioeca</i> (Kunth) Browning
MALVACEAE	<i>Searsia burchellii</i> (Sond. ex Engl.) Moffett
MALVACEAE	<i>Searsia dregeana</i> (Sond.) Moffett
MALVACEAE	<i>Searsia erosa</i> (Thunb.) Moffett
MALVACEAE	<i>Sericorema sericea</i> (Schinz) Lopr.
MALVACEAE	<i>Setaria sphacelata</i> (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. <i>torta</i> (Stapf) Clayton
MALVACEAE	<i>Setaria verticillata</i> (L.) P.Beauv.
MALVACEAE	<i>Sida chrysantha</i> Ulbr.
MALVACEAE	<i>Sida cordifolia</i> L. subsp. <i>cordifolia</i>
MOLLUGINACEAE	<i>Verbesina encelioides</i> (Cav.) Benth. & Hook. var. <i>encelioides</i>
MOLLUGINACEAE	<i>Vigna unguiculata</i> (L.) Walp. subsp. <i>unguiculata</i> var. <i>unguiculata</i>
MOLLUGINACEAE	<i>Viscum rotundifolium</i> L.f.
MOLLUGINACEAE	<i>Wahlenbergia androsacea</i> A.DC.
MOLLUGINACEAE	<i>Wahlenbergia denticulata</i> (Burch.) A.DC. var. <i>transvaalensis</i> (Adamson) W.G.Welman
POACEAE	<i>Aptosimum lineare</i> Marloth & Engl. var. <i>lineare</i>
POACEAE	<i>Aristida congesta</i> Roem. & Schult. subsp. <i>congesta</i>
POACEAE	<i>Asparagus laricinus</i> Burch.
POACEAE	<i>Asparagus nelsii</i> Schinz
POACEAE	<i>Barleria irritans</i> Nees
POACEAE	<i>Berkheya ferox</i> O.Hoffm. var. <i>tomentosa</i> Roessler
POACEAE	<i>Berula thunbergii</i> (DC.) H.Wolff
POACEAE	<i>Bidens pilosa</i> L.
POACEAE	<i>Brachiaria brizantha</i> (A.Rich.) Stapf
POACEAE	<i>Convolvulus multifidus</i> Thunb.
POACEAE	<i>Corallocarpus triangularis</i> Cogn.
POACEAE	<i>Crassula lanceolata</i> (Eckl. & Zeyh.) Endl. ex Walp. subsp. <i>transvaalensis</i> (Kuntze) Toelken



## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
POACEAE	<i>Crotalaria griquensis</i> L.Bolus
POACEAE	<i>Cyperus margaritaceus</i> Vahl var. <i>margaritaceus</i>
POACEAE	<i>Dipcadi marlothii</i> Engl.
POACEAE	<i>Eragrostis chloromelas</i> Steud.
POACEAE	<i>Eragrostis curvula</i> (Schrad.) Nees
POACEAE	<i>Gazania krebsiana</i> Less. subsp. <i>arctotooides</i> (Less.) Roessler
POACEAE	<i>Geigeria brevifolia</i> (DC.) Harv.
POACEAE	<i>Geigeria filifolia</i> Mattf.
POACEAE	<i>Geigeria ornativa</i> O.Hoffm. subsp. <i>ornativa</i>
POACEAE	<i>Gisekia africana</i> (Lour.) Kuntze var. <i>africana</i>
POACEAE	<i>Gisekia pharnacioides</i> L. var. <i>pharnacioides</i>
POACEAE	<i>Gladiolus permeabilis</i> D.Delaroche subsp. <i>edulis</i> (Burch. ex Ker Gawl.) Oberm.
POACEAE	<i>Glossochilus burchellii</i> Nees
POACEAE	<i>Gnaphalium englerianum</i> (O.Hoffm.) Hilliard & B.L.Burt
POACEAE	<i>Hibiscus fleckii</i> Gürke
POACEAE	<i>Hibiscus ludwigii</i> Eckl. & Zeyh.
POACEAE	<i>Hibiscus micranthus</i> L.f. var. <i>micranthus</i>
POACEAE	<i>Hibiscus pusillus</i> Thunb.
POACEAE	<i>Hirpicium echinus</i> Less.
POACEAE	<i>Hyparrhenia anamesa</i> Clayton
POACEAE	<i>Hypoestes forskoolii</i> (Vahl) R.Br.
POACEAE	<i>Juncus exsertus</i> Buchenau
POACEAE	<i>Juncus rigidus</i> Desf.
POACEAE	<i>Justicia puberula</i> Immelman
POACEAE	<i>Kalanchoe brachyloba</i> Welw. ex Britten
POACEAE	<i>Kalanchoe rotundifolia</i> (Haw.) Haw.
POACEAE	<i>Kedrostis africana</i> (L.) Cogn.
POACEAE	<i>Kleinia longiflora</i> DC.
POACEAE	<i>Kohautia caespitosa</i> Schnizl. subsp. <i>brachyloba</i> (Sond.) D.Mantell
POACEAE	<i>Kyllinga alba</i> Nees
POACEAE	<i>Lamarckia aurea</i> (L.) Moench
POACEAE	<i>Lantana rugosa</i> Thunb.
POACEAE	<i>Lapeirousia erythrantha</i> (Klotzsch ex Klatt) Baker
POACEAE	<i>Lapeirousia littoralis</i> Baker subsp. <i>caudata</i> (Schinz) Goldblatt
POACEAE	<i>Lapeirousia sandersonii</i> Baker
POACEAE	<i>Ledebouria apertiflora</i> (Baker) Jessop



## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
POACEAE	<i>Leptochloa fusca</i> (L.) Kunth
POACEAE	<i>Leucas capensis</i> (Benth.) Engl.
POACEAE	<i>Leysera tenella</i> DC.
POACEAE	<i>Limeum aethiopicum</i> Burm.f. var. <i>intermedium</i> Friedrich
POACEAE	<i>Limeum fenestratum</i> (Fenzl) Heimerl var. <i>fenestratum</i>
POACEAE	<i>Limeum myosotis</i> H.Walter var. <i>myosotis</i>
POACEAE	<i>Limeum viscosum</i> (J.Gay) Fenzl subsp. <i>transvaalense</i> Friedrich
POACEAE	<i>Lobelia erinus</i> L.
POACEAE	<i>Lobelia thermalis</i> Thunb.
POACEAE	<i>Lophiocarpus polystachyus</i> Turcz.
POACEAE	<i>Lotononis crumanina</i> Burch. ex Benth.
POACEAE	<i>Lycium cinereum</i> Thunb.
POACEAE	<i>Lycium hirsutum</i> Dunal
POACEAE	<i>Lycium pilifolium</i> C.H.Wright
POACEAE	<i>Medicago laciniata</i> (L.) Mill. var. <i>laciniata</i>
POACEAE	<i>Megaloprotachne albescens</i> C.E.Hubb.
POACEAE	<i>Melhania burchellii</i> DC.
POACEAE	<i>Melhania virescens</i> (K.Schum.) K.Schum.
POACEAE	<i>Melilotus albus</i> Medik.
POACEAE	<i>Moraea longistyla</i> (Goldblatt) Goldblatt
POACEAE	<i>Moraea pallida</i> (Baker) Goldblatt
POACEAE	<i>Moraea polystachya</i> (Thunb.) Ker Gawl.
POACEAE	<i>Nerine laticoma</i> (Ker Gawl.) T.Durand & Schinz
POACEAE	<i>Nidorella hottentotica</i> DC.
POACEAE	<i>Oxalis lawsonii</i> F.Bolus
POACEAE	<i>Oxygonum dregeanum</i> Meisn. subsp. <i>canescens</i> (Sond.) Germish. var. <i>canescens</i>
POACEAE	<i>Panicum coloratum</i> L. var. <i>coloratum</i>
POACEAE	<i>Panicum kalaharensis</i> Mez
POACEAE	<i>Senecio consanguineus</i> DC.
POACEAE	<i>Senecio inaequidens</i> DC.
POACEAE	<i>Senna italica</i> Mill. subsp. <i>arachoides</i> (Burch.) Lock
POACEAE	<i>Sericorema remotiflora</i> (Hook.f.) Lopr.
POACEAE	<i>Solanum catombelense</i> Peyr.
POACEAE	<i>Trianthena parvifolia</i> E.Mey. ex Sond. var. <i>parvifolia</i>
POACEAE	<i>Trochomeria debilis</i> (Sond.) Hook.f.
POACEAE	<i>Urelytrum agropyroides</i> (Hack.) Hack.
PORTULACACEAE	<i>Aptosimum albomarginatum</i> Marloth & Engl.



## TERRESTRIAL ECOLOGY SCREENING STUDY

Family	Species Name
RANUNCULACEAE	<i>Elephantorrhiza elephantina</i> (Burch.) Skeels
RHAMNACEAE	<i>Salsola tuberculata</i> (Moq.) Fenzl
RUBIACEAE	<i>Asparagus suaveolens</i> Burch.
RUBIACEAE	<i>Tragia dioica</i> Sond.
SCROPHULARIACEAE	<i>Atriplex semibaccata</i> R.Br. var. <i>appendiculata</i> Aellen
SCROPHULARIACEAE	<i>Babiana bainesii</i> Baker
SCROPHULARIACEAE	<i>Babiana hypogaea</i> Burch.
SCROPHULARIACEAE	<i>Barleria bechuanensis</i> C.B. Clarke
SCROPHULARIACEAE	<i>Cyperus marlothii</i> Boeckeler
SCROPHULARIACEAE	<i>Tamarix parviflora</i> DC.
SCROPHULARIACEAE	<i>Tapinanthus oleifolius</i> (J.C. Wendl.) Danser
SCROPHULARIACEAE	<i>Tarchonanthus camphoratus</i> L.
SINOPTERIDACEAE	<i>Diheteropogon amplexens</i> (Nees) Clayton var. <i>amplexens</i>
SOLANACEAE	<i>Heliotropium ovalifolium</i> Forssk.
THYMELAEACEAE	<i>Pteronia glauca</i> Thunb.
VERBENACEAE	<i>Dicoma kurumanii</i> S. Ortiz & Netnou
VERBENACEAE	<i>Dicoma macrocephala</i> DC.
VERBENACEAE	<i>Digitaria eriantha</i> Steud.
VERBENACEAE	<i>Digitaria polyphylla</i> Henrard
VERBENACEAE	<i>Triaspis hypericoides</i> (DC.) Burch. subsp. <i>hypericoides</i>
VERBENACEAE	<i>Tribulus excrucians</i> Wawra

Source: POSA



# APPENDIX B

Mammals potentially occurring in the study area.



## TERRESTRIAL ECOLOGY SCREENING STUDY

Scientific Name	Common Name	IUCN – Regional Status	NEMBA List (2013)	TOPS	Northern Cape – Protected Species (2009)
<i>Macroscelides proboscideus</i>	Round-eared Sengi	-	-		Protected
<i>Elephantulus intufi</i>	Bushveld Sengi	-	-		Protected
<i>Atelerix frontalis</i>	Southern African Hedgehog	Near Threatened	-		Specially Protected
<i>Crocidura cyanea</i>	Reddish-grey Musk Shrew	-	-		Protected
<i>Crocidura hirta</i>	Lesser Red Mush Shrew	-	-		Protected
<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	-	-		Protected
<i>Rhinolophus clivus</i>	Geoffroy's Horseshoe bat	Near Threatened	-		Protected
<i>Miniopterus schreibersii</i>	Schreibers's long-fingered Bat	Near Threatened	-		Protected
<i>Neoromicia capensis</i>	Cape Serotine Bat	-	-		Protected
<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	-	-		Protected
<i>Papio cynocephalus urisus</i>	Chacma Baboon	-	-		-
<i>Manis temminckii</i>	Pangolin	Vulnerable	Vulnerable		Specially Protected
<i>Lepus capensis</i>	Cape Hare	-	-		Protected
<i>Lepus saxatilis</i>	Scrub Hare	-	-		Protected
<i>Xerus inauris</i>	Ground Squirrel	-	-		-
<i>Graphiurus ocellatus</i>	Spectacled Dormouse	-	-		-
<i>Pedetes capensis</i>	Springhare	-	-		-
<i>Cryptomys hottentotus</i>	Common Mole-rat	-	-		-
<i>Cryptomys africae australis</i>	Porcupine	-	-		-
<i>Zelotomys woosnami</i>	Woosnam's Desert Rat	-	-		-
<i>Saccostomus campestris</i>	Pouched Mouse	-	-		-
<i>Staetomys krebsii</i>	Kreb's Fat Mouse	-	-		-
<i>Dendromus melanotis</i>	Grey Climbing Mouse	-	-		Protected
<i>Malacothrix typica</i>	Gerbil Mouse	-	-		Protected
<i>Desmodillus auricularis</i>	Cape Short-tailed Gerbil	-	-		Protected
<i>Gerbillurus paebea</i>	Hairy-footed gerbil	-	-		Protected
<i>Tatera leucogaster</i>	Bushveld Gerbil	-	-		Protected
<i>Tatera brantsii</i>	Highveld Gerbil	-	-		Protected
<i>Micaelamys namaquensis</i>	Namaqua Rock Mouse	-	-		-
<i>Aethomys chrysophilus</i>	Red Veld Rat	-	-		Protected
<i>Rhabdomys pumilio</i>	Four-striped Grass Mouse	-	-		-
<i>Mus indutus</i>	Desert Pygmy Mouse	-	-		-
<i>Thallomys paedulcus</i>	Acacia Rat	-	-		Protected
<i>Mastomys natalensis/coucha</i>	Multimammate mouse	-	-		-
<i>Parotomys brantsii</i>	Brant's Whistling Rat	-	-		-
<i>Otomys irroratus</i>	Vlei Rat	-	-		Protected
<i>Vulpes chama</i>	Cape Fox	-	Protected		Specially Protected
<i>Tocyon megalotis</i>	Bat-eared Fox	-	Protected		-
<i>Canis mesomelas</i>	Black-backed Jackal	-	-		-
<i>Mellivora capensis</i>	Honey Badger	Near Threatened	-		Specially Protected
<i>Poecilogale albinucha</i>	African Striped Weasel	-	-		Specially Protected
<i>Ictonyx striatus</i>	Striped Polecat	-	-		Specially Protected
<i>Galerella sanguinea</i>	Slender Mongoose	-	-		Protected
<i>Cynictis penicillata</i>	Yellow Mongoose	-	-		Protected
<i>Suricata suricatta</i>	Suricate	-	-		Protected
<i>Geneta genetta</i>	Small-spotted Genet	-	-		-
<i>Parahyaena brunnea</i>	Brown Hyaena	-	Protected		Specially Protected
<i>Proteles cristatus</i>	Aardwolf	-	-		Specially Protected
<i>Felis silvestris lybica</i>	African Wild Cate	-	-		-



## TERRESTRIAL ECOLOGY SCREENING STUDY

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Felis nigripes</i>	Small-spotted Cat	-	Protected	Specially Protected
<i>Caracal caracal</i>	Caracal	-	-	Specially Protected
<i>Acinonyx jubatus</i>	Cheetah	Vulnerable	Vulnerable	Specially Protected
<i>Panthera pardus</i>	Leopard	-	Protected	Specially Protected
<i>Orycteropus afer</i>	Aardvark	-	Protected	Specially Protected
<i>Procavia capensis</i>	Rock Dassie	-	-	Protected
<i>Tragelaphus strepsiceros</i>	Kudu	-	-	Protected
<i>Oryx gazelle</i>	Gemsbok	-	Protected	Protected
<i>Antidorcas marsupialis</i>	Springbok	-	-	Protected
<i>Oreotragus oreotragus</i>	Klipspringer	-	Protected	Protected
<i>Raphicerus capestris</i>	Steenbok	-	-	Protected
<i>Sylvicapra grimmia</i>	Common Duiker	-	-	Protected

Source: Species distributions based on Stuart & Stuart (2007)





# APPENDIX C

**Birds previously recorded in the study area according to data presented by the SABAP2.**



## TERRESTRIAL ECOLOGY SCREENING STUDY

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Acridotheres tristis</i>	Myna, Common	-	-	Protected
<i>Acrocephalus arundinaceus</i>	Reed-Warbler, Great	-	-	Protected
<i>Acrocephalus baeticatus</i>	Reed-Warbler, African	-	-	Protected
<i>Acrocephalus gracilirostris</i>	Swamp-Warbler, Lesser	-	-	Protected
<i>Acrocephalus schoenobaenus</i>	Warbler, Sedge	-	-	Protected
<i>Actitis hypoleucos</i>	Sandpiper, Common	-	-	Protected
<i>Afrotis afraoides</i>	Korhaan, Northern Black	-	-	Protected
<i>Alcedo cristata</i>	Kingfisher, Malachite	-	-	Protected
<i>Alopochen aegyptiacus</i>	Goose, Egyptian	-	-	Protected
<i>Amadina erythrocephala</i>	Finch, Red-headed	-	-	Protected
<i>Amaurornis flavirostris</i>	Crake, Black	-	-	Protected
<i>Anas capensis</i>	Teal, Cape	-	-	Protected
<i>Anas erythrorhyncha</i>	Teal, Red-billed	-	-	Protected
<i>Anas hottentota</i>	Teal, Hottentot	-	-	Protected
<i>Anas smithii</i>	Shoveler, Cape	-	-	Protected
<i>Anhinga rufa</i>	Darter, African	-	-	Protected
<i>Anthoscopus minutus</i>	Penduline-Tit, Cape	-	-	Protected
<i>Anthus cinnamomeus</i>	Pipit, African	-	-	Protected
<i>Anthus similis</i>	Pipit, Long-billed	-	-	Protected
<i>Anthus vaalensis</i>	Pipit, Buffy	-	-	Protected
<i>Apus affinis</i>	Swift, Little	-	-	Protected
<i>Apus apus</i>	Swift, Common	-	-	Protected
<i>Apus bradfieldi</i>	Swift, Bradfield's	-	-	Protected
<i>Apus caffer</i>	Swift, White-rumped	-	-	Protected
<i>Aquila pennatus</i>	Eagle, Booted	-	-	Specially Protected
<i>Aquila rapax</i>	Eagle, Tawny	Endangered	-	Specially Protected
<i>Aquila verreauxii</i>	Eagle, Verreaux's	Vulnerable	-	Specially Protected
<i>Ardea cinerea</i>	Heron, Grey	-	-	Protected
<i>Ardea melanocephala</i>	Heron, Black-headed	-	-	Protected
<i>Ardea purpurea</i>	Heron, Purple	-	-	Protected
<i>Ardeola ralloides</i>	Heron, Squacco	-	-	Protected
<i>Ardeotis kori</i>	Bustard, Kori	Near Threatened	Protected	Protected
<i>Batis pririt</i>	Batis, Pririt	-	-	Protected
<i>Bostrychia hagedash</i>	Ibis, Hageda	-	-	Protected
<i>Bradornis infuscatus</i>	Flycatcher, Chat	-	-	Protected
<i>Bradornis mariquensis</i>	Flycatcher, Marico	-	-	Protected
<i>Bubo africanus</i>	Eagle-Owl, Spotted	-	-	Specially Protected



## TERRESTRIAL ECOLOGY SCREENING STUDY

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Bubo lacteus</i>	Eagle-Owl, Verreaux's	-	-	Specially Protected
<i>Bubulcus ibis</i>	Egret, Cattle	-	-	Protected
<i>Burhinus capensis</i>	Thick-knee, Spotted	-	-	Protected
<i>Buteo vulpinus</i>	Buzzard, Steppe	-	-	Specially Protected
<i>Calandrella cinerea</i>	Lark, Red-capped	-	-	Protected
<i>Calendulauda africanoides</i>	Lark, Fawn-coloured	-	-	Protected
<i>Calendulauda sabota</i>	Lark, Sabota	-	-	Protected
<i>Calidris minuta</i>	Stint, Little	-	-	Protected
<i>Campethera abingoni</i>	Woodpecker, Golden-tailed	-	-	Protected
<i>Caprimulgus europaeus</i>	Nightjar, European	-	-	Specially Protected
<i>Caprimulgus rufigena</i>	Nightjar, Rufous-cheeked	-	-	Specially Protected
<i>Centropus burchellii</i>	Coucal, Burchell's	-	-	Protected
<i>Centropus superciliosus</i>	Coucal, White-browed	-	-	Protected
<i>Cercomela familiaris</i>	Chat, Familiar	-	-	Protected
<i>Cercotrichas coryphoeus</i>	Scrub-Robin, Karoo	-	-	Protected
<i>Cercotrichas paena</i>	Scrub-Robin, Kalahari	-	-	Protected
<i>Ceryle rudis</i>	Kingfisher, Pied	-	-	Protected
<i>Charadrius hiaticula</i>	Plover, Common Ringed	-	-	Protected
<i>Charadrius pecuarius</i>	Plover, Kittlitz's	-	-	Protected
<i>Charadrius tricollaris</i>	Plover, Three-banded	-	-	Protected
<i>Chersomanes albofasciata</i>	Lark, Spike-heeled	-	-	Protected
<i>Chlidonias leucopterus</i>	Tern, White-winged	-	-	Protected
<i>Chrysococcyx caprius</i>	Cuckoo, Diderick	-	-	Protected
<i>Ciconia abdimii</i>	Stork, Abdim's	Near Threatened	-	Protected
<i>Ciconia nigra</i>	Stork, Black	Vulnerable	-	Specially Protected
<i>Cinnyris fuscus</i>	Sunbird, Dusky	-	-	Protected
<i>Cinnyris mariquensis</i>	Sunbird, Marico	-	-	Protected
<i>Cinnyris talatala</i>	Sunbird, White-bellied	-	-	Protected
<i>Circaetus pectoralis</i>	Snake-Eagle, Black-chested	-	-	Specially Protected
<i>Cisticola aridulus</i>	Cisticola, Desert	-	-	Protected
<i>Cisticola fulvicapilla</i>	Neddicky, Neddicky	-	-	Protected
<i>Cisticola juncidis</i>	Cisticola, Zitting	-	-	Protected
<i>Cisticola rufilatus</i>	Cisticola, Tinkling	-	-	Protected
<i>Cisticola tinniens</i>	Cisticola, Levallant's	-	-	Protected
<i>Clamator jacobinus</i>	Cuckoo, Jacobin	-	-	Protected
<i>Colius colius</i>	Mousebird, White-backed	-	-	Protected
<i>Columba guinea</i>	Pigeon, Speckled	-	-	Protected



## TERRESTRIAL ECOLOGY SCREENING STUDY

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Columba livia</i>	Dove, Rock	-	-	Protected
<i>Coracias garrulus</i>	Roller, European	-	-	Protected
<i>Coracias naevius</i>	Roller, Purple	-	-	Protected
<i>Corvus albus</i>	Crow, Pied	-	-	Protected
<i>Corvus capensis</i>	Crow, Cape	-	-	Protected
<i>Corythaixoides concolor</i>	Go-away-bird, Grey	-	-	Protected
<i>Cossypha caffra</i>	Robin-Chat, Cape	-	-	Protected
<i>Coturnix coturnix</i>	Quail, Common	-	-	Protected
<i>Creatophora cinerea</i>	Starling, Wattled	-	-	Protected
<i>Crithagra atrogularis</i>	Canary, Black-throated	-	-	Protected
<i>Crithagra flaviventris</i>	Canary, Yellow	-	-	Protected
<i>Cuculus clamosus</i>	Cuckoo, Black	-	-	Protected
<i>Cursorius rufus</i>	Courser, Burchell's	Vulnerable	-	Protected
<i>Cypsiurus parvus</i>	Palm-Swift, African	-	-	Protected
<i>Dendrocygna bicolor</i>	Duck, Fulvous	-	-	Protected
<i>Dendrocygna viduata</i>	Duck, White-faced	-	-	Protected
<i>Dendropicos fuscescens</i>	Woodpecker, Cardinal	-	-	Protected
<i>Dendropicos namaquus</i>	Woodpecker, Bearded	-	-	Protected
<i>Dicrurus adsimilis</i>	Drongo, Fork-tailed	-	-	Protected
<i>Egretta alba</i>	Egret, Great	-	-	Protected
<i>Egretta garzetta</i>	Egret, Little	-	-	Protected
<i>Egretta intermedia</i>	Egret, Yellow-billed	-	-	Protected
<i>Elanus caeruleus</i>	Kite, Black-shouldered	-	-	Specially Protected
<i>Emberiza capensis</i>	Bunting, Cape	-	-	Protected
<i>Emberiza flaviventris</i>	Bunting, Golden-breasted	-	-	Protected
<i>Emberiza impetuani</i>	Bunting, Lark-like	-	-	Protected
<i>Emberiza tahapisi</i>	Bunting, Cinnamon-breasted	-	-	Protected
<i>Eremomela icteropygialis</i>	Eremomela, Yellow-bellied	-	-	Protected
<i>Eremopterix verticalis</i>	Sparrowlark, Grey-backed	-	-	Protected
<i>Estrilda astrild</i>	Waxbill, Common	-	-	Protected
<i>Estrilda erythronotos</i>	Waxbill, Black-faced	-	-	Protected
<i>Euplectes orix</i>	Bishop, Southern Red	-	-	Protected
<i>Falco biarmicus</i>	Falcon, Lanner	Vulnerable	-	Specially Protected
<i>Falco naumanni</i>	Kestrel, Lesser	-	-	Specially Protected
<i>Falco peregrinus</i>	Falcon, Peregrine	-	-	Specially Protected
<i>Falco rupicoloides</i>	Kestrel, Greater	-	-	Specially Protected
<i>Falco rupicolus</i>	Kestrel, Rock	-	-	Specially Protected



## TERRESTRIAL ECOLOGY SCREENING STUDY

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Fulica cristata</i>	Coot, Red-knobbed	-	-	Protected
<i>Gallinago nigripennis</i>	Snipe, African	-	-	Protected
<i>Gallinula chloropus</i>	Moorhen, Common	-	-	Protected
<i>Glaucidium perlatum</i>	Owlet, Pearl-spotted	-	-	Specially Protected
<i>Granatina granatina</i>	Waxbill, Violet-eared	-	-	Protected
<i>Gyps africanus</i>	Vulture, White-backed	Endangered	Protected	Protected
<i>Halcyon albiventris</i>	Kingfisher, Brown-hooded	-	-	Protected
<i>Halcyon chelicuti</i>	Kingfisher, Striped	-	-	Protected
<i>Himantopus himantopus</i>	Stilt, Black-winged	-	-	Protected
<i>Hippolais icterina</i>	Warbler, Icterine	-	-	Protected
<i>Hirundo albigularis</i>	Swallow, White-throated	-	-	Protected
<i>Hirundo cucullata</i>	Swallow, Greater Striped	-	-	Protected
<i>Hirundo fuligula</i>	Martin, Rock	-	-	Protected
<i>Hirundo rustica</i>	Swallow, Barn	-	-	Protected
<i>Hirundo semirufa</i>	Swallow, Red-breasted	-	-	Protected
<i>Hirundo spilodera</i>	Cliff-Swallow, South African	-	-	Protected
<i>Indicator indicator</i>	Honeyguide, Greater	-	-	Protected
<i>Ixobrychus minutus</i>	Bittern, Little	-	-	Protected
<i>Lagonosticta senegala</i>	Firefinch, Red-billed	-	-	Protected
<i>Lamprolornis nitens</i>	Starling, Cape Glossy	-	-	Protected
<i>Laniarius atrococcineus</i>	Shrike, Crimson-breasted	-	-	Protected
<i>Lanius collaris</i>	Fiscal, Common	-	-	Protected
<i>Lanius collurio</i>	Shrike, Red-backed	-	-	Protected
<i>Lanius minor</i>	Shrike, Lesser Grey	-	-	Protected
<i>Larus cirrocephalus</i>	Gull, Grey-headed	-	-	Protected
<i>Lophotis ruficrista</i>	Korhaan, Red-crested	-	-	Protected
<i>Lybius torquatus</i>	Barbet, Black-collared	-	-	Protected
<i>Macronyx capensis</i>	Longclaw, Cape	-	-	Protected
<i>Malcorus pectoralis</i>	Warbler, Rufous-eared	-	-	Protected
<i>Melierax canorus</i>	Goshawk, Southern Pale Chanting	-	-	Specially Protected
<i>Melierax gabar</i>	Goshawk, Gabar	-	-	Specially Protected
<i>Merops apiaster</i>	Bee-eater, European	-	-	Protected
<i>Merops bullockoides</i>	Bee-eater, White-fronted	-	-	Protected
<i>Merops hirundineus</i>	Bee-eater, Swallow-tailed	-	-	Protected
<i>Milvus aegyptius</i>	Kite, Yellow-billed	-	-	Protected
<i>Mirafra apiata</i>	Lark, Cape Clapper	-	-	Protected



## TERRESTRIAL ECOLOGY SCREENING STUDY

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Mirafra fasciolata</i>	Lark, Eastern Clapper	-	-	Protected
<i>Mirafra marjoriae</i>	Lark, Agulhas Clapper	-	-	Protected
<i>Monticola brevipes</i>	Rock-Thrush, Short-toed	-	-	Protected
<i>Motacilla aguimp</i>	Wagtail, African Pied	-	-	Protected
<i>Muscicapa striata</i>	Flycatcher, Spotted	-	-	Protected
<i>Myrmecocichla formicivora</i>	Chat, Anteating	-	-	Protected
<i>Neotis ludwigii</i>	Bustard, Ludwig's	Endangered	Endangered	Specially Protected
<i>Netta erythrophthalma</i>	Pochard, Southern	-	-	Protected
<i>Nilaus afer</i>	Brubru, Brubru	-	-	Protected
<i>Numida meleagris</i>	Guineafowl, Helmeted	-	-	Protected
<i>Nycticorax nycticorax</i>	Night-Heron, Black-crowned	-	-	Protected
<i>Oena capensis</i>	Dove, Namaqua	-	-	Protected
<i>Oenanthe monticola</i>	Wheatear, Mountain	-	-	Protected
<i>Oenanthe pileata</i>	Wheatear, Capped	-	-	Protected
<i>Onychognathus nabouroup</i>	Starling, Pale-winged	-	-	Protected
<i>Oriolus oriolus</i>	Oriole, Eurasian Golden	-	-	Protected
<i>Ortygospiza atricollis</i>	Quailfinch, African	-	-	Protected
<i>Oxyura maccoa</i>	Duck, Maccoa	Near Threatened	-	Protected
<i>Parisoma subcaeruleum</i>	Tit-Babbler, Chestnut-vented	-	-	Protected
<i>Parus cinerascens</i>	Tit, Ashy	-	-	Protected
<i>Passer diffusus</i>	Sparrow, Southern Grey-headed	-	-	Protected
<i>Passer domesticus</i>	Sparrow, House	-	-	Protected
<i>Passer griseus</i>	Sparrow, Northern Grey-headed	-	-	Protected
<i>Passer motitensis</i>	Sparrow, Great	-	-	Protected
<i>Phalacrocorax africanus</i>	Cormorant, Reed	-	-	Protected
<i>Phalacrocorax carbo</i>	Cormorant, White-breasted	-	-	Protected
<i>Philetairus socius</i>	Weaver, Sociable	-	-	Protected
<i>Philomachus pugnax</i>	Ruff, Ruff	-	-	Protected
<i>Phoenicopterus minor</i>	Flamingo, Lesser	Near Threatened	-	Specially Protected
<i>Phoenicopterus ruber</i>	Flamingo, Greater	Near Threatened	-	Protected
<i>Phylloscopus trochilus</i>	Warbler, Willow	-	-	Protected
<i>Pinarocorys nigricans</i>	Lark, Dusky	-	-	Protected
<i>Platalea alba</i>	Spoonbill, African	-	-	Protected
<i>Plectropterus gambensis</i>	Goose, Spur-winged	-	-	Protected



## TERRESTRIAL ECOLOGY SCREENING STUDY

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Plegadis falcinellus</i>	Ibis, Glossy	-	-	Protected
<i>Plocepasser mahali</i>	Sparrow-Weaver, White-browed	-	-	Protected
<i>Ploceus velatus</i>	Masked-Weaver, Southern	-	-	Protected
<i>Polemaetus bellicosus</i>	Eagle, Martial	Endangered	Vulnerable	Specially Protected
<i>Polihierax semitorquatus</i>	Falcon, Pygmy	-	-	Specially Protected
<i>Porphyrio madagascariensis</i>	Swamphen, African Purple	-	-	Protected
<i>Prinia flavicans</i>	Prinia, Black-chested	-	-	Protected
<i>Psophocichla litsipsirupa</i>	Thrush, Groundscraper	-	-	Protected
<i>Pternistis adspersus</i>	Spurfowl, Red-billed	-	-	Protected
<i>Pterocles bicinctus</i>	Sandgrouse, Double-banded	-	-	Protected
<i>Pterocles burchelli</i>	Sandgrouse, Burchell's	-	-	Protected
<i>Pterocles namaqua</i>	Sandgrouse, Namaqua	-	-	Protected
<i>Ptilopus granti</i>	Scops-Owl, Southern White-faced	-	-	Specially Protected
<i>Pycnonotus nigricans</i>	Bulbul, African Red-eyed	-	-	Protected
<i>Pytilia melba</i>	Pytilia, Green-winged	-	-	Protected
<i>Quelea quelea</i>	Quelea, Red-billed	-	-	Protected
<i>Recurvirostra avosetta</i>	Avocet, Pied	-	-	Protected
<i>Rhinopomastus cyanomelas</i>	Scimitarbill, Common	-	-	Protected
<i>Rhinoptilus africanus</i>	Cursorer, Double-banded	Near Threatened	-	Protected
<i>Riparia cincta</i>	Martin, Banded	-	-	Protected
<i>Riparia paludicola</i>	Martin, Brown-throated	-	-	Protected
<i>Sagittarius serpentarius</i>	Secretarybird, Secretarybird	Vulnerable	-	Specially Protected
<i>Saxicola torquatus</i>	Stonechat, African	-	-	Protected
<i>Scleroptila lewaillantoides</i>	Francolin, Orange River	-	-	Protected
<i>Scopus umbretta</i>	Hamerkop, Hamerkop	-	-	Protected
<i>Sigelus silens</i>	Flycatcher, Fiscal	-	-	Protected
<i>Spizocorys conirostris</i>	Lark, Pink-billed	-	-	Protected
<i>Sporopipes squamifrons</i>	Finch, Scaly-feathered	-	-	Protected
<i>Spreo bicolor</i>	Starling, Pied	-	-	Protected
<i>Stenostira scita</i>	Flycatcher, Fairy	-	-	Protected
<i>Streptopelia capicola</i>	Turtle-Dove, Cape	-	-	Protected
<i>Streptopelia semitorquata</i>	Dove, Red-eyed	-	-	Protected
<i>Streptopelia senegalensis</i>	Dove, Laughing	-	-	Protected
<i>Struthio camelus</i>	Ostrich, Common	-	-	Protected
<i>Sylvia borin</i>	Warbler, Garden	-	-	Protected



## TERRESTRIAL ECOLOGY SCREENING STUDY

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Sylvietta rufescens</i>	Crombec, Long-billed	-	-	Protected
<i>Tachybaptus ruficollis</i>	Grebe, Little	-	-	Protected
<i>Tadorna cana</i>	Shelduck, South African	-	-	Protected
<i>Tchagra australis</i>	Tchagra, Brown-crowned	-	-	Protected
<i>Telophorus zeylonus</i>	Bokmakierie, Bokmakierie	-	-	Protected
<i>Terpsiphone viridis</i>	Paradise-Flycatcher, African	-	-	Protected
<i>Thalassornis leuconotus</i>	Duck, White-backed	-	-	Protected
<i>Threskiornis aethiopicus</i>	Ibis, African Sacred	-	Protected	Protected
<i>Tockus leucomelas</i>	Hornbill, Southern Yellow-billed	-	-	Protected
<i>Tockus nasutus</i>	Hornbill, African Grey	-	-	Protected
<i>Trachyphonus vaillantii</i>	Barbet, Crested	-	-	Protected
<i>Tricholaema leucomelas</i>	Barbet, Acacia Pied	-	-	Protected
<i>Tringa glareola</i>	Sandpiper, Wood	-	-	Protected
<i>Tringa nebularia</i>	Greenshank, Common	-	-	Protected
<i>Tringa stagnatilis</i>	Sandpiper, Marsh	-	-	Protected
<i>Turdoides bicolor</i>	Babbler, Southern Pied	-	-	Protected
<i>Turdus olivaceus</i>	Thrush, Olive	-	-	Protected
<i>Turdus smithi</i>	Thrush, Karoo	-	-	Protected
<i>Tyto alba</i>	Owl, Barn	-	-	Specially Protected
<i>Upupa africana</i>	Hoopoe, African	-	-	Protected
<i>Urocolius indicus</i>	Mousebird, Red-faced	-	-	Protected
<i>Vanellus armatus</i>	Lapwing, Blacksmith	-	-	Protected
<i>Vanellus coronatus</i>	Lapwing, Crowned	-	-	Protected
<i>Vidua macroura</i>	Whydah, Pin-tailed	-	-	Protected
<i>Vidua regia</i>	Whydah, Shaft-tailed	-	-	Protected
<i>Zosterops pallidus</i>	White-eye, Orange River	-	-	Protected
<i>Zosterops virens</i>	White-eye, Cape	-	-	Protected

Source: SABAP2





# APPENDIX D

Herpetofauna potentially occurring in the study area.



## TERRESTRIAL ECOLOGY SCREENING STUDY

### Amphibians

Scientific Name	Common Name	IUCN – Regional Status	Northern Cape – Protected Species (2009)
<i>Amieta angolensis</i>	Common River Frog		Protected
<i>Amieta fuscigula</i>	Cape River Frog		Protected
<i>Amietophrynus garmani</i>	Eastern Olive Toad		Protected
<i>Amietophrynus gutturalis</i>	Guttural Toad		Protected
<i>Amietophrynus poweri</i>	Western Olive Toad		Protected
<i>Breviceps adspersus</i>	Bushveld Rain Frog		Protected
<i>Cacosternum boettgeri</i>	Boettger's Caco		Protected
<i>Kassina senegalensis</i>	Bubbling Kassina		Protected
<i>Pyxicephalus adspersus</i>	Giant Bullfrog	Near Threatened	Specially Protected
<i>Schismaderma carens</i>	Red Toad		Protected
<i>Tomopterna cryptotis</i>	Tremolo Sand Frog		Protected
<i>Tomopterna tandyi</i>	Tandy's Sand Frog		Protected
<i>Vandijkophrynus gariensis</i>	Karoo Toad		Protected
<i>Xenopus laevis</i>	Common Platanna		Protected

Source: Minter *et al.* (2004), Du Preez & Carruthers (2009)

### Reptiles

Scientific Name	Common Name	IUCN – Regional Status	NEMBA TOPS List (2013)	Northern Cape – Protected Species (2009)
<i>Acontias kgalagadi kgalagadi</i>	Kgalagadi Legless Skink	-	-	-
<i>Afrotyphlops bibronii</i>	Bibron's blind snake	-	-	-
<i>Agama aculeata aculeata</i>	Western Ground Agama	-	-	-
<i>Agama atra</i>	Southern Rock Agama	-	-	-
<i>Aparallactus capensis</i>	Black-headed Centipede-eater	-	-	-
<i>Aspidelaps scutatus scutatus</i>	Common Shield Cobra	-	-	-
<i>Atractaspis bibronii</i>	Bibron's Stiletto Snake	-	-	-
<i>Atractaspis duerdeni</i>	Duerden's Stiletto Snake	-	-	-
<i>Bitis arietans arietans</i>	Puff Adder	-	-	-
<i>Bitis caudalis</i>	Horned Adder	-	Protected	-
<i>Boaedon capensis</i>	Common House Snake	-	-	-
<i>Chamaeleo dilepis dilepis</i>	Common Flap-neck Chameleon	-	-	-
<i>Chamaeleo namaquensis</i>	Namaqua Chameleon	-	-	Specially Protected
<i>Chondrodactylus angulifer</i>	Common Giant Gecko	-	-	-
<i>Chondrodactylus bibronii</i>	Bibron's Gecko	-	-	-
<i>Colopus wahlbergii wahlbergii</i>	Kalahari ground Gecko	-	-	-
<i>Dasypeltis scabra</i>	Rhombic Egg-eater	-	-	Protected
<i>Dispholidus typus</i>	Boomslang	-	-	-
<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	-	-	-
<i>Heliobolus lugubris</i>	Bushveld Lizard	-	-	Protected
<i>Homopus fermoralis</i>	Greater Dwarf Tortoise	-	-	-
<i>Karusasaurus polyzonus</i>	Southern Karusa Lizard	-	-	-
<i>Leptotyphlops scutifrons</i>	Peter's Thread Snake	-	-	-
<i>Lycophidion capense capense</i>	Cape Wolf Snake	-	-	Protected
<i>Lygodactylus capensis capensis</i>	Common Dwarf Gecko	-	-	-



## TERRESTRIAL ECOLOGY SCREENING STUDY

<b>Reptiles</b>				
<i>Meroles squamulosus</i>	Savanna Lizard	-	-	Protected
<i>Meroles suborbitalis</i>	Spotted Desert Lizard	-	-	Protected
<i>Monopeltis infuscata</i>	Dusky Worm Lizard	-	-	-
<i>Monopeltis mauricei</i>	Maurice's Worm Lizard	-	-	-
<i>Naja nigricincta</i>	Black Spitting Cobra	-	-	-
<i>Naja nivea</i>	Cape Cobra	-	-	-
<i>Nucras intertexta</i>	Spotted Sandveld Lizard	-	-	Protected
<i>Pachydactylus capensis</i>	Cape Gecko	-	-	-
<i>Pachydactylus rugosus</i>	Common Rough Gecko	-	-	-
<i>Pedioplanis lineocellata lineocellata</i>	Spotted Sand Lizard	-	-	Protected
<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	-	-	Protected
<i>Pelomedusa subrufa</i>	Marsh Terrapin	-	-	-
<i>Philothamnus semivariatus</i>	Spotted Bush Snake	-	-	Protected
<i>Prosymna sundervallii</i>	Sundevall's Shovel-Snout	-	-	Protected
<i>Psammobates oculifer</i>	Serrated Tent Tortoise	-	-	Protected
<i>Psammophis brevirostris</i>	Short-snouted Grass Snake	-	-	-
<i>Psammophis trinasalis</i>	Fork-marked sand snake	-	-	-
<i>Pseudaspis cana</i>	Mole Snake	-	-	Protected
<i>Ptenopus garrulous garrulus</i>	Common Barking Gecko	-	-	-
<i>Python natalensis</i>	Southern African Python	-	Protected	Specially Protected
<i>Rhinotyphlops lalandei</i>	Delalande's Beaked Blind Snake	-	-	-
<i>Stigmochelys pardalis</i>	Leopard Tortoise	-	-	Protected
<i>Telescopus semiannulatus semiannulatus</i>	Eastern Tiger Snake	-	-	-
<i>Trachylepis capensis</i>	Cape Skink	-	-	-
<i>Trachylepis occidentalis</i>	Western Three-striped Skink	-	-	-
<i>Trachylepis punctatissima</i>	Speckled Rock Skink	-	-	-
<i>Trachylepis punctulata</i>	Speckled Sand Skink	-	-	-
<i>Trachylepis spilogaster</i>	Kalahari Tree Skink	-	-	-
<i>Trachylepis sulcata sulcata</i>	Western Rock Skink	-	-	-
<i>Trachylepis variegata</i>	Vargiegated Skink	-	-	-
<i>Varanus albigularis albigularis</i>	Southern Rock Monitor	-	-	Protected
<i>Xenocalamus bicolor bicolor</i>	Bicoloured Quill-snouted snake	-	-	-
<i>Zygaspis quadrifrons</i>	Kalahari Dwarf Worm Lizard	-	-	-

Source: Bates *et al.* (2014)



# APPENDIX E

## Document Limitations



## DOCUMENT LIMITATIONS

### DOCUMENT LIMITATIONS

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