# PROPOSED 400kV NZHELELE - TRIANGLE PROJECT, MUSINA, LIMPOPO PROVINCE

**Ecological Scoping Report**

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# 1. INTRODUCTION

The increase in human demand for space and life-supporting resources resulted in a rapid loss of natural open space in South Africa. When natural systems are rezoned for development, indigenous fauna and flora are replaced by exotic species and converted to sterile landscapes with no dynamic propensity or ecological value (Wood *et al.,* 1994). Additionally, development rarely focussed on decisive planning to conserve natural environments, while little thought was given to the consequences on the ecological processes of development in highly sensitive areas.

Transformation and fragmentation are not the only results of unplanned and intended developments, the loss of ecosystem functioning and ultimately the local extinction of species can also result. Therefore, careful planning will not only preserve rare and endemic fauna and flora, but also the ecological integrity of ecosystems of the landscape level which is imperative for the continuation of natural resources, such as fossil fuels, water and soils with agricultural potential.

In 1992, the Convention of Biological Diversity, a landmark convention, was signed by more than 90 % of all members of the United Nations. The enactment of the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004), together with the abovementioned treaty, focuses on the preservation of all biological diversity in its totality, including genetic variability, natural populations, communities, ecosystems up to the scale of landscapes. Hence, the local and global focus changed to the sustainable utilisation of biological diversity.

## 1.1 Background

Pachnoda Consulting cc was contracted by Baagi Environmental Consultancy cc to provide an ecological scoping report for the proposed Nzhelele-Traingle Project in the northern parts of the Limpopo Province. The project entails the proposed construction of a 400 kV transmission corridor from the Nzhelele Substation near Musina to the international border of Zimbabwe (approximately 50 km), from where ZESA will take over to link the corridor with the Triangle Substation (approximately 181 km). The proposed project only has reference to the corridor that falls within the ambit of South Africa (Figure 1).

Based on the length of the proposed transmission line, two alternative corridors (each 4 km wide and each consisting of two options) have been proposed (Figure 1):

- *Alternative 1 A* (51.5 km) runs northwards along the N1 Highway whereby it deflects westwards at the Sand River. From here it runs northwards along the western side of the Messina Nature Reserve towards Beitbridge;
- *Alternative 1 B* (45 km) runs northwards along the N1 Highway and east of Musina towards the Limpopo River;

- *Alternative 2 A* (57.5 km) runs eastwards towards the R508 from where it deviates westwards and following the R508 towards Musina. From here it continues northwards to the Limpopo River; and
- *Alternative 2 B* (52 km) runs north-eastwards to the R508 and continues northwards and west of the Nzhelele River towards the Limpopo River.

### 1.2 Terms of Reference

The main aim of a scoping exercise is to investigate the ecological attributes of the proposed corridors by means of a desktop analysis of GIS based information.

The terms of reference for this scoping report are to:

- conduct an assessment on a screening level of available information pertinent to the ecological attributes on the study area;
- conduct an assessment of all information on a screening level in order to present the following results:
  - typify the regional vegetation that will be affected by the proposed alignment;
  - provide an indication on the occurrence of threatened, "near-threatened", endemic and conservation important plant, bird or animal species likely to be affected by the proposed transmission line;
  - provide an indication of sensitive areas or bird habitat types corresponding to the proposed corridors;
  - highlight areas of concern or hotspot areas;
  - identify potential impacts on the terrestrial ecological environment that are considered pertinent to the proposed development;
  - highlight gaps of information in terms of the ecological environment; and
  - recommend further studies to be conducted as part of the Environmental Impact Assessment (EIA) phase.

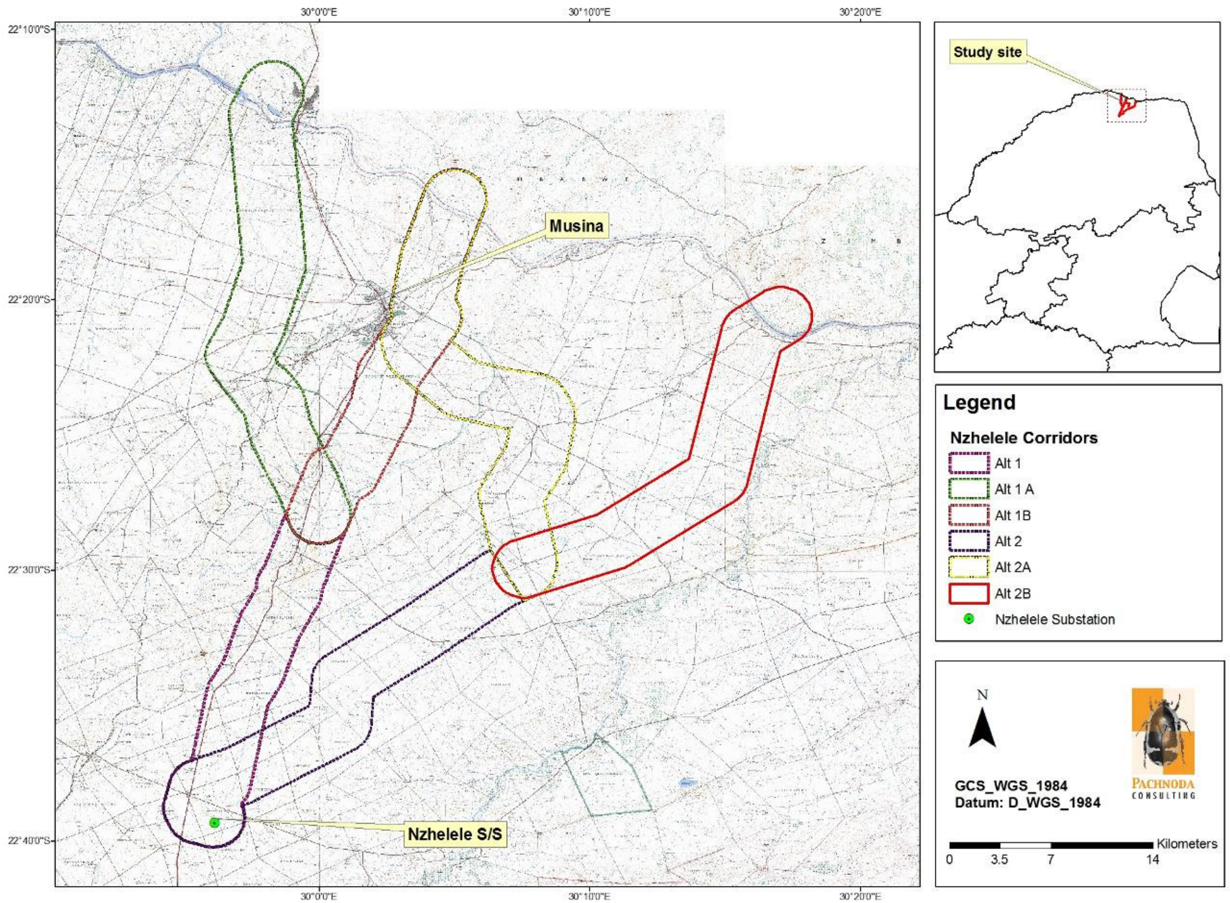


**Figure 1:** A locality map illustrating the geographic position of the proposed 400 kV Nzhelele transmission line corridor with two proposed alternatives.

# 2. METHODS & APPROACH

A site visit was conducted during 20-23 January 2014 whereby the physical environment of the proposed corridors was inspected by road and from the air following an evaluation of GIS based information on the biotic and biophysical attributes of the area.

Visual observations of the proposed corridors were made during the site visit. The objectives of this part of the study were to:

- obtain a basic overview of the variation and general status of habitat types likely to be affected by the proposed development; and
- inspect existing transmission lines within the proximity of the proposed alternative routes to obtain an overview of the range of potential impacts and likely effects of long-term management activities on the vegetation and faunal community.

## 2.1 Desktop Analysis

A desktop analysis of available biotic and biophysical attributes of the proposed study area was performed whereby the following databases were consulted:

- Regional vegetation (Mucina and Rutherford, 2006);
- Land cover classes (2000 & 2009);
- Presence/absence of wetlands, rivers, drainage lines and other impoundments;
- Protected and conservation areas;
- Settlement and transformed areas.

These databases were utilised to identify areas that constitute:

- natural vegetation;
- areas of environmental sensitivity (e.g. outcrops and wetland systems);
- areas likely to sustain high numbers of threatened, “near-threatened” and endemic taxa; and
- protected areas.

The likely occurrence of threatened, “near-threatened” and conservation important faunal and floral taxa were based on the presence of suitable habitat and through various field guides and atlases. In addition, historical distribution records (when available) were also consulted.

## 2.2 Avifaunal evaluation and desktop analysis

A number of references were consulted during the evaluation process which includes the following:

- Hockey *et al*. (2005) for general information on bird identification and life history attributes;
- Taylor (2014) and IUCN (2014) for information regarding the conservation status of each species;
- Distributional data, especially for species of conservation concern (apart from those obtained during the site visit) was sourced from the South African Bird Atlas Project (SABAP1) and verified against Harrison *et al.* (1997). Therefore, the SABAP1 data represents the abundance and composition of bird species recorded within a quarter degree square (QDS) which was the sampling unit chosen. It should be noted that the atlas data makes use of reporting rates that were calculated from observer cards submitted by lay people as well as citizen scientists. It therefore provides an indication of the thoroughness of which the QDSs were surveyed between 1987 and 1991;
- Additional distributional data was also sourced from the SABAP2 database (sabap2.adu.org.za). Since bird distributions are dynamic (based on landscape changes affected by fragmentation and climate change), SABAP2 was born (and launched in 2007) from SABAP1 with the main difference being that all sampling is done at a finer scale known as pentad grids (5 min lat x 5 min long, equating to 9 pentads within a QDS). This implies that the data is more site-specific, recent and more comparable with observations made during the site visit; and
- Additional information regarding bird-power line interactions was provided by my own personal observations.

## 2.3 Sensitivity Analysis

An ecological sensitivity map was compiled based on the outcome of a desktop analysis.

The ecological sensitivity of any piece of land is based on its inherent ecosystem service (e.g. wetlands) and overall preservation of biodiversity.

### *2.3.1 Ecological Function*

Ecological function relates to the degree of ecological connectivity between systems within a landscape matrix. Therefore, systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive and will be those contributing to ecosystem service (e.g. wetlands) or the overall preservation of biodiversity.

### *2.3.2 Biodiversity Importance*

Biodiversity importance relates to species diversity, endemism (unique species or unique processes) and the high occurrence of threatened and protected species or ecosystems protected by legislation.

### *2.3.3 Sensitivity Scale*

- *High* – Sensitive ecosystems with either low inherent resistance or low resilience towards disturbance factors or highly dynamic systems considered important for the maintenance of ecosystem integrity. Most of these systems represent ecosystems with high connectivity with other important ecological systems OR with high species diversity and usually provide suitable habitat for a number of threatened or rare species. These areas should be protected;
- *Medium* – These are slightly modified systems which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems OR ecosystems with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species; and
- *Low* – Degraded and highly disturbed/transformed systems with little ecological function and are generally very poor in species diversity (most species are usually exotic or weeds).

## 2.4 Limitations

In order to obtain a comprehensive understanding of the dynamics of both the floral and faunal communities on the study area, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints such long-term studies are not feasible and are mostly based on instantaneous sampling bouts.

It should also be realised that animal, in particular bird distribution patterns fluctuate widely in response to environmental conditions, meaning that a composition noted at a particular moment in time will differ during another time period at the same locality. In addition, some sections of the proposed corridors (e.g. private property) were inaccessible by road and could not be evaluated.

Due to the scope of the work presented in this assessment, a detailed investigation of all, or part of the proposed corridors were not possible and is not perceived as part of the Terms of Reference for a scoping level exercise. It should be emphasised that information, as presented in this document, only has reference to the proposed corridors as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

Furthermore, additional information may come to light during a later stage of the process or development since a large area of the site was not accessible during the site visit. This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.

# 3. PRELIMINARY RESULTS AND DESCRIPTION OF THE AFFECTED ENVIRONMENT

## 3.1 Regional Vegetation Description

The study area corresponds to the Savanna Biome and more particularly to the Mopane Bioregion as defined by Mucina & Rutherford (2006). The proposed corridors comprehend two ecological types known as (a) Musina Mopani Bushveld, and (b) Limpopo Ridge Bushveld (Figure 2 and Table 1):

*(a) Musina Mopani Bushveld*: This vegetation type extends from Baines Drift and Alldays in the west, eastwards and north of the Soutpansberg to Banyini Pan. It is predominantly located on undulating plains that are irregularly interspersed by tributaries of the Limpopo River. On the study area, it forms a moderately open, albeit arid savanna dominated by *Colophospermum mopane*, *Terminalia prunoides*, *Commiphora* species and *Combretum apiculatum*. The field layer is well developed and tends to become more open during the dry season. The herbaceous layer is poor in species richness.

This vegetation type was widespread, least threatened and dominant on the study area.

*(b) Limpopo Ridge Bushveld:* This bushveld type is associated with low hills and outcrops (mainly Clarens Formation sandstone) scattered within the Mucina Mopani Bushveld. It conforms to a typical and moderately open savanna, dominated by *Kirkia acuminata* and *Adansonia digitata,* especially on areas of calcareous soils.

This ecological type is localised consisting of prominent sandstone hills and ridges.

**Table 1:** The surface area (ha) of each regional vegetation type in relation to the approximate total surface area of the proposed corridors.

| Vegetation Type | Alt 1 A | | Alt 1 B | | Alt 2 A | | Alt 2 B | |
|---|---|---|---|---|---|---|---|---|
| | Area (ha) | % | Area (ha) | % | Area (ha) | % | Area (ha) | % |
| Musina Mopani Bushveld | 13173.13 | 60.95% | 12818.27 | 66.56% | 19123.06 | 77.55% | 17198.94 | 77.12% |
| Limpopo Ridge Bushveld | 8440.41 | 39.05% | 6441.15 | 33.44% | 5536.86 | 22.45% | 5103.89 | 22.88% |
| **Total** | **21613.54** | **100.00%** | **19259.42** | **100.00%** | **24659.92** | **100.00%** | **22302.83** | **100.00%** |

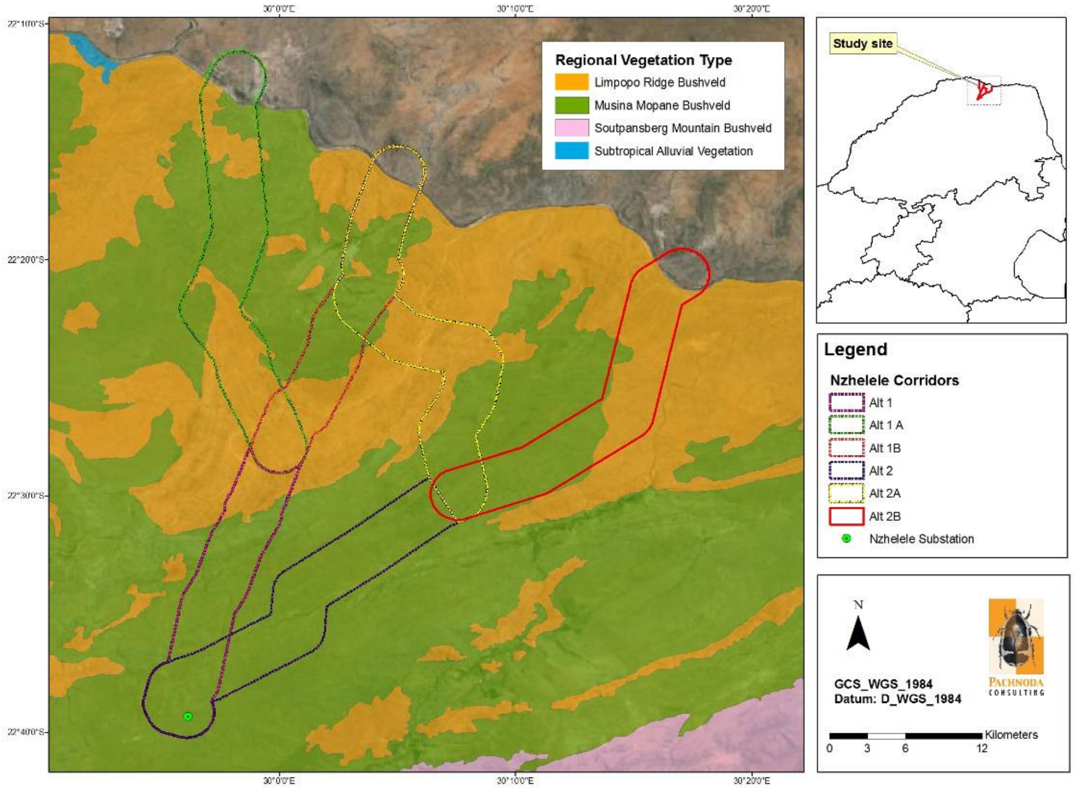


**Figure 2:** A satellite image illustrating the regional vegetation types traversed by the proposed corridors. Vegetation type categories were chosen according to Mucina & Rutherford (2006).

It is evident that both Alternative 1A and 1B traverse a higher percentage of Limpopo Ridge Bushveld compared to Alternative 2. This means that Alternative A is more likely to cross over or be positioned in close proximity to hills and ridges which are often focal habitat for birds of prey and substrate-specialist taxa (e.g. scorpions). In addition, the high spatial heterogeneity in micro-habitat types presented by these landscape features are more likely to hold a higher floristic richness to the Musina Mopani Bushveld.

### 3.2 Geology & Soils

Although geology was never really considered to be an important factor contributing towards faunal community structure, it does play a role in segregating floral communities (Figure 3). Of even more importance is the relationship between certain geological formations and plant compositions in explaining areas with high floristic endemism and richness (so-called centres of endemism). Therefore, differences in floristic composition and structure is likely to be present in nutrient-poor soils derived from quartzite and anorthosite lithologies as opposed to the gneiss. The former lithologies were more prominent on Alternative 1.

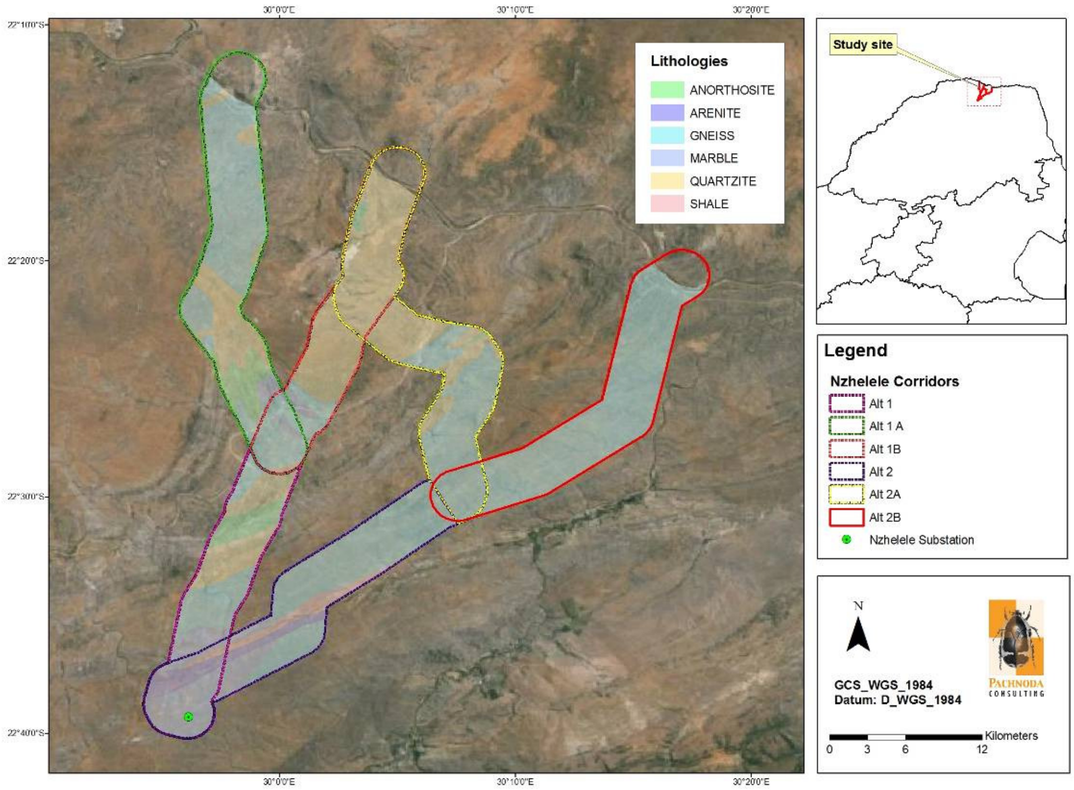


**Figure 3:** A map illustrating the regional geology and lithologies underlain by the proposed corridors.

## 3.3 Land Cover

The local land cover classes (2000 & 2009) on the respective corridors include (Figure 3; Table 2):

Natural areas:

- Woodland;
- Thicket and bushland; and
- Various waterbodies and rivers.

Transformed areas:

- Cultivated land (primarily commercial land);
- Mines and quarries; and
- Urban/ built-up areas.

From the land cover analysis it is evident that the proposed corridors are dominated by woodland and bushveld habitat (Table 2 & Figure 4). It clearly shows that over 95 % of the study site is covered in natural habitat types as opposed to transformed areas (see Figure 5).

Even though the corridors is predominantly covered in natural woodland and bushveld habitat, the condition of the woodland units differs significantly from area to area (ranging from open woodland to secondary shrubland). Unsubstantiated observations made during the site visit (according to access) testified that certain parts of the study site that are classified as thicket and bushland is of secondary ecological condition and show historical transformation (e.g. past clearing events or regenerating woodland on old agricultural lands). These areas should be re-classified as "degraded woodland and bushland".

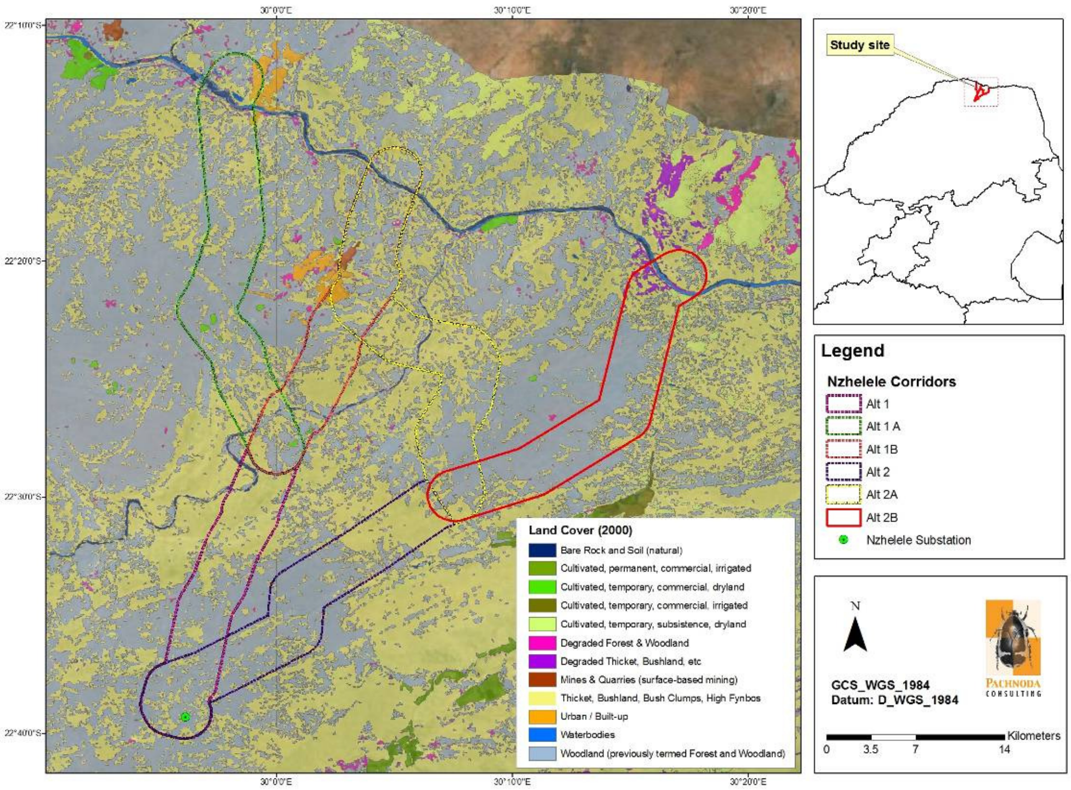


**Figure 4:** A map illustrating the land cover classes (2000) corresponding to the proposed corridors.

The extent and diversity of the land cover categories on each respective corridor show that Alternative 2B is *less* transformed when compared to the other corridors (Table 2). However, the highest surface area of transformed habitat corresponds to Alternative 2A and Alternative 1B.

**Table 2:** The respective surface area (ha) of the land cover classes, natural and transformed land cover categories on each of the proposed power line corridors (based on a 2 km buffer allocated to each alternative and the 2000 land cover dataset).

| Land Cover Class | Alternative 1A | | Alternative 1B | | Alternative 2A | | Alternative 2B | |
|---|---|---|---|---|---|---|---|---|
| | Surface area (ha) | Percentage total area (%) | Surface area (ha) | Percentage total area (%) | Surface area (ha) | Percentage total area (%) | Surface area (ha) | Percentage total area (%) |
| Bare Rock & soil | 236.22 | 1.03% | 183.46 | 0.91% | 127.05 | 0.50% | 23.84 | 0.10% |
| Cultivated (commercial) | 108.94 | 0.48% | 43.94 | 0.22% | 0.00 | 0.00% | 98.52 | 0.42% |
| Degraded woodland & bushland | 118.75 | 0.52% | 97.00 | 0.48% | 82.66 | 0.32% | 296.84 | 1.28% |
| Woodland | 12600.78 | 55.13% | 9786.25 | 48.61% | 13877.62 | 54.40% | 14499.65 | 62.37% |
| Thicket & Bushland | 9486.53 | 41.51% | 9583.43 | 47.60% | 11030.08 | 43.24% | 8230.53 | 35.40% |
| Waterbodies | 100.71 | 0.44% | 51.12 | 0.25% | 45.78 | 0.18% | 92.35 | 0.40% |
| Urban/built-up | 202.50 | 0.89% | 252.07 | 1.25% | 212.11 | 0.83% | 5.30 | 0.02% |
| Mines & Quarries | 0.00 | 0.00% | 135.23 | 0.67% | 134.45 | 0.53% | 0.00 | 0.00% |
| Natural | 22424.24 | 98.12% | 19604.26 | 97.38% | 25080.53 | 98.32% | 22846.38 | 98.28% |
| Transformed | 430.19 | 1.88% | 861.46 | **4.28%** | 1720.94 | **6.75%** | 400.66 | 1.72% |
| **Total** | **22854.43** | **100.00%** | **20132.51** | **100.00%** | **25509.75** | **100.00%** | **23247.04** | **100.00%** |

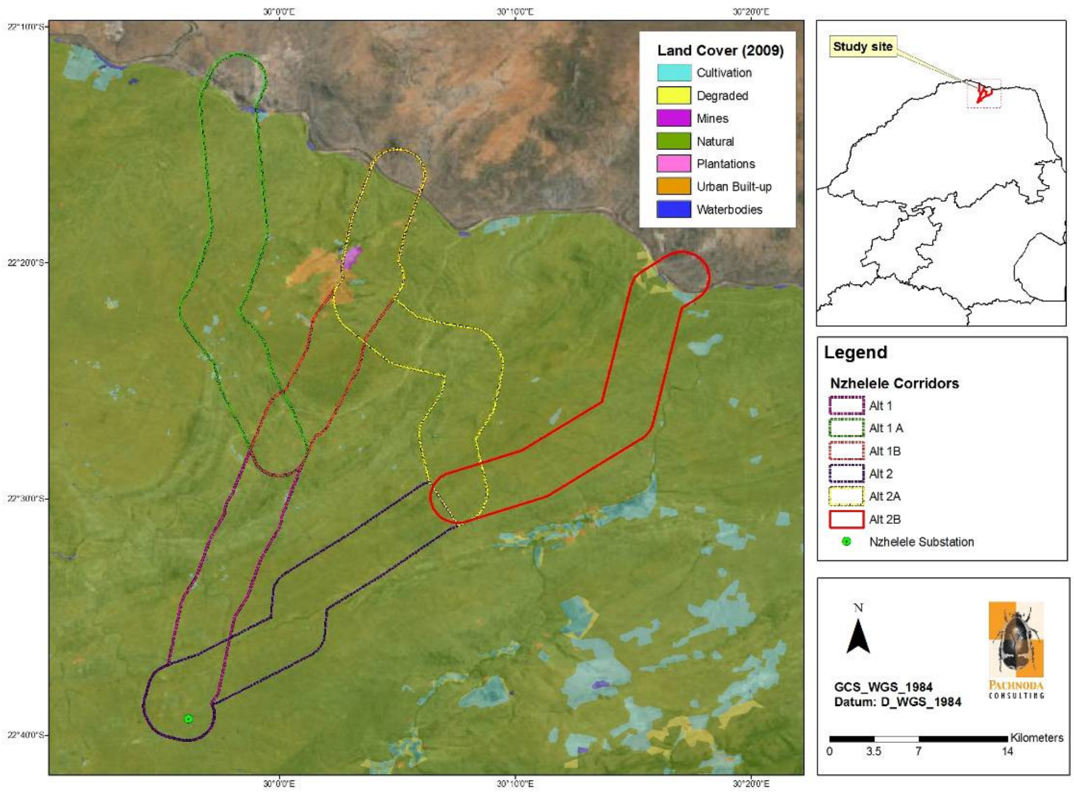


**Figure 5:** A map illustrating the land cover classes (2009) corresponding to the proposed corridors.

### 3.4 Conservation & Protected Areas

According to Figure 6, it is evident that part of Alternative 1B and Alternative 2A corresponds to the Musina Nature Reserve. In addition, a large section of Alternative 2B traverses the large Maremani nature reserve.

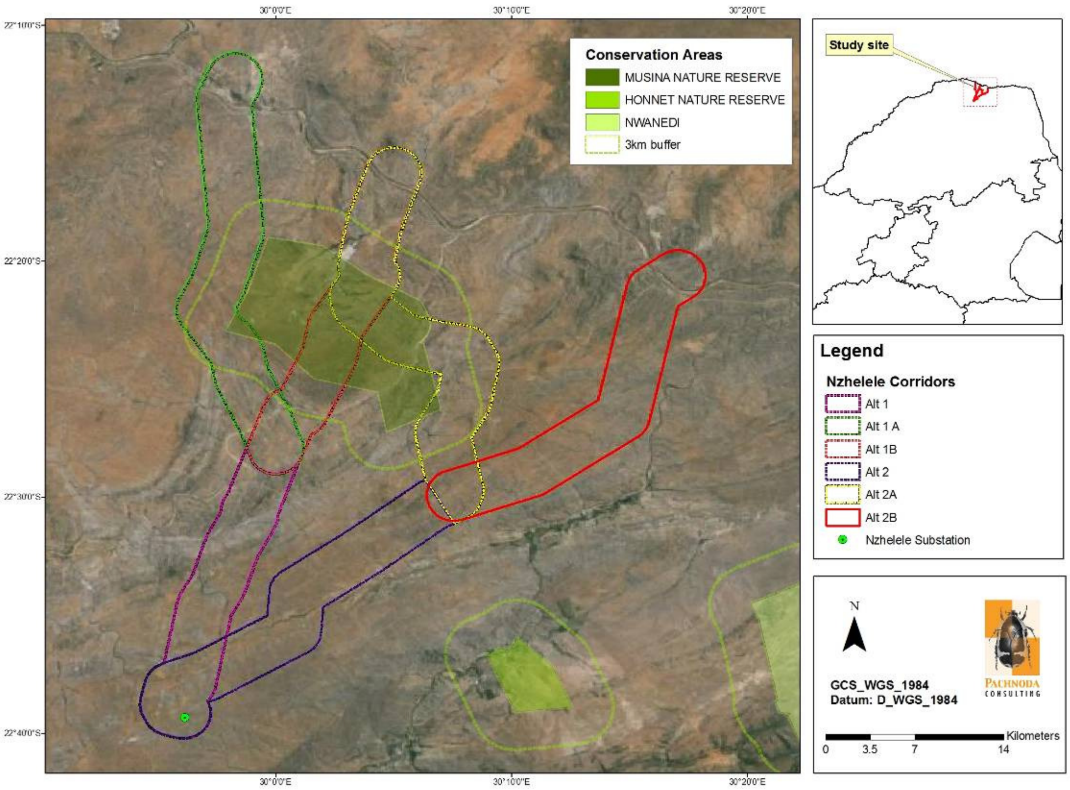


**Figure 6:** The spatial position of conservation and protected areas on the study area.

### 3.5 Wetland and drainage line crossings

The proposed corridors are located within the Limpopo River Catchment. The important rivers and drainage lines to be crossed by the proposed corridors are few and include the Sand River (Figure 7) although numerous seasonal tributaries and drainage lines are to be crossed (see Table 3). It is evident that Alternative 2A and Alternative 2B will cross more drainage lines when compared to Alternative 1.

**Table 3:** The number of anticipated river and seasonal drainage line crossings inferred from a line in the centre of each corridor.

| Corridor | Non-perennial drainage line/river | Perennial drainage line/river | Total |
|---|---|---|---|
| Alternative 1A | 121 | 2 | 123 |
| Alternative 1B | 108 | 2 | 110 |

| Corridor | Non-perennial drainage line/river | Perennial drainage line/river | Total |
|---|---|---|---|
| Alternative 2A | 134 | 2 | 136 |
| Alternative 2B | 124 | 1 | 125 |

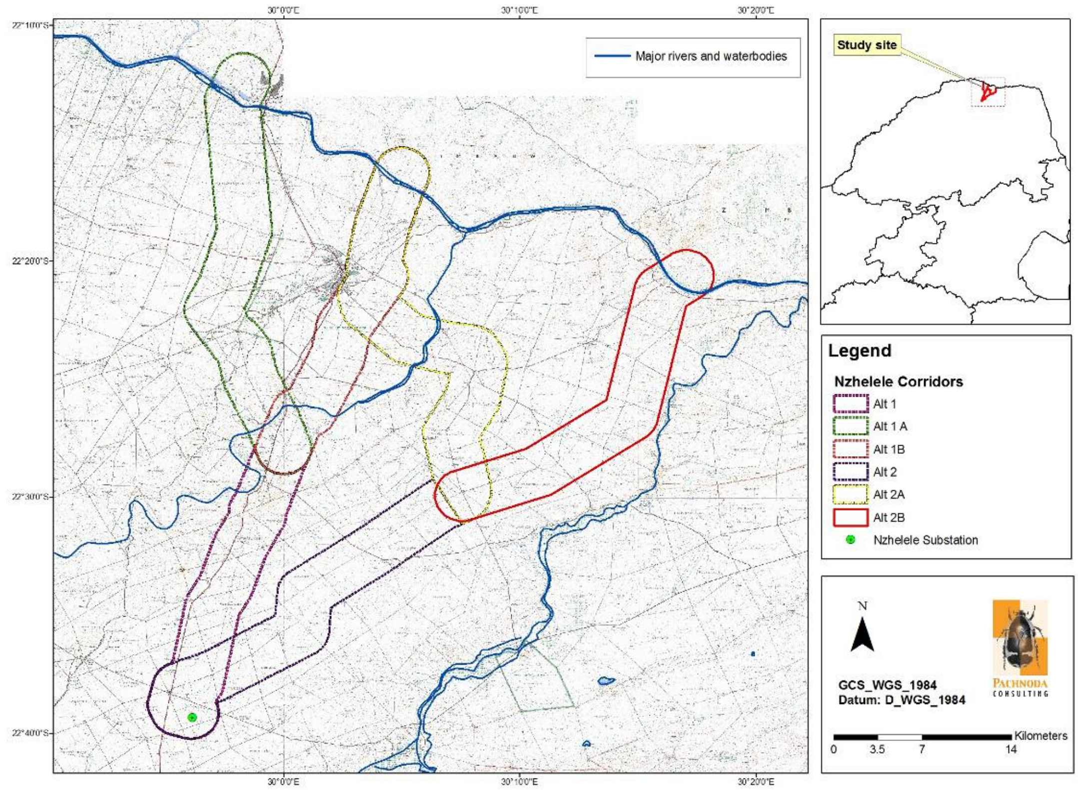


**Figure 7:** A map illustrating the major anticipated river/drainage line crossings corresponding to the proposed corridors.

## 3.6 Vegetation: Species of conservation concern

*Threatened, near-threatened, rare and declining taxa (according to Raimondo et al., 2009)*

The study area consists largely of arid woodland which is widely distributed in the region and often dominated by near-monotonous stands of *Colophospermum mopane*. Therefore, the threatened and near-threatened taxa, in contrast to the Grassland Biome, is poorly represented on the study area as evidenced by the low richness of confirmed taxa at a quarter-degree level (see Table 4 & Table 5). However, a preliminary analysis of the typical habitat requirements of these taxa show that moderate to high probabilities of occurrence is expected on the various ridges and hills (broken terrain) and deciduous riverine woodland (along the Limpopo and Sand River) in the area as opposed to the plains. Nevertheless, the direct relationship between these species and areas where slopes are relative steeper has been proven, and a subsequent high level of environmental significance should be attributed to these particular areas. Table 4 lists the conservation important taxa that could occur on the study area, and provides an indication of their potential occurrence.

**Table 4:** Red Data and Orange Listed plant species likely to occur on the proposed corridors based on the occurrence of suitable habitat. Flowering season, suitable habitat (Retief & Herman, 1997) and probability of occurrence are indicated (conservation status according to Raimondo *et al*. (2009)).

| Species | Flowering Season | Habitat | Probability of occurrence | Conservation Status |
|---|---|---|---|---|
| **Orange Listed** | | | | |
| *Ansellia africana* | August-October | Hot arid mixed deciduous woodland, especially riverine woodland. | Possible, along tall riverine woodland dominated by *Adansonia, Peltophorum* and *Combretum imberbe*.. | Declining |
| *Adenia fruticosa subsp. simplicifolia* | September | Low deciduous woodland and thorny bushveld on rocky areas (gneiss, granite and pegmatite). | High, likely to be present in arid woodland on rocky substrate. | Data Deficient |
| *Peristrophe cliffordii* | May & August - October | Deep Kalahari sand in mopane bushveld. | Could occur in the north along the Limpopo River. | Rare |

It is evident that the northern part of the study area appears to hold the highest probability for these taxa to occur, which corresponds to Alternative 1A, 1B and 2A. *It clearly illustrates the importance of the riverine woodland and bushveld confined to ridges* for these taxa to be present.

**Table 5:** The number of threatened, near-threatened, declining or rare plant species recorded from six quarter degree grids that overlap with the proposed corridors.

| Quarter Degree | Number of species |
|---|---|
| 2229BB | 1 |
| 2229BD | 0 |
| 2229DB | 0 |
| 2230CA | 0 |
| 2230AC | 2 |
| 2230AD | 0 |

*National Protected Trees*

Four tree species (Table 6) appear on the national list of protected tree species as promulgated by the National Forests Act, 1998 (No 84 of 1998). The main reasons for this list are to provide strict protection to certain species while others require control over harvesting and utilisation.

These species occur widely throughout the study area and is by no means restricted in range nor localised. In addition, these species are not threatened (not Red Data listed), but should be considered during the project based on their legal status.

In terms of the National Forests Act of 1998, a licence should be granted by the Department of Forestry (or a delegated authority) prior to the removal, damage or destruction of any individual. Therefore, such activities (as mentioned above) should be directed to the responsible Forestry official in each province or area.

It is unavoidable that a number of individuals are likely to become lost or removed during the proposed construction phase of the project (if permission is granted). Even though they are regionally well distributed, effort should be put in place to conserve tall canopy constituents represented by *Adansonia digitata* and *Combretum imberbe.* Individuals of these taxa should be identified by means of a "walk-down" of the preferred corridor prior to the construction phase.

**Table 6:** Protected tree species expected to be present on the study area.

| Species | Predicted status on study area |
|---|---|
| *Adansonia digitata* (Bombacaceae) - Baobab | Widespread and prominent, especially on shallow rocky soils. |
| *Boscia albitrunca* (Capparaceae) - Sheppard's Tree | Widespread, especially on low lying areas with clay soils. |
| *Combretum imberbe* (Combretaceae) - Leadwood | Widespread, located along drainage lines. |
| *Sclerocarya birrea* subsp. *caffra* (Anacardiaceae) - Marula | Widespread, mainly on soils derived from granite or gneiss. |

*Protected Plant species*

A number of plant species are expected to be present on the study area and are listed as protected (Table 7) under Schedule 12 of the Limpopo Environmental Management Act (No 7 of 2003). It is evident that the majority of these species are concentrated on hot, arid woodland on stony soils (mainly calcareous soils) that are dominated by *Colophospermum mopane*.

**Table 7:** Protected plant species expected to occur on the study area.

| Species | Predicted status on study area |
|---|---|
| *Adenia fruticosa simplicifolia* | In arid woodland on rocky soils. |
| *Adenium spp.* | Arid woodland. |
| *Adansonia digitata* | Widespread. |
| *Hoodia currorii ssp. lugardii* | Open *Acacia tortilis* and *C. mopane* bushveld on calcareous soils. |
| *Orbea lugardii, O. carnosa ssp. keithii, O. rogersii* | Open thorn or Mopani woodland among rocks. |
| *Peristrophe cliffordii* | Deep Kalahari sand in mopane bushveld. |
| *Stapelia kwebensis, S. gettliffei, S. gigantea* | Open Mopani woodland among rocks. |
| *Tavaresia barklyi* | Calcrete and limestone outcrops. |
| *Huernia zebrina zebrina* | Short bushveld among calcrete. |
| *Spirostachys africana* | Widespread, expected to be present in localised stands in heavy clay soils in riverine woodland or along drainage lines. |

A permit is required to remove or disturb a protected plant. It is recommended that protected plants in danger of becoming destroyed during the construction phase be removed prior to the commencement of construction activities by means of a "walk-down" of the proposed pylon positions.

### 3.7 Red Listed, Endemic and Conservation Important Faunal Taxa[1]

The proposed corridors will traverse through extensive areas of natural woodland and game reserves, especially on the eastern and central section of the study area which provide suitable habitat for a variety of large and charismatic mammal species. Likewise, the perennial rivers provide suitable habitat for a number of near-threatened and data deficient taxa that are wetland-dependant (e.g. shrew taxa of the genus *Crocidura*). However, the area is likely to support a high richness of near-threatened meso- and meta-carnivores on a global and national level (e.g. Leopard *Panthera pardus* and Brown Hyaena *Parahyaena brunnea*). The objective is not to provide a detailed account on the various animal communities present, but merely to provide an indication of the diversity and potential occurrence of taxa of conservation concern.

Most mammal species are in general highly mobile and therefore able to vacate areas should adverse environmental conditions prevail. Therefore, direct impacts associated with construction activities on adult mortality are less likely to occur, although indirect impacts will have consequences on their “fitness” (e.g. the ability of

[1] Please note that the avifauna is excluded from this section and will be dealt with under a separate heading in the report.

a species to reproduce). However, persistent disturbances across extended temporal scales will eventually affect any population’s ability to sustain itself, and will more than likely result in total abandoning of a particular area.

Species most likely to be affected are either K-selected species or habitat specialists e.g. substrate specialists (e.g. baboon spiders). K-selected species are mostly long-lived species with slow reproductive rates, while habitat specialists are those restricted to a particular type of microhabitat or niche, being it structurally, altitudinal or floristic. Most of these species are therefore threatened, “near-threatened” or Red Listed.

Faunal compositions are believed to remain the same irrespective of the intensity of the construction activities (e.g. road construction) associated with the power lines, but the distribution and abundance of species could effectively change. Many habitat specialists (in particular those restricted to outcrops) could eventually suffer from local range contraction.

In addition, construction activities go hand in hand with high ambient noise. Although the construction phase is considered to be of short duration, many of the larger terrestrial species will vacate the study area during the construction phase and will become temporarily displaced.

Table 5 provides a list of threatened, “near-threatened” and conservation important faunal species with geographic distribution ranges sympatric (overlapping) to the study area. It is evident that a high richness (especially mammal species) is expected to occur. This emphasises the untransformed ecological condition of the various habitat types in the area and the extensive surface areas occupied by these habitat types. Many of these areas coincide with large private game reserves which provide sanctuary for taxa with large body sizes.

**Table 8:** A list of threatened, "near-threatened" and conservation important faunal species likely to occur on the study area (excluding introduced game, e.g. Lion, buffalo, elephant and rhino). The conservation status of mammal, amphibian, reptile and invertebrate taxa was based on IUCN Red List (2014), Friedman & Daly (2004), Minter *et al.* (2004), Bates *et al.* (2014), Mecenero *et al.,* (2013) and Schedule 10 of the list of protected invertebrate species issued in terms of Section 61(1)(a) and (b) of the Limpopo Environmental Management Act, 2003 respectively.

| Scientific Name | Common Name | Global Conservation Status | National Conservation Status | Probability of Occurrence | Habitat |
|---|---|---|---|---|---|
| **Mammals** | | | | | |
| *Acinonyx jubatus* | Cheetah | Vulnerable | Vulnerable | Potentially restricted to conservation areas on the extreme north and on the eastern parts of the study area. | Open and lightly wooded savanna. |
| *Leptailurus serval* | Serval | | Near-threatened | High. | Along moist grassland near rivers and dams. |
| *Panthera pardus* | Leopard | Near-threatened | | High, regarded to be widespread on study area. | Widespread, from open woodland to hills and ridges. |
| *Raphicerus sharpei* | Sharp's Grysbok | | Near-threatened | Could occur, known to occur on western (Alternative 1A) part of the study area. | Dense shrub and woodland areas, especially riverine woodland. |
| *Atelerix frontalis* | South African Hedgehog | | Near-threatened | Could occur. | A widespread species that prefer dry habitat types and will often utilise urban gardens. |
| *Elephantulus intufi* | Bushveld Elephant-shrew | | Data Deficient | High, likely to be present. | Sandy soils with low basal cover. |
| *Petrodromus tetradactylus* | Four-toed Elephant-shrew | | Endangered | Low, only known from a single recent observation on the southern part of the study area (2230CA). | Dense forested areas with well-developed understorey and leaf litter - most likely to be present in well-developed riverine woodland. |
| *Hippotragus niger niger* | Sable Antelope | | Vulnerable | Probably introduced. | Well wooded savanna, dependant on waterbodies. |
| *Paracynictis selousi* | Selous' Mongoose | | Data Deficient | Could occur, known to be present in QDS 2230AC. | Savanna within the Limpopo River valley. |
| *Pipistrellus rusticus* | Rusty Bat | | Near-threatened | High, likely to be present. | Well-developed savanna, mainly riparian woodland. |

| Scientific Name | Common Name | Global Conservation Status | National Conservation Status | Probability of Occurrence | Habitat |
|---|---|---|---|---|---|
| *Mellivora capensis* | Honey Badger | | Near-threatened | High, likely to occur. | Catholic, widespread and tolerant to most habitat types. |
| *Crocidura cyanea* | Reddish-Grey Musk Shrew | | Data Deficient | High. | Dry terrain among rocks in dense scrub and grass, in moist places and in hedges. |
| *Crocidura hirta* | Lesser Red Musk Shrew | | Data Deficient | High. | Wide habitat tolerance. |
| *Crocidura mariquensis* | Swamp Musk Shrew | | Data Deficient | High. | Moist habitats, e.g. thick grass along riverbanks, reedbeds and in swamps. |
| *Graphiurus platyops* | Rock Dormouse | | Data Deficient | High. | Rocky habitat. |
| *Epomophorus gambianus crypturus* | Gambian Epauletted Fruit Bat | | Data Deficient | Could occur. | Riverine woodland with a high density of *Ficus* spp. |
| *Hipposideros caffer* | Sundevall's Leaf-nosed Bat | | Data Deficient | Likely to be present. | Forages over savanna, roost in caves. |
| *Rhinolophus hildebrandtii* | Hildebrandt's Horseshoe Bat | | Near-threatened | Could occur, especially in the vicinity of hills and ridges. | Forages over savanna, roost in caves. |
| **Reptiles** | | | | | |
| *Crocodylus niloticus* | Nile Crocodile | | Vulnerable | High. | Mainly confined to the Limpopo River. |
| *Homopholis mulleri* | Muller's Velvet Gecko | | Vulnerable | Possible, known from the southern part of the study area. | Holes in *Sclerocarya birrea, Colophospermum mopane* and *Acacia nigrescens* trees in Mopani woodland. |
| *Chirindia langi occidentalis* | Soutpansberg Worm Lizard | | Vulnerable | Could occur, probably peripheral to study site. | Low-lying areas under stones embedded in sandy soils. |
| **Invertebrates** | | | | | |
| *Thoracistus viridicrus* | Green-kneed Seedpod Shieldback | | Vulnerable | Status uncertain - only known from six localities in Limpopo pre-1985. | Savanna. |
| *Pterinochilus) lugardi* | | | Protected | Could occur. | Known from the Soutpansberg district near Nwanedzi River. |
| *Augacephalus (=Pterinochilus) junodi* | Junodi's Golden Baboon Spider | | Protected | High. | Widespread. |
| *Ceratogyrus darlingi* | South African horned baboon spider | | Protected | High. | Widespread. |

## 3.8 Avifauna

### *3.8.1 Important avifaunal micro-habitat types*

A number of important micro-habitat units are present in the landscape, and it was necessary to elaborate on their importance from an avifaunal perspective (mapping of these units together with detailed descriptions on their spatial position and avifaunal composition will only be dealt with during the EIA phase of this project):

- *Open arid woodland with sparse basal cover* - A large part of the study area is characterised by arid *Colophospermum-* and *Commiphora*-dominated woodland of which the field layer is poorly developed. Therefore, the floristic structure and low presence of human-induced disturbances have facilitated the colonisation and regular foraging of large terrestrial bird species as evidenced by high reporting rates for Kori Bustard (*Ardeotis kori*), Southern Ground Hornbill (*Bucorvus leadbeateri*) and Secretarybird (*Sagittarius serpentarius*);
- *Limpopo and Sand Rivers* – These include large shallow river with wide expansive and sandy floodplains. Not only do these linear systems facilitate bird dispersal, thereby linking the study area with other important foraging areas located within the Limpopo River catchment, but it also provide critical important foraging habitat for various threatened and near-threatened stork species and numerous other waterbird species. The riparian woodland is also earmarked by prominent canopy constituents (mainly *Ficus sycomorus*) which provide additional refuge and roosting habitat for the large bird of prey species;
- *Artificial dams* – these represent artificial dams which provide habitat for a variety of waterbird species which benefited from their presence and utilise these bodies of water for breeding and foraging purposes;
- *Arable land and cultivated fields* - These are represented by agricultural land, which provide ephemeral foraging habitat for a number of bird species in particular that of the nationally Secretarybird (*S. serpentarius*) and other species that are prone to power line collisions such as the White Stork (*Ciconia ciconia*), Abdim's Stork (*C. abdimii*), Spur-winged Goose (*Plectropterus gambensis*) and Egyptian Goose (*Alopochen aegyptiaca*);
- *Isolated ridges and hills* - These landscape features provide ideal nesting and hunting habitat for a range of bird of prey species. Typical species include the Lanner Falcon (*Falco biarmicus*) and the Verreaux's Eagle (*Aquila verreauxii*);
- *Tall canopy trees* - The landscape is characterised by prominent individuals of *Adansonia digitata*, which also provides ideal nesting and roosting platforms for a diversity of birds of prey species (e.g. Wahlberg's Eagle *Hieraaetus wahlbergi* and White-backed Vulture *Gyps africanus*).

### *3.8.2 Genera Impacts associated with transmission lines*

Birds are impacted in three ways by means of transmission lines. It is however a common rule that large and heavy-bodied terrestrial bird species are more at risk of being affected in a negative way when interacting with transmission lines. These include the following:

- *Electrocution*

Electrocution happens when a bird bridges the gap between the live components or a combination of a live and earth component of a power line, thereby creating a short circuit. This happens when a bird, mainly a species with a fairly large wingspan attempts to perch on a tower or attempts to fly-off a tower. Many of these species include vultures (of the genera *Gyps* and *Aegypius*) as well as other large birds of prey such as the Martial Eagle (*Polemaetus bellicosus*) (Ledger & Annegarn, 1981; Kruger, 1999; Van Rooyen, 2000). These species will attempt to roost and even breed on the tower structures if available nesting platforms are a scarce commodity. Other types of electrocutions happen by means of so-called “bird-streamers”. This happens when a bird, especially when taking off, excretes and thereby causing a short-circuit through the fluidity excreta (Van Rooyen & Taylor, 1999). This method of electrocution is however a rare phenomena. Other species also likely to be affected include species prone towards roosting on towers such as the Black Stork (*Ciconia nigra*).

However, it is recommended that the “Cross-rope Suspension” tower, a bird-friendly design, be used since it does not provide a suitable roosting or nesting substrate birds, and discourages birds from breeding or roosting on the tower (Vosloo, 2003; Figure 8). However, the use of other towers that do offer perching or nesting habitat, for example the “Self-supporting” (which is commonly used at bend points) and “Guyed-Suspension” towers should be limited and fitted with metal bird guards (Figure 9) and sleeves to insulate certain phases of the lines (Vosloo, 2003).

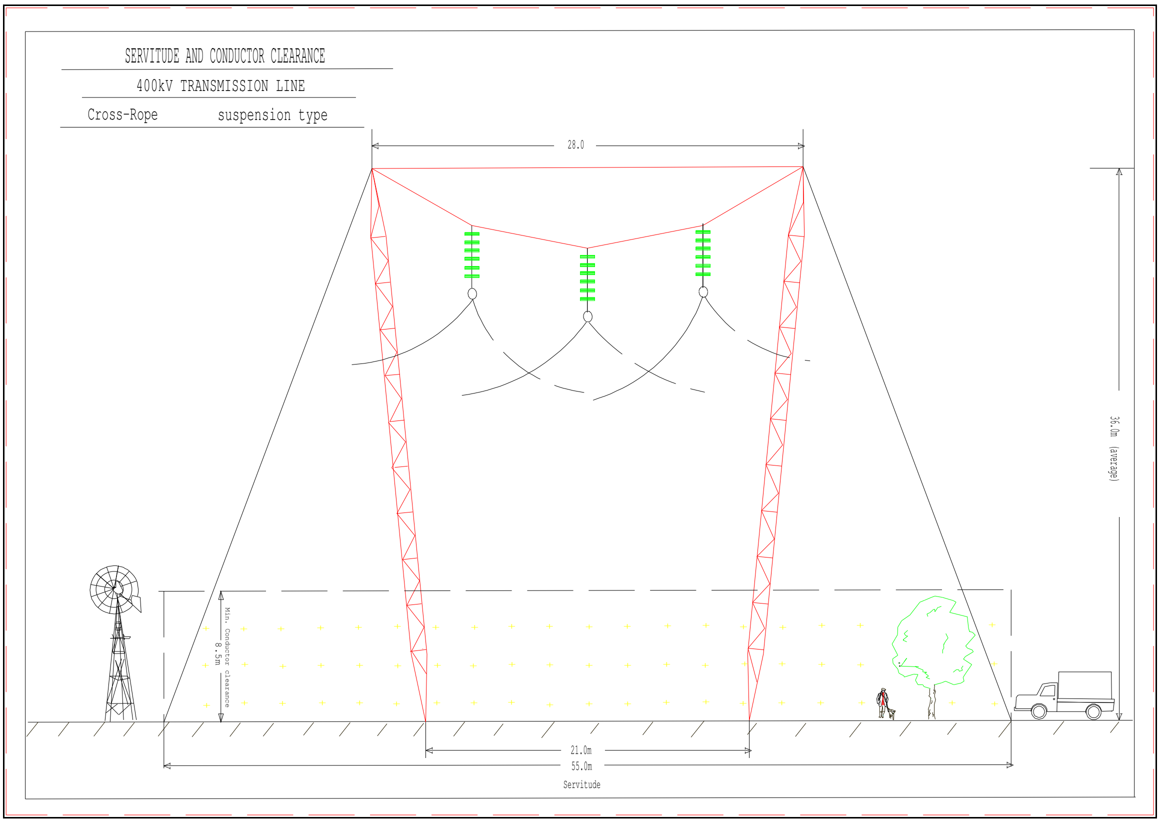


**Figure 8:** The "cross-rope suspension" tower design, a bird-friendly design.

**Figure 9:** Bird guards ('spikes') fitted to a self-supporting tower.

- *Collision*

Collisions with earth wires have probably accounted for most bird-transmission line interactions in South Africa. In general, the earth wires are much thinner in diameter when compared to the live components, and therefore less visible to approaching birds. Many of the species likely to be affected include heavy, large-bodied terrestrial species such as cranes, storks, flamingos, bustards, korhaans and a variety of waterbirds that are not very agile or manoeuvrable once airborne. These species, especially those with the habit of flying with outstretched necks (e.g. most species of storks and flamingos) find it difficult to make a sudden change in direction while flying – resulting in the bird flying into the earth wires.

Areas where bird collisions are likely to be high could be ameliorated by marking the lines with bird devices such as “bird diverters” and “flappers” to increase the visibility of the lines. For the current project it is proposed that all river and dam crossings, including proximal areas of arable land and open woodland areas be fitted with "Double Loop Bird Flight Diverters" (BFDs).

In addition, by placing the transmission line along an existing power lines will also greatly increase the visibility of the overhead cables.

- *Physical disturbances and habitat destruction caused during construction and maintenance*

It is anticipated that a number of access roads need to be constructed as well as the clearing of vegetation as part of the power line servitude. However, intensive clearing and pruning of trees is likely to take place along corridors corresponding to the tall woodland or bushveld (e.g. areas corresponding riverine woodland and tall bushveld dominated by *Adansonia digitata*).

Birds in general are highly mobile and therefore able to vacate areas should such adverse environmental conditions prevail. Therefore, direct impacts associated with construction activities on adult mortality are less likely to occur, although indirect impacts will have severe consequences on their “fitness” (e.g. the ability of a species to reproduce). Likely examples include habitat loss and disturbances preventing individuals from breeding successfully, especially considering the close proximity of crane nesting areas. However, persistent disturbances across extended temporal scales will eventually affect any population’s ability to sustain itself, and will more than likely result in total abandoning of a particular area.

### *3.8.3 Bird species likely to be impacted*

In general, the study area supports a high richness of birds species (mean of 243.6 spp, n=6 QDGs) which is explained by the extensive area of woodland habitat and the occurrence of tropical riverine habitat along the Sand and Limpopo Rivers. The latter support many species with marginal distribution ranges in South Africa, since the majority reach their southern distribution limits on the study area. The number of bird species recorded for each quarter degree square range from 192 species at Kumkusi (2229BD) to as many as 278 species at Beitbridge (2229BB).

Threatened and Near-threatened Species

The highly seasonal and ephemeral nature of surface water retention in the area, along with the presence of large rivers with extensive sandy floodplains and pools are responsible for the occurrence of many threatened and near-threatened stork species (*c*. five species) in the region. These habitat features, in combination with the open structure of the woodland habitat (which favour large terrestrial bird species such as bustards, ground hornbills and Secretarybirds), an abundance of game species (which favours scavengers), the rural practice of ranching in neighbouring Zimbabwe (which favours scavengers of the vulture genera *Terathopius, Gyps* and *Aegyptius*) and the presence of isolated, although prominent landscape features (e.g. ridges which provide optimal hunting habitat for Verreaux's Eagle *Aquila verreauxii* and Lanner Falcon *Falco biarmicus*) have all contributed to the high richness of threatened and near-threatened bird species in the area, especially large birds of prey. Therefore, a total of 19.5 % (133 spp) of all national threatened and near-threatened bird species are present on the study area. In retrospect, the majority of species are also highly prone towards collisions with earth wires, and therefore at risk.

Table 9 and Figure 10 summarizes the Red listed species that could potentially occur on the study area. It is evident that the highest reporting rates (according to Harrison *et al*., 1997) were recorded from the southern and waster parts of the study area corresponding to 2229DB (Mopane), 2229BD (Kamkusi) and 2230CA (Thipise). Those areas with high reporting rates were well-utilised by the Kori Bustard (*Ardeotis kori*), followed by the Lapped-faced Vulture (*Aegypius tracheliotos*), Verreaux's Eagle (*Aquila verreauxii*), Southern Ground Hornbill (*Bucorvus leadbeateri*) and Secretarybird (*Sagittarius serpentarius*).

According to Figure 10, Alternative 1A is the most sensitive alignment due to the high reporting rates recorded for conservation important species along this alignment. It is in these areas where proper mitigation actions to reduce collisions or disturbances (through the loss of habitat) are required.

Non-threatened species

A number of other bird species are also likely to be affected by the proposed transmission line and include species such as the White Stork (*Ciconia ciconia*), Woolly-necked Stork (*Ciconia episcopus*), African Openbill (*Anastomus lamelligerus*), African Fish-eagle (*Haliaeetus vocifer*), Brown Snake-eagle (*Circaetus cinereus*), Black-chested Snake-eagle (*Circaetus pectoralis*) and a number of waterbird species pertaining to the Anatidae (ducks and geese), Phalacrocoracidae (cormorants), Anhingidae (darters), Ardeidae (herons and egrets) as well as Threskiornithidae (ibises).

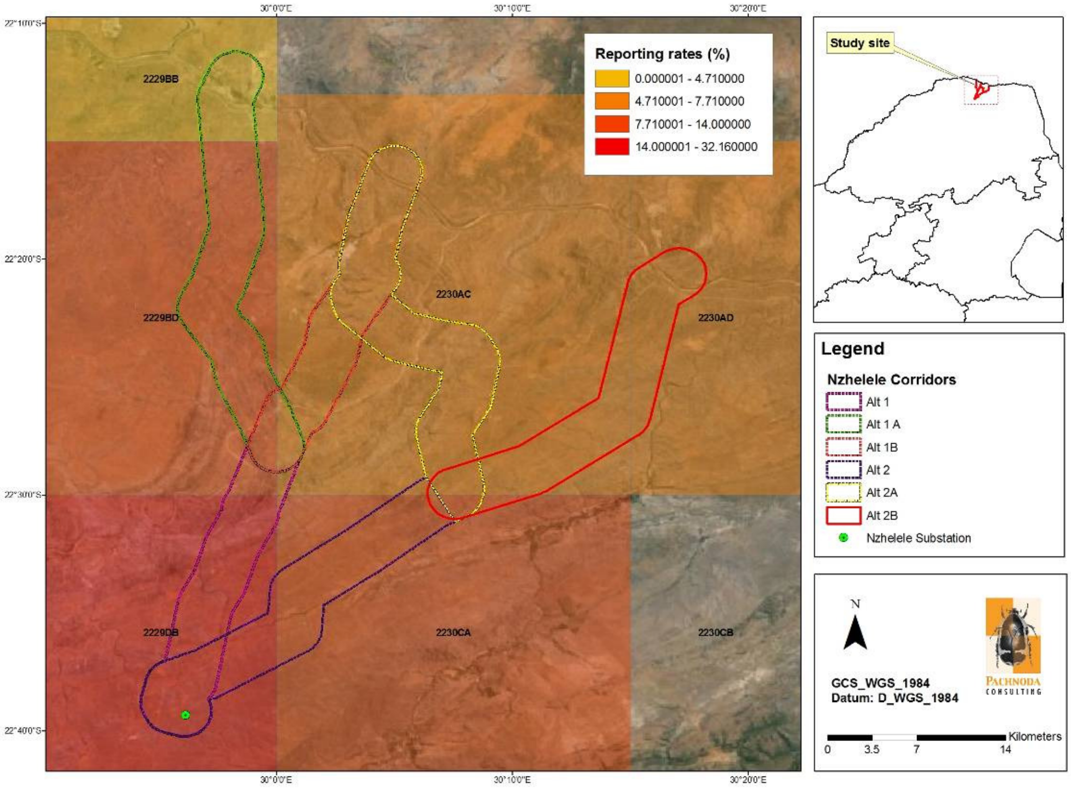


**Figure 10:** A spatial presentation of the mean reporting rates (%) for Red listed bird taxa recorded from the quarter degree squares on the study area.

**Table 9:** The reporting rates (%) for each Red listed species (IUCN, 2014; Taylor, 2014) likely to occur on six quarter degree grids. CE – Critically Endangered, EN - Endangered, V- Vulnerable and NT – Near-threatened.

| QDGC<br>Species | Global Status | Regional Status | 2229BB<br>Beitbridge | 2229BD<br>Kamkusi | 2229DB<br>Mopane | 2230AC<br>Musina | 2230CA<br>Thipise | 2230AD<br>Esmefour |
|---|---|---|---|---|---|---|---|---|
| Great White Pelican (*Pelecanus onocrotalus*) | - | V | 3 | | | | | 3 |
| Pink-backed Pelican (*Pelecanus rufescens*) | - | V | 6 | | | | | |
| White-backed Night-heron (*Gorsachius leuconotus*) | - | V | | | | | | 3 |
| **Yellow-billed Stork (*Mycteria ibis*)** | **-** | **EN** | | **8** | | **2** | | **9** |
| **Black Stork (*Ciconia nigra*)** | **-** | **V** | **3** | | | **5** | | **9** |
| **Abdim's Stork (*Ciconia abdimii*)** | **-** | **NT** | **3** | | **14** | **2** | **6** | |
| **Saddle-billed Stork (*Ephippiorhynchus senegalensis*)** | **-** | **EN** | **6** | | | | | **6** |
| **Marabou Stork (*Leptoptilos crumeniferus*)** | **-** | **NT** | **10** | | | **2** | | |
| Greater Flamingo (*Phoenicopterus ruber*) | - | NT | 3 | | | | | |
| Lesser Flamingo (*Phoeniconaias minor*) | NT | NT | 3 | | | | | |
| **Secretarybird (*Sagittarius serpentarius*)** | **V** | **V** | | **8** | **29** | **2** | | |
| African White-backed Vulture (*Gyps africanus*) | EN | EN | 3 | 8 | 21 | | | 3 |
| Cape Vulture (*Gyps coprotheres*) | V | EN | | 8 | 21 | | | |
| White-headed Vulture (*Aegypius occipitalis*) | V | EN | | 8 | | | | |
| Lapped-faced Vulture (*Aegypius tracheliotos*) | V | EN | | | 21 | | | |
| Verreaux's Eagle (*Aquila verreauxii*) | - | V | 6 | | | 31 | 13 | |
| Tawny Eagle (*Aquila rapax*) | - | EN | 3 | | 7 | 7 | 6 | 15 |
| Martial Eagle (*Polemaetus bellicosus*) | V | EN | 6 | 8 | 21 | 11 | | 6 |
| Bateleur (*Terathopius ecaudatus*) | NT | EN | | | 29 | 2 | 6 | 3 |
| Pallid Harrier (*Circus macrourus*) | NT | NT | | | | 2 | 6 | |
| Lanner Falcon (*Falco biarmicus*) | - | V | 10 | | 7 | 7 | 6 | 6 |
| **Kori Bustard (*Ardeotis kori*)** | **NT** | **NT** | **3** | **62** | **50** | **13** | **31** | **15** |
| Greater Painted Snipe (*Rostratula benghalensis*) | - | V | 6 | | | 2 | | 3 |
| Chestnut-banded Plover (*Charadrius pallidus*) | NT | NT | 3 | | | | | |
| European Roller (*Coracias garrulus*) | NT | NT | 3 | 8 | 29 | 15 | 38 | 15 |

| QDGC<br><br>Species | Global Status | Regional Status | 2229BB<br><br>Beitbridge | 2229BD<br><br>Kamkusi | 2229DB<br><br>Mopane | 2230AC<br><br>Musina | 2230CA<br><br>Thipise | 2230AD<br><br>Esmefour |
|---|---|---|---|---|---|---|---|---|
| Southern Ground Hornbill (*Bucorvus leadbeateri*) | V | EN | | 8 | 29 | | | 12 |
| **Average Reporting Rate** | | | 4.71 | 14.00 | 23.16 | 7.36 | 14.00 | 7.71 |
| **Total Richness** | | | 17 | 9 | 12 | 14 | 8 | 14 |

Species highlighted in **red** are critically endangered or endangered, and very susceptible to habitat transformation and disturbance.
Species highlighted in **black bold** are especially vulnerable to power line collision.
Total values in red refer to QDGs with a high relative abundance of Red Listed species.

### 3.9. Preliminary ecological sensitivity

A preliminary sensitivity map was compiled, illustrating areas comprising of potential sensitive elements based on the following arguments (Figure 11):

*Areas of high ecological sensitivity*

- *Extensive (contiguous) natural woodland units with open canopy and poorly developed field layer* : A large part of the study area is characterised by arid woodland dominated by *Colophospermum mopane* or mixed *Commiphora* woodland which support high reporting rates for large terrestrial bird species. These species are invariably susceptible to power line mortalities;
- *Large conservation areas and natural preserves*: These areas provide refuge for a high richness of mammal species, including large non-ruminant herbivores and apex predators. The presence of game is a mutual attractant of large-bodied scavengers (e.g. vulture taxa) to the area;
- *Prominent topographical features (>600m amsl)*: These include isolated ridges and hills which, based on their high spatial heterogeneity and shallow rocky soils, provide habitat for a number of protected succulent plant taxa. In addition, these areas are frequented by threatened birds of prey which breed obligatory on outcrop habitat;
- *Tall canopy constituents* (e.g. *Adansonia digitata*): These provide optimal breeding, hunting and roosting platforms for birds of prey species;
- *Presence of large river systems, drainage lines and manmade dams*: These habitat types provide ephemeral foraging habitat for a large number of stork species (all prone towards collisions with earth wires) while the linear configuration of the rivers and drainage lines facilitate animal dispersal across the landscape.

*Areas of medium-high ecological sensitivity*

- *Arable land and cultivated land*: These areas often attract large number of stork taxa and large-bodied anatids (geese). Any placement of a transmission line proximal to these habitat types could increase the probability of bird collisions with overhead cables. In addition, this habitat often attract foraging Secretarybirds and bustards when left fallow.

*Areas of medium ecological sensitivity*

- These areas refer to short, dense bushveld which is often less suitable as foraging habitat for large terrestrial birds and mammal species. In general, the floristic composition of these areas are species poor and with reduced numbers of tall protected tree individuals (this statement will be verified during the EIA phase - refer to next section).

*Areas of low ecological sensitivity*

- These areas are not considered to be pristine and occurred on areas where severe habitat transformation took place;
- Many of these areas are composed of built-up land and provide habitat for invader taxa, thus contributing little towards local biodiversity; and
- The vegetation assemblages are at an advanced state of degradation and will seldom (if ever) revert back to that of a late-successional unit that typifies the regional vegetation types.

*It should be borne in mind that the current sensitivity map shows a large surface area that is earmarked as sensitive woodland. This is based on information as provided by the national land cover dataset (2000 & 2009). It is unlikely that all of these woodland units are pristine due to current habitat modifications or poor habitat management. It is therefore expected that some of these woodland and bushveld units represent secondary (transformed) compositions.*

*However, it is evident from the preliminary sensitivity analysis (and dominant land cover - see section 3.4) that Alternative 2B and Alternative 1A are the least preferred corridors. Therefore, Alternative 1B and Alternative 2A are better suited since they encompass large areas of transformed habitat and run parallel to existing road infrastructure, but only so if the proposed alignments strive to avoid prominent ridge habitat (prominent on the southern section of Alternative 1).*

# 4. POTENTIAL IMPACTS AND PLAN OF STUDY FOR THE EIA

Due to the limited level of detail that is normally implemented during a scoping assessment, it is imperative that detailed ecological (flora and fauna) investigations be conducted on the study area at an appropriate season. Results from the detailed ecological investigations will then be used to identify a feasible corridor with an appropriate route alignment (a proposed alignment within the 4 km wide corridor) with the least environmental impact on the biodiversity value and ecological function of the study area.

## 4.1 Vegetation

### *4.1.1 Potential impacts*

1. Loss of near-threatened, declining and protected plant and tree species (e.g. due to placement of towers, stringing operations and access roads);
2. Loss of woodland and bushveld habitat due to clearing and pruning activities;
3. Establishment of alien and invader taxa along the power line servitude; and

4. Maintenance of the vegetation below the power line servitude (e.g. mowing).

### *4.1.2 Proposed approach and methods*

- Provide a description of the dominant floristic species richness and community composition along the proposed corridors according to plot-based sampling protocols;
- Sampling will aim to duplicate the Braun-Blanquet approach, which is basically the standard for phytosociological studies (plant description and mapping) in South Africa. The Braun-Blanquet plot method is the preferred sampling technique of the National Spatial Biodiversity Assessment team (Rouget *et al*., 2004);
- A minimum of 20 plots (preferably 30) will be sampled during the wet season (November-March) based on available soil and landscape information, and physiognomic differences observed on large-scale aerial photographs and satellite imagery. The random, pro-rata placement of the sampling plots will be facilitated with the aid of a Geographic Information System (GIS). The co-ordinates of the plots will be exported to Mapsource and uploaded to a GARMIN Montana 650 Global Positioning System (GPS) receiver for navigation in the field. Actual location in the field will be recorded within a 5 m accuracy interval;
- At each plot, the following abiotic and floristic attributes will be documented:
    - Topography – altitude, terrain unit, percentage slope;
    - Soil – soil form, soil depth (mm), erosion, estimated percentage clay of A horizon;
    - Estimated percentage rock cover – gravel, small, medium, large;
    - Vegetation cover – total, trees, shrubs, herbs, open water, rock; and
    - Estimated average height of trees, shrubs and herbs – highest and lowest categories.
- A list of all plant species within an approximate 100m$^2$ will be recorded in the following growth form categories: grasses, forbs and woody species. Cover abundance values will be estimated for each species within the plot. Unknown species or potential Red Data species will be identified using relevant field guides, the University of Pretoria's herbarium and specialists from the National Botanical Institute.
- The relative density of protected trees will be calculated from fixed-length transect lines in the vicinity of each sampling plot. The transect results will provide an estimate of the number of tree individuals per unit area.
- The survey results will be entered into a relational database for record purposes and analysis of the abiotic and vegetation characteristics. The species data will be entered into TURBOVEG and analysed with the software package JUICE. A vegetation map will be compiled/ refined, based on the results of the phytosociological table and boundaries of the homogenous units.

## 4.2 Fauna (ex Avifauna)

### *4.2.1 Potential impacts*

1. Loss of threatened and near-threatened species (e.g. due to placement of towers and access roads);
2. Loss of important ecological habitat types (e.g. ridges) and potential fragmentation of ecological corridors (drainage lines and rivers); and
3. Disturbances and displacement of species during the construction phase and maintenance procedures.

### *4.2.2 Proposed approach and methods*

- The following literature and databases will be consulted:
  - The occurrence and conservation status of mammal taxa will be based on the IUCN Red List (2014) and Friedmann & Daly (2004), while mammalian nomenclature will be based on Skinner & Chimimba (2005) unless otherwise specified;
  - Red Data categories for reptile taxa will be chosen according to Bates *et al.* (2014); and
  - Red Data categories and listings of amphibian taxa will follow Minter *et al*. (2004) and Measey (2010).
  - Red Data categories and listings of butterfly taxa will follow Mecenero *et al.* (2013).
- An inventory of faunal taxa based on faunal activity (mammal spoor, dropping, burrows) will be compiled based on field data recorded from stratified sampling plots distributed at random in different homogenous habitat types (during a site visit). Therefore, the sampling plots will represent a sample of the habitat variation on the study area according to differences in floristic condition, structure and composition, as well as habitat diversity within the landscape.

## 4.3 Avifauna

### *4.3.1 Potential impacts*

1. Possible electrocution and bird streamers/pollution;
2. Collision of birds with earth wires;
3. Potential loss of important foraging and breeding habitat during construction activities (e.g. loss of tall trees or canopy constituents); and
4. Disturbances and displacement caused by construction activities and maintenance of the transmission line servitude.

#### 4.3.2 Proposed approach and methods

- The following literature and databases will be consulted:
    - Hockey *et al*. (2005) will be consulted for general information on the life history attributes of bird species;
    - The Southern African Bird Atlas Project (SABAP1) (Harrison *et al*, 1997) will be consulted to obtain information regarding the distribution patterns of bird species;
    - Additional distributional data will be sourced from the SABAP2 database (www.sabap2.adu.org.za);
    - The conservation status of bird species and their respective biogeographic affinities will be sourced from the IUCN Red List (2014), Taylor (2014) and Barnes (1998). The latter provides an overview of the Important Bird Areas (IBAs) in southern Africa;
    - Data on power line derived bird mortalities in the area will be sourced from the electrical infrastructure mortality incident register (obtained from the EWT);
    - Conversations with the public sector (farers and reserve managers) and my own personal observations; and
    - Data on wetland types will be obtained from the National Wetlands Inventory (Version.3, 2006) and Mr. Retief Grobler; and
- Bird data will also be collected by means of selected point counts (see Buckland *et al.,* 1993) to provide an overview of the dominant species (according to Clarke & Warwick, 1994) on the study area and to identify areas (or hotspots) with high numbers of Red listed species.

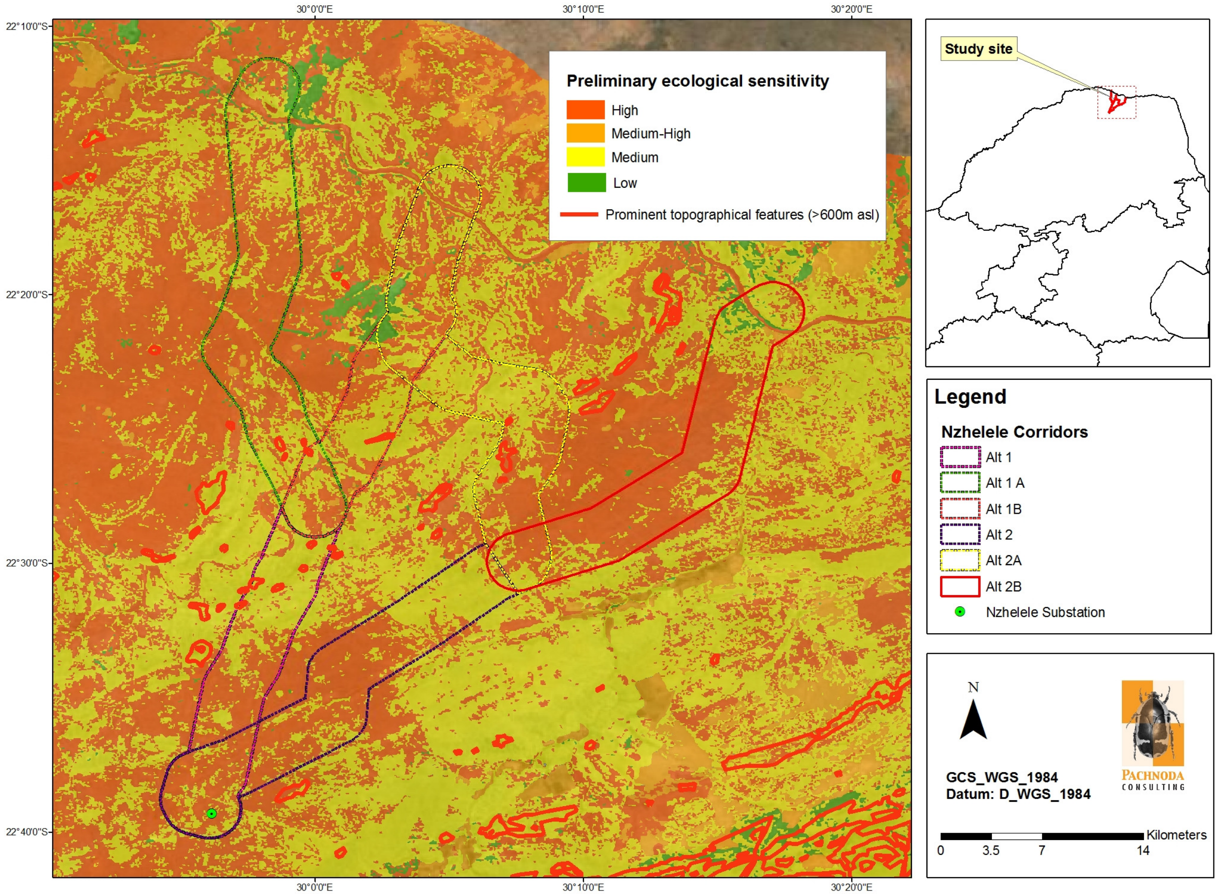


**Figure 11:** A map illustrating the preliminary ecological sensitivity of the area based on habitat types which is perceived to support high faunal richness and habitat for bird species prone towards power line collisions.

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