MARCH 2015

AN ECOLOGICAL REPORT ON THE FLORA AND FAUNA

Eskom Kimberley Strengthening Phase 4 Project : Manganore-Ferrum

(Double circuit 400kV powerline from Manganore to Ferrum, including a new Manganore TX Substation and a new Ferrum TX Substation adjacent to the existing Manganore Dx Substation and the existing Ferrum Dx Substation respectively)

A report commissioned by

LANDSCAPE DYNAMICS

ENVIROGUARD ECOLOGICAL SERVICES CC

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CONTENTS

TERMS OF REFERENCE

Project Description:

ESKOM is planning the construction of an approximately 90km powerline from Manganore to Ferrum, including a new Manganore Tx Substation and a new Ferrum TX Substation adjacent to the existing Manganore Dx Substation and the existing Ferrum Dx Substation respectively. The powerline route and locality of the substation will be determined during the Scoping and EIA process.

Project Locality:

The project area is roughly located north of the town of Postmasburg stretching north for approximately 48 km ending at the Power substation (Ferrum) just outside the town of Kathu.

Aim of this assessment:

The aim of the impact assessment is to present floristic descriptions of the different vegetation units encountered within the study area and to highlight sensitive attributes and areas within the environment that might be adversely affected by the proposed development. The impacts are to be evaluated and pertinent mitigating actions recommended

ASSIGNMENT

Enviroguard Ecological Services cc. was commissioned by **Landscape Dynamics Environmental Consultants** to conduct an ecological assessment (Flora & Fauna) of the proposed routes identified for the construction of the new Eskom powerlines.

The proposed project contains two proposed routes with an alternative corridor section on one route that stretch from the Manganore Power substation to the Ferrum Power substation at the town of Kathu.

The aims of the study are to:

- conduct a vegetation survey for the proposed routes
- conduct a faunal assessment for the proposed routes
- identify ecologically sensitive area/s if they are found to be present

The objectives of this study were to:

- Identify the different vegetation units present along the proposed routes
- Describe and map the different vegetation units
- Provide a description of the fauna occurring within the study area.
- Identify species (mammals, reptiles, amphibians) of conservation importance that could possibly occur on the study site.
- Determine potential impacts of the proposed development on the proposed site on the associated fauna.
- To provide a sensitive map of the study

CONDITIONS RELATING TO THIS REPORT

Factors limiting the quality of this study

Flora: A once off survey was conducted on 30 January 2014 followed by surveys from 9-10 January 2015. Thus only those flowering plants that flowered at the time of the visit could be identified with high levels of confidence. Some of the more rare and cryptic species may have been overlooked due to their inconspicuous growth forms. Many of the rare and endangered succulent species can only be distinguished (in the veld) from their very similar relatives on the basis of their reproductive parts. These plants flower during different times of the year. Multiple visits to any site during the different seasons of the year could therefore increase the chances to record a larger portion of the total species complex associated with the area. The survey of the study site is however considered as successful with a correct identification of the different vegetation units.

Fauna: An initial site investigation was undertaken on the 10^{h} February 2014 with additional surveys conducted from the 22nd-24th of March 2015. The majority of threatened species are extremely secretive and difficult to observe even during intensive field surveys conducted over several years. The presence of threatened species on site is assessed mainly on habitat availability and suitability observed during the field surveys as well as desk-top research (literature, personal records and previous surveys conducted on the site and similar habitats within the area).

Approach

Conclusions reached and recommendations made are based not only on occurrence of individual species, but more appropriately on habitats and ecosystem pattern and processes. Planning must therefore allow for the maintenance of species, habitats and ecosystem processes, even if Red Data or endemic plant species are absent.

Declaration of interest

Enviroguard Ecological Services cc has no vested interest in the property studied nor is it affiliated with any other person/body involved with the property and/or proposed development. Enviroguard Ecological Services cc is not a subsidiary, legally or financially of the proponent.

The study was undertaken by Prof LR Brown (PhD Plant Ecology - UP), Dr H Bezuidenhout (PhD Botany - UP) and Mr CL Cook (MSc Zoology - UP). They are registered as a Professional Natural Scientists with the following details:

Prof LR Brown:	Reg. No. 400075/98 (Botanical Science and Ecological Science).
Dr H Bezuidenhout:	Reg. No. 400148/07 (Ecological Science)
Mr C Cook:	Reg. No. 400084/08 (Zoological Science)

Indemnity

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- The results of the project;
- The technology described in any report;
- Recommendations delivered to the Client.

INTRODUCTION

The natural resources of South Africa, with its highly complex and diversified society, are continually under threat from development especially in and close to areas richly endowed with natural resources. The natural environment and assets such as soil, water, indigenous vegetation, biodiversity, endemic and rare species and indigenous wildlife should be part of planning any new developments. New development plans should be based on scientific, ecological principles to prevent destruction or the deterioration of the environment and consequently the loss of valuable natural assets - also the loss of plant and animal species (biodiversity) and natural open spaces within the urban environment. This does not only have economic consequences, but from a conservation viewpoint, may have enormous advantages to the natural ecosystems. Development should, therefore, be planned to make the best possible use of natural resources and to avoid degradation, and therefore attention must be paid to environmental factors to make informed decisions. During the last years development became complicated and sophisticated, scientifically based, enterprises where environmental and nature systems are (or should be) accounted for in the planning stages. Modern development planning is intended to improve the way in which South African environmental resources are utilised. This provides a cost-effective procedure for ensuring that environmental concerns are carefully considered in the project development process. This procedure aims at guiding and facilitating the development process of a project. **An ecological evaluation of any area to be developed is presently considered a necessity.**

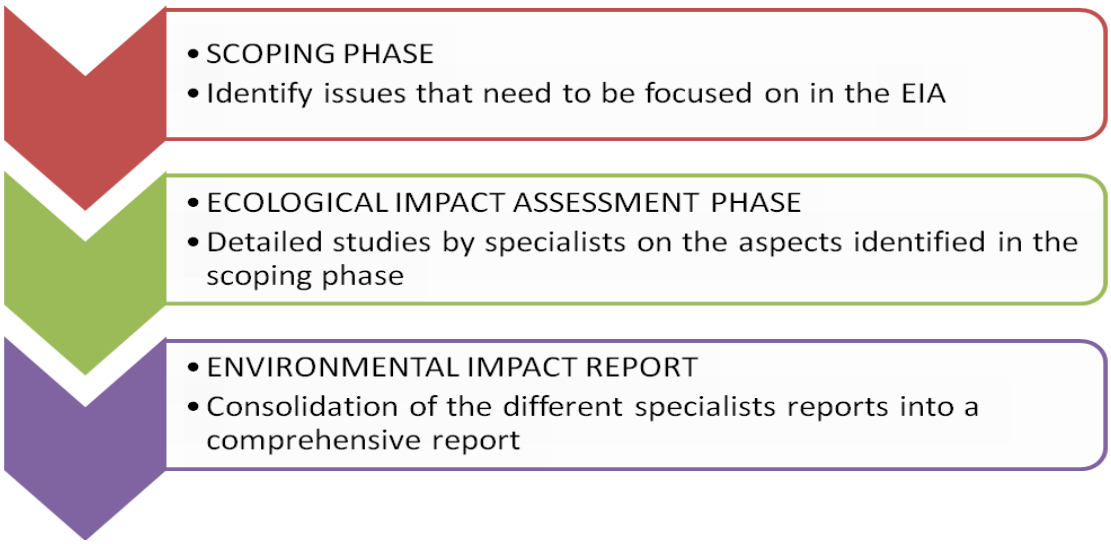
Eskom Transmission is responsible for providing a high quality supply of electricity to meet the ever increasing needs of its end users in South Africa. As a result, its infrastructure of power lines and substations are continuingly being established and expanded upon to support annual load growth.

Eskom endeavors to provide sustainable and affordable energy through the integration and consideration of economic development, environmental quality and social equity. Environmental performance is fundamental to Eskom and they strive to lessen their impact on the natural environment as far as possible. "*Eskom continues to operate as a responsible corporate citizen in South Africa – the goal being to be*

recognised as a world-class utility in terms of environmental management practices and environmental duty of care." (Eskom website 2014).

Active participation of affected and interested parties in the different Eskom projects early in the environmental impact assessment process ensures that the environmental is taken into account before any further plans are made.

In terms of the Environment Conservation Act (Act no. 73 of 1989) an Environmental Impact Assessment (EIA) must be undertaken before any development on land can begin. Such a process will ensure that all aspects and possible consequences to the environment, stakeholders and affected parties are considered during the project. The initial phase of the EIA is the scoping exercise. That is followed by a formal and detailed EIA from where the findings of all specialists are condensed in an Environmental Management Plan (see diagram below).



The overarching purpose of an EIA on the environment is to determine the different consequences of a proposed development on the local and regional environment and to assess and evaluate them (positive and negative). The EIA will also recommend strategies to minimise or even avoid negative impacts. It is also important that consideration is given to the probable significance or "acceptability" of the effects or consequences. According to the National Environmental Management Act (Act 107 of 1998) an environmental impact refers to any impacts on land, water, the atmosphere or living organisms, or on the inter-relationships between them, and impacts on their physical, chemical, aesthetic and cultural properties and conditions

that influence human health and well-being (National Environmental Management Act, 1998 (ACT N0.107 OF 1998).

This vegetation and faunal assessment was undertaken to assist with final decisions regarding the preferred route for the Eskom power line to be constructed between Manganore Power Station and Ferrum Power Station.

Plant communities are regarded as fundamental units of an ecosystem and therefore form the base for environmental planning and the compilation of environmental management plans. Vegetation is the most physical representation of the environment and any changes in the environment is first detected in changes in vegetation. Vegetation also provides habitat for various animal species. Some animal species may use various habitats for various purposes such as feeding, sleeping and reproduction. Thus plant species assemblages reflect habitat and ecosystem health and rarity, and are therefore imperative for an Environmental Impact Assessment.

This report provides information on:

- Broad ecological characteristics of the proposed routes
- Main vegetation types that occur along the proposed routes
- Vegetation units present along the proposed routes
- Faunal species present along the proposed routes
- Likelihood that red data plant and animal species could occur along the different proposed routes
- Sensitive ecosystems that could be affected by the proposed routes

STUDY AREA

The study area is north of the Manganore substation (28°07'59.88"S and 23°06'03.33"E) stretches for approximately 48 km where it ends at the Ferrum substation (27°43'54.71"S and 23°03'25.45"E) at the town of Kathu (Figure 1).

Climate

The area is known for its hot summers (November-February) and relatively cold winters (June-August). The average midday temperatures for the area range from 18°C in June to 33°C in January and can be below 0.2°C in winter (July). January with an average temperature of 25.3 °C, is the hottest month of the year. In July, the average temperature is 10.8 °C. It is the lowest average temperature of the whole yearMost rainfall occurs during the summer months. The average annual rainfall for the area is 240mm with the lowest (0mm) in June and July with the highest (55mm) in February/March. (Figure 2).

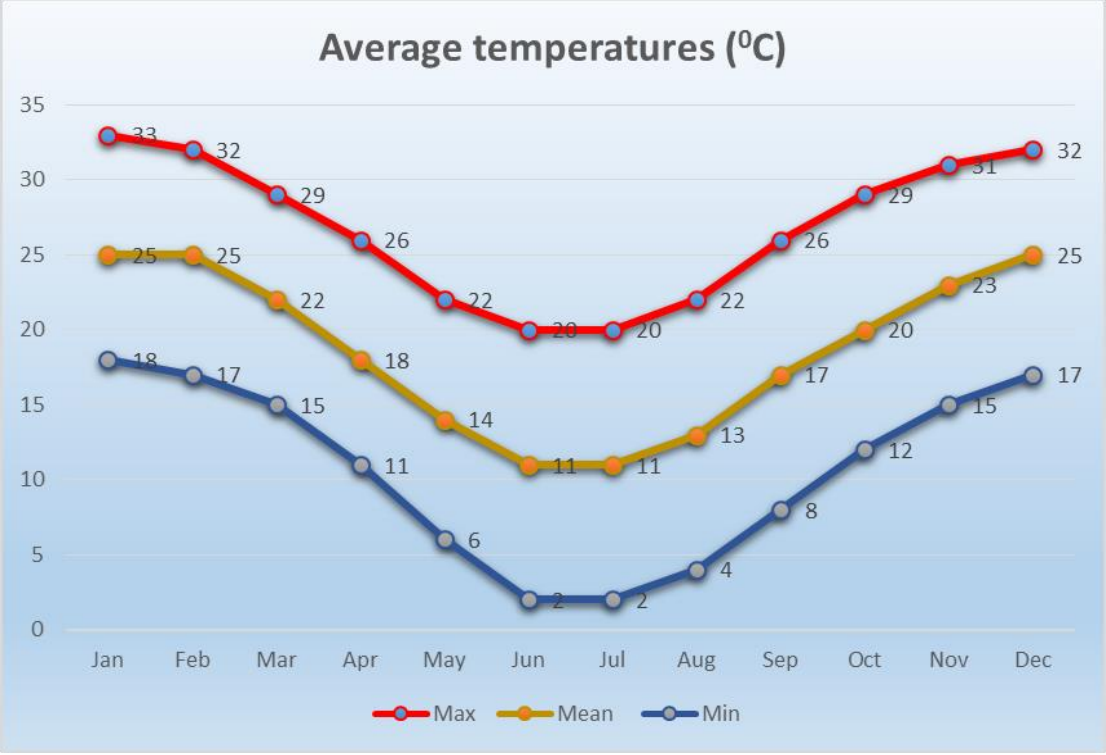


Figure 1. Average temperatures for the study area.

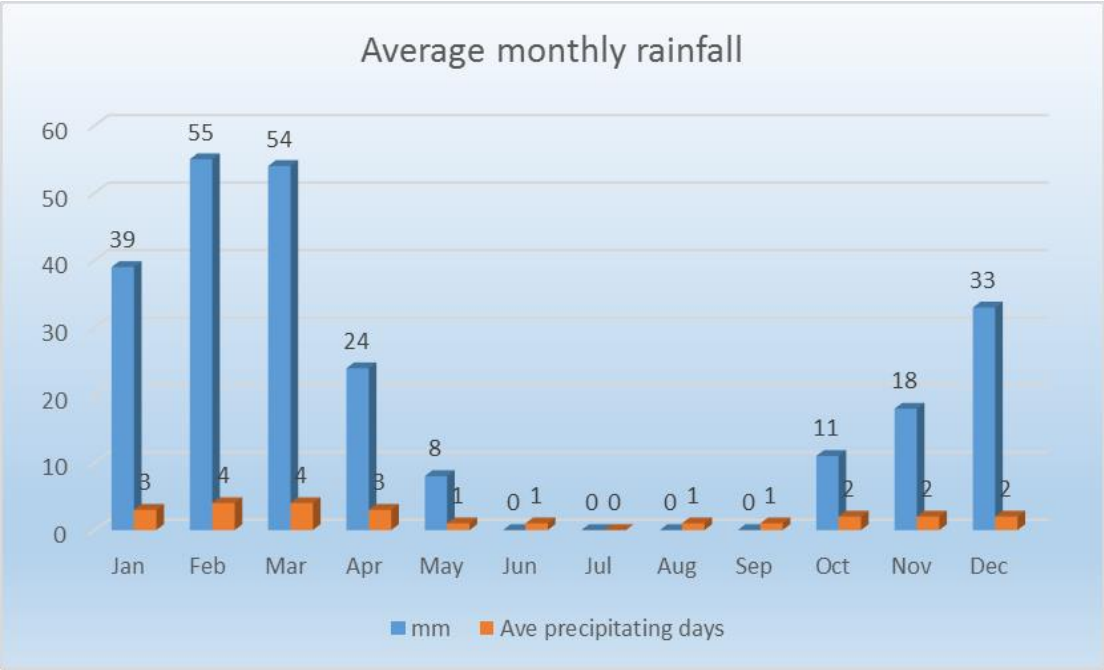


Figure 2. Precipitation for the study area for the study area.

Topography & geology

The landscape varies from gently undulating plains to rolling hills. No major rivers flow through the proposed route area. The following topographical positions are distinguished: crest, steeper midslopes, flat midslopes and drainage lines. The soil / rock complex is being dominated by Rock and Mispah soil form.

The following geological types occur in the area: The hills consist of banded iron formation, with jaspilite, chert and riebeckite-asbestos of the Griqualand West Supergroup. In some areas small pockets of red, deep, aeolian sands of the Kalahari Group overlying the volcanics and sediments of the Griqualand West Supergroup were observed.

METHODS

Two alternative routes were visited and surveyed and are indicated on Figure 3

VEGETATION

The vegetation of the proposed routes was surveyed and data analysed. Prior to the field survey, available literature, and database information pertaining to the vegetation and threatened species of the study area was obtained and reviewed. The literature review included scientific and popular publications on related aspects for the area. Internet searches for ecological issues in the area and red data plant and animal species were done. The Google search engine was used for information pertaining to Red Data flora and fauna and their habitat preferences.

During the first field trip the proposed routes were covered using both vehicle and helicopter transport. During the second visit in 2015 the routes were covered by vehicle and on foot to survey the vegetation in the field.

The Braun-Blanquet survey technique to describe plant communities as ecological units was used for this study (Brown *et al.* 2013; Kent & Coker 1992; Mueller-Dombois & Ellenberg 1974). It allows for the mapping of vegetation and the comparison of the data with similar studies in the area. The vegetation survey was conducted by Prof. LR Brown and Dr H Bezuidenhout.

By using aerial photographs, the study area was stratified into physiognomic - physiographic units. Sample plots were placed on a randomly stratified manner to represent each vegetation unit identified. Plot sizes were fixed at approximately 400 m^2 according to Brown (1997).

Data recorded included:

Data pertaining to the vegetation physiognomy and floristic composition (species richness and canopy cover of each species) was gathered. A list of all plant species present, including trees, shrubs, grasses, forbs, geophytes and succulents were made.

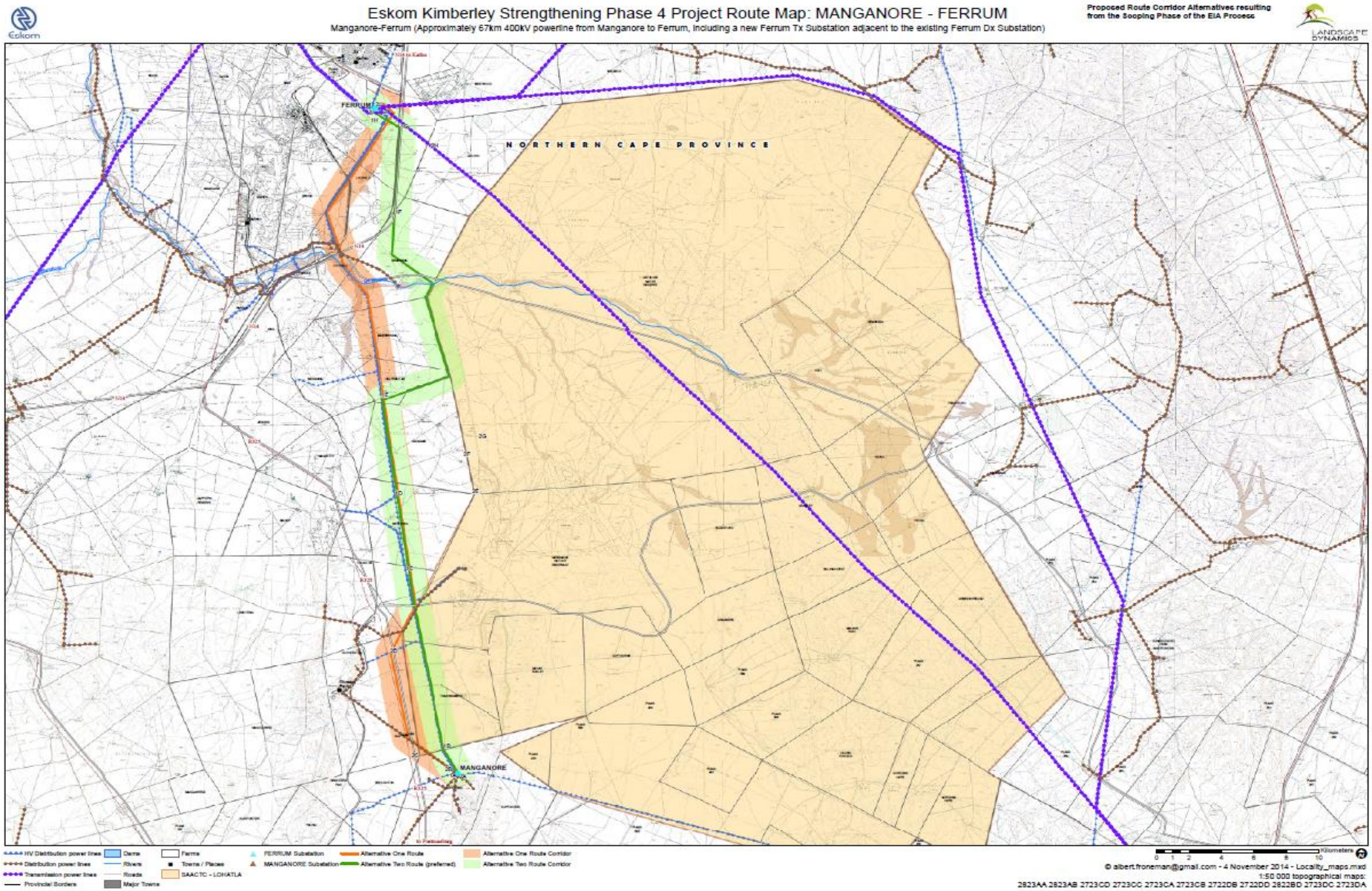


Figure 3: Location of the study area and proposed routes.

Red data species

An investigation was also carried out on rare and protected plants that might possibly occur in the region. For this investigation the National Red List of Threatened Plants of South Africa, Lesotho & Swaziland, compiled by the Threatened Species Programme, South African National Biodiversity Institute (SANBI) as well as information provided by the Northern Cape Nature Conservation office were used. Internet sources were also consulted on the distribution of these species in the area. Other information used included:

- Publication of lists of species that are threatened or protected, activities that are prohibited and exemption from restriction from the National Environmental Management: Biodiversity Act, 2004 (ACT NO. 10 OF 2004).
- List of protected tree species under the National Forests Act, 1998 (ACT NO 84 OF 1998)

The presence of rare and protected species or suitable habitat was recorded during the field visit.

Data processing

A classification of vegetation data was done based on the plant species groupings and occurrence to identify, describe and map vegetation units. The descriptions of the vegetation units include the tree, shrub and herbaceous layers.

The **conservation priority** of each vegetation unit was assessed by evaluating the plant species composition in terms of the present knowledge of the vegetation of the Gauteng area, and the Grassland and Savanna Biomes of South Africa.

The following four **conservation priority** categories were used for each vegetation unit:

High:	Area with high species richness and habitat diversity; presence of viable populations of red data plant species OR suitable habitat for such species; presence of unique habitats; less than 5% pioneer/alien plant species present. These areas are ecologically valuable and important for ecosystem functioning. This land should be conserved and managed and is not suitable for development purposes.
Medium-high:	An area with a natural species composition; not a threatened or unique ecosystem; moderate-high species diversity; between 5-10%

pioneer/alien plant species present, and has connectivity with other natural ecosystems. Although natural it is not a sensitive habitat and commonly occur in the region. Low density development/impacts could be allowed with areas to be left in its natural composition so as to lessen the impact on the natural ecosystem.

Medium: An area with a relatively natural species composition; not a threatened or unique ecosystem; moderate species and habitat diversity; between 10-20% pioneer/alien plant species present; that would need moderate input to rehabilitate to an improved condition; and where low density development would have a limited impact on the vegetation / ecosystem. It is recommended that certain sections of the vegetation are maintained**.**

Low-medium: A common vegetation type; moderate to low species and habitat diversity; previously or currently degraded or with large sections in a secondary successional phase; between 20-40% pioneer and/or alien plant species; low ecosystem functioning; low rehabilitation potential. Development could be supported with little impact on the natural environment.

Low: A totally degraded and transformed area with a low habitat diversity and ecosystem functioning; no viable populations of natural plants; >40% pioneer and/or alien plant species present; very low habitat uniqueness; whose recovery potential is extremely low; and on which development could be supported with little to no impact on the natural vegetation / ecosystem.

A **sensitivity analysis** was done for the vegetation units identified. This was achieved by evaluating the different vegetation units against a set of habitat criteria. For impact assessment the **potential impacts** on the vegetation was assessed by using the NEMA 2006 guidelines and criteria. To further quantify the severity of each impact, values were assigned to criteria ratings (Table 1).

Table 1: Criteria, criteria ratings and values (in brackets) used in this study to assess possible impacts on vegetation during the proposed development

Criteria	Rating (value)
Extent of impact	Site (1), Region (2), National (3), International (4)
Duration of impact	Short term (1), Medium term (2), Long term (3), Permanent (4)
Intensity of impact	Low (1), Medium (2), High (3)
Probability of impact	Improbable (1), Probable (2), Highly probable (3), Definite (4)

FAUNA

Predictive methods

Satellite imagery of the area was obtained from Google Earth was studied in order to get a three dimensional impression of the topography and current land use. Aerial photographs were utilised for the sensitivity mapping using Arcview 9.2

Literature Survey

A detailed literature search was undertaken to assess the current status of threatened plants well as faunal species that have been historically known to occur in the Postmasburg (Manganore) and Kathu (Ferrum) 2823AA, 2823DA, 2723DB and 2723CA quarter degree grid cells (QDGC). The literature search was undertaken utilising *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford 2006) for the vegetation description as well as *National Red List of Threatened Plants of South Africa* (Raimondo *et al,* 2009) as well as internet using POSA (http://posa.sanbi.org). *The Mammals of the Southern African Subregion* (Skinner & Chimimba 2005) and *The Red Data Book of the Mammals of South Africa: A Conservation Assessment* (Friedmann and Daly (editors) 2004) as well as ADU's MammalMap (http://vmus.adu.org.za/vm) accessed on the 19th of March 2015) for mammals. The *Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland* (Minter *et al.* 2004) for amphibians as well as SAFAP's FrogMap (http://vmus.adu.org.za) The *Field Guide to the Snakes and other Reptiles of Southern Africa* (Branch 2001) and *South African Red Data Book-Reptiles and Amphibians* (Branch 1988) as well as SARCA's ReptileMAP (http://sarca.adu.org.za) accessed on the 19th of March 2015) for reptiles.

Site Investigation Methodology

A preliminary assessment of the status, spatial requirements and habitat preferences of all priority species likely to occur on the site was done. For certain species, an estimate of the expected or historical distribution for the area could be extrapolated from published information and unpublished reports, while habitat and spatial requirements were generally derived from the literature

A survey of the proposed development areas was carried out by driving around the site by car and closer inspection of the actual site carried out on foot during daylight hours. A single night nocturnal survey (18h00-22h00) was undertaken on the 22nd of March 2015.

RESULTS

VEGETATION UNITS

Three distinct vegetation units could be identified and are indicated in Figure 4 namely:

1. *Tarchonanthus camphoratus* shrubland
2. *Vachellia karroo* riverine woodland
3. *Senegalia mellifera open shrubland*

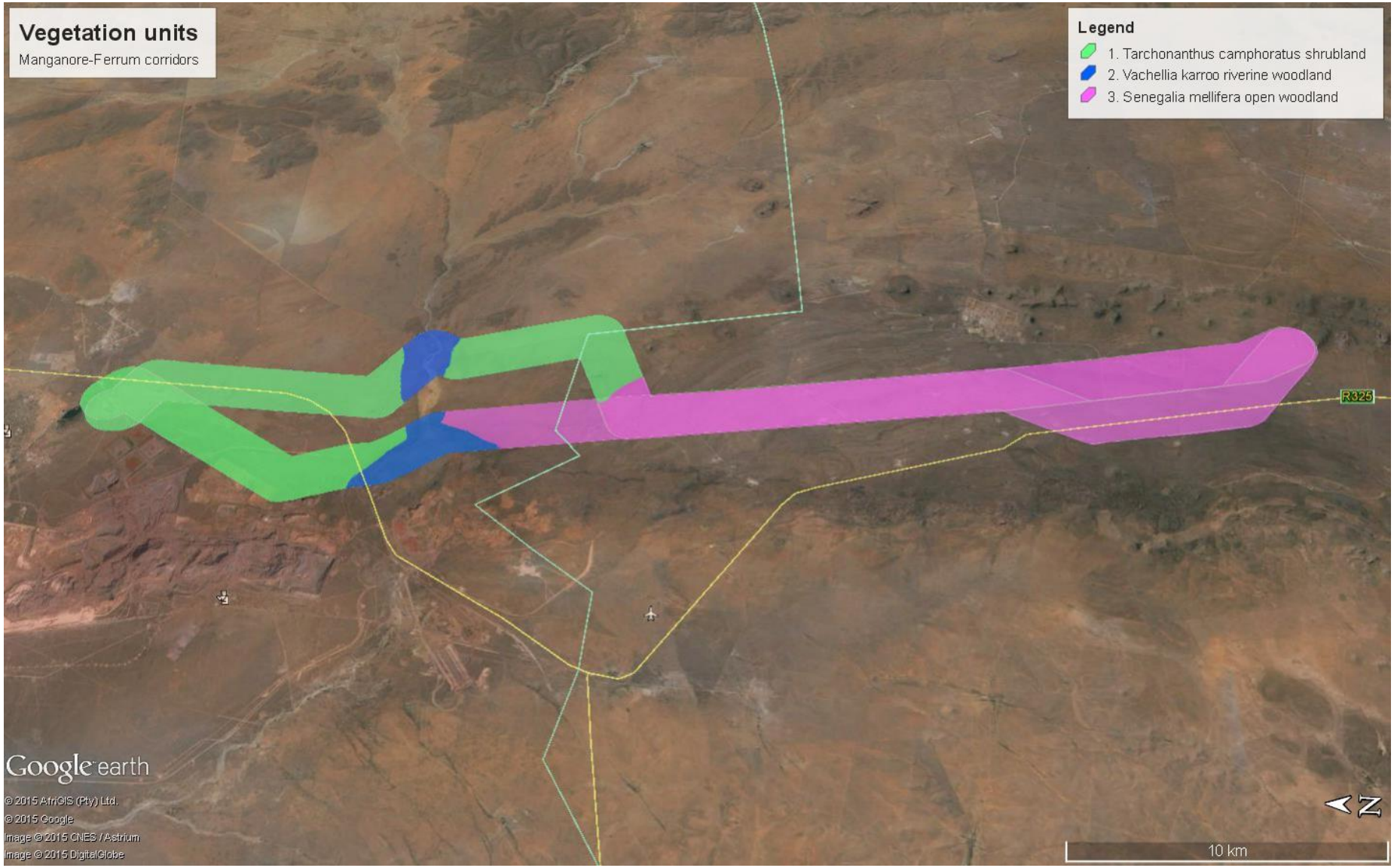


Figure 4. Vegetation units of the proposed study routes (Source: Google earth 2015)

1. *Tarchonanthus camphoratus* shrubland

Soil	Red sandy soil 0.2-0.6m deep	**Tree cover**	2%
Topography	Floodplain (4)	**Shrub cover**	25%
Land use	Mining, livestock and free moving game	**Herb cover**	3%
Unit status	Natural to degraded	**Grass cover**	60%
Faunal spp.	Birds, insects, small mammals, domestic animals	**Rock cover**	0%
		Erosion	0%

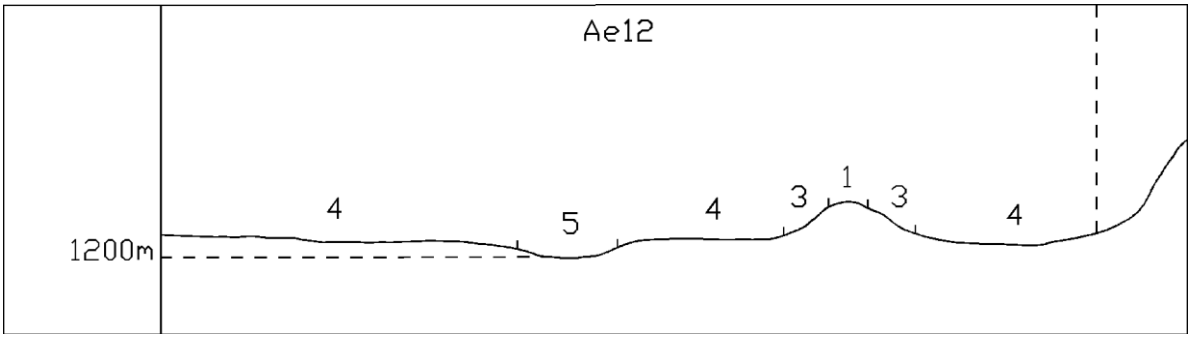
Dominant spp.	*Tarchonanthus camphoratus, Senegalia mellifera, Schmidtia pappophoroides, Stipagrostis uniplumis; Eragrostis lehmanniana*.

Conservation value	**Low-medium**	**Ecosystem functioning**	**Low-medium**

The *Tarchonanthus camphoratus* shrubland occurs on wide plains that are strongly associated with the Aeolian red sand and surface calcrete. The shrub *Tarchonanthus camphoratus* dominates the woody layer while the tree *Senegalia mellifera* is prominent. The grass *Schmidtia pappophoroides* dominates the herbaceous layer with the grasses *eragrostis lehmanniana* and *Stipagrostis uniplumis* prominent. This shrubland woodland occurs along the western part of the proposed corridors on flat to slightly undulating terrain. The most common land –uses are cattle and other

livestock farming, which have resulted in some areas being overgrazed. It seems as though large areas of the woody layer was sprayed with herbicides some years ago

The topography varies from flat to slightly undulating floodplains (4). The well-drained, red brown soil (clay-content 4-8%) of this community varies in depth from shallow to deep (0.3 > 1.2 m). The dominant rock-soil complex of this Ae12 land type shrubland is the Hutton soil forms.



Ae 12 land type terrain form sketch (Land Type Survey Staff 1987)

Geology: Red to flesh-coloured wind-blown sand with outcrops of shale, flagstone, quartzite and conglomerate (Gamagara Formation).

Dominant terrain unit: Floodplain (4) with the Hutton soil form dominant. Soil texture fine / medium sand with clay content between 4 to 8%. The red apedal B21 horison is well drained and the soil depth is between 0.3 to deeper than 1.2 m.

In summary the important features for this vegetation unit are as follows:

The woody layer is dominated by shrubs that cover 25% of the area with single individuals of larger tree species such as *Vachellia erioloba* present in low numbers scattered throughout the area. The trees cover approximately 2% of the area. Woody species present in this unit include *Grewia flava,*

Searsia silliata, Ziziphus mucronata, Gymnosporia buxifolia, Plinthus sericeus, Asparagus suaveolens, and *Ehretia rigida*. The grass layer is well-developed and covers 60% of the area, though bare soil patches are present between the large grass tufts due mainly to heavy grazing (see photo below). Other grass species present include *Aristida meridionalis, Cymbopogon pospischili, Aristida diffusa, Heteropogon contortus, Aristida congesta* subsp. *congesta, Melinis repens* and *Pogonarthria squarrosa.* The forbs cover between 1 and 3% and include *Tribulus terrestris, Tephrosia semiglabra, Hypertelis salsoloides, Hermannia tomentosa, Elephanthorrhiza elephantina, Rhynchosia totta, Sesamum triphyllum, Talinum caffrum, Hermannia comosa, Dicoma anomala, Pentzia incana, Lightfootia nodosa, Pollichia campestris, Kyllinga alba, Lotononis* spp, *Kohautia* spp., and *Rhynchosia nervosa.*

In some areas the highly invasive cactus *Cylindropuntia inbricata* was observed. This vegetation unit occurs widely throughout the region.

Red data species

One protected and red data species the tree *Vachellia erioloba* was found within this shrubland.

In the broader context of the landscape the proposed power line will impact on the Kuruman Thornveld (SVk9) and Kathu Bushveld (SVk12) vegetation types. Although none of these vegetation types are statutorily conserved they are regarded as least threatened vegetation systems with little erosion (Mucina & Rutherford 2006). The area is and arid area with summer rainfall that varies between 220-380mm mm per year. Frost occurs frequently in winter.

2. *Vachellia karroo* riverine woodland

Soil	Red-brown apedal (Hutton soil form) soil, clay content of 4 to 8%.	**Tree cover**	2%
Topography	Floodplain	**Shrub cover**	10-15%
Land use	Mining & grazing	**Herb cover**	5%
Unit status	Natural to degraded	**Grass cover**	70%
Faunal spp.	Birds, insects	**Rock cover**	10%
		Erosion	10%

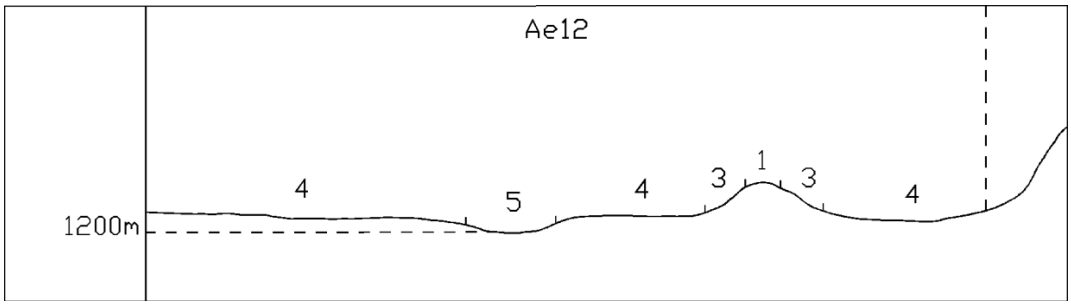
Dominant spp.	Tree *Vachellia karroo* and the grasses *Cymbopogon caesius* and *Cyndodn dactylon*

Conservation value	**Medium-High**	**Ecosystem functioning**	**Medium-high**

The The *Vachellia karroo* riverine woodland is located in the plains between and forms part of the mountain savanna in the area. The tree *Vachellia karroo* and the grasses *Cymbopogon caesius* and *Cynodon dactylon* dominate the vegetation while the tree *Vachellia erioloba,* the shrub *Diospyros lycioides* and the grasses *Cencrus cilliaris* and *Melinis repens* are prominent throughout this unit. This unit occurs in the central to western section of the proposed corridors. The vegetation is dense with many of the larger woody species killed by iron dust from the mines around the area.

The most common land –uses are mining and grazing. Sections within this unit are totally degraded due to mining activities and agricultural practices.

The topography varies from flat to slightly undulating plains with dry naam? River (5) running through it. The well-drained, soil (clay-content 4 to 8%) of this community varies in depth from shallow to deep (0.3 to > 1.2 m). The dominant rock-soil complex of this Ae 12 land type woodland is the Hutton soil form.



Ae 12 land type terrain form sketch (Land Type Survey Staff 1987)

Geology: Red to flesh-coloured wind-blown sand with outcrops of shale, flagstone, quartzite and conglomerate (Gamagara Formation).

Dominant terrain unit: River (5) with the Hutton soil form dominant. Soil texture fine / medium sand with clay content between 4 to 8%. The red apedal B21 horison is well drained and the soil depth is between 0.3 to deeper than 1.2 m.

In summary the important features for this woodland are as follows:

The woody layer forms dense nearly impenetrable clumps in some areas with the shrub layer being dominant covering between 10-15% of the area. Common woody species present include *Vachellia erioloba, Ziziphus mucronata, Tarchonanthus camphoratus, Senegalia mellifera, Gymnosporia buxifolia, Diospyros lycioides, Lycium hirta, Searsia lancea* and the alien invasive *Prosopis glandulosa.* The herbaceous layer is dominated by the grasses covering up to 70% of the area while the forb layer covers 5%. Common grass species include *Cenchrus cilliaris, Schmidtia pappophoroides, Aristida congesta* subsp. *congesta, Stipagrostis uniplumis, Eragrostis echinochloidea,* and *melinis repens.* Prominent forbs include

Aptosimum albomarginatum, Sutherlandia frutescens, Geigeria ornativa, Conyza pyramidalis, Chenopodium album, Salvia spp. and *Nidorella hottentotica.*

Alien invasive species include the tree *Prosopis glandulosa,* the cactus *Cylindropuntia imbricata,* the grass *Pennisetum setaceum* and the forb *Argemone Mexicana.*

Red data species

The protected and red data tree *Vachellia erioloba* was found within this riverine woodland.

In the broader context of the landscape the proposed power line will impact on the Kuruman Mountain Bushveld (SVk10). Although none of this vegetation type is statutorily conserved it is regarded as a least threatened vegetation system with little erosion (Mucina & Rutherford 2006). The area mainly has summer and autumn rainfall ranging between 200-500 mm per annum.

3. *Senegalia mellifera* shrubland

Soil	Rocky with shallow soil (0.1 – 0.3m) with clay content 6- 12%.	**Tree cover**	0%
Topography	Plains (4)	**Shrub cover**	1%
Land use	Livestock and free moving game	**Herb cover**	20%
Unit status	Natural to degraded	**Grass cover**	55%
Faunal spp	Various birds & insects	**Rock cover**	30%
		Erosion	20%

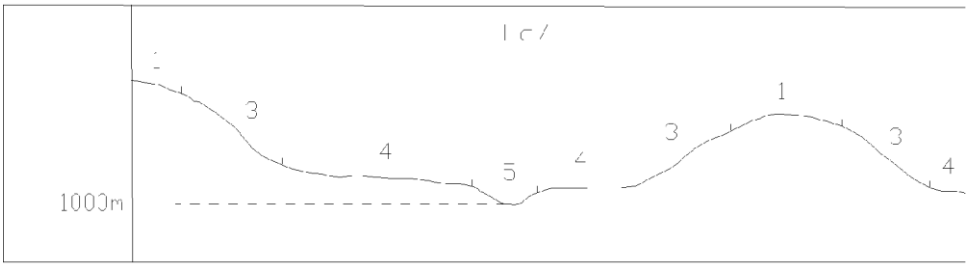
Dominant spp	*Senegalia mellifera*, *Searsia ciliata*, *Tarchonanthus camphoratus, Heteropogon contortus*

Conservation value	**Low-medium**	**Ecosystem functioning**	**Low-medium**

The *Senegalia mellifera* shrubland is associated with plains. The dominant and prominent woody plant species is the shrub *Senegalia mellifera* with *Tarchonanthus camphoratus* prominent. This closed shrubland comprises the largest part of the proposed corridors. The most common land–uses are game and goat farming, which have resulted in some areas being overgrazed.

The shrubland is closely associated with shallow (0.1 – 0.3m depth) soil with surface limestone as well as interbedded siltstone and in some isolated places shale,

quartzite and conglomerate. The habitat of this shrubland consists of well drained rocky soil (clay-content between 6 - 12%). The shrubland is situated in the Fc 7 land type with the rock-soil complex being dominated by rock and Mispah soil form.



Fc 7 land type terrain form sketch (Land Type Survey Staff 1987)

Geology: Oolitic, stromatolitic and algal limestone with interbedded siltstone (Schmidtsdrif Formation, Campbell Group), shale, quartzite, grit and conglomerate (Vryburg Formation, Campbell Group) and surface limestone of Tertiary to Recent age.

Dominant terrain unit: Midslope (3) with the rock-soil complex dominated by rock and Mispah soil form. Soil texture fine / medium sand with clay content between 6 to 12%. The soil is well drained and the soil depth is between 0.1 to 0.3m.

In summary the important features for this vegetation unit are as follows:

Sparse distributed tree species (*Vachellia tortilis* and *Ziziphus mucronata*) with a low canopy cover of 1% has been recorded. The well-developed shrub stratum has a canopy cover of 20%. Other shrubs recorded are *Gymnosporia buxifolia* and *Ziziphus mucronata*. The herbaceous layer has a canopy cover of 75% and is dominated by the grass species *Enneapogon cenchroides*, *Schmidtia pappophoroides*, *Eragrostis lehmanniana*, *Cymbopogon pospischili, Heteropogon contortus*, and *Aristida congesta Eragrostis echinochloidea*. The forbs *Geigeria ornitiva*, *Tribulus zeyheri*, *Chrysocoma ciliata*, *Hermannia comosa, Sesamum triphyllum* were recorded in the shrubland.

An exotic plant species *Opuntia ficus-indica* is also recorded.

Red data species

No rare or endangered plant species were recorded.

In the broader context of the landscape the proposed power lines impact on the Kuruman Thornveld (SVk9). The conservation value of this vegetation type is least threatened and none has been statutorily conserved (Mucina & Rutherford 2006).

FAUNA

No comprehensive faunal surveys were conducted and species lists provided in the Appendix are of species most likely to occur on the site compiled from species observed during the brief field survey and supplemented from previous surveys conducted in the Kathu area as well as published literature.

Three general habitat sensitivity scans were carried out from the 22nd -24th of March 2015. These site visits did not entail intensive surveying or utilisation of any sampling methods and can rather be viewed as being an opportunity to identify sensitive faunal habitats along the proposed Manganore-Ferrum power line alignments.

All animals (mammals (larger), reptiles and amphibians) seen or heard; were recorded. Use was also made of indirect evidence such as animal tracks (footprints, droppings) to identify animals. The data was supplemented by previous surveys conducted in similar habitats, literature investigations, personal records and historic data. Different habitats were explored to identify any sensitive or specialized species. Habitats explored included the *Tarchonanthus camphoratus* shrubland, *Vachellia karroo* riverine woodland, *Senegalia mellifera open* shrubland in various forms of transformation and degradation (overgrazing, frequent fires, alien vegetation invasion), loosely embedded rock material, rocky hills/outcrops, Rivers (Ga-Mogara) and associated riparian zones, stumps, moribund termite mounds, abandoned animal burrows, trees and under lose bark material.

Mammals

No small mammal trappings were conducted due to time constraints and the limitations that the results from single night or brief field surveys would pose. The brief fieldwork was augmented with previous surveys in similar habitats as well as published data. Mammal species recorded within the study area as well as those that may occur within the study area, on the basis of available distribution records and known habitat requirements are included in the Table below. The majority of larger mammal species are likely to have been eradicated or have moved away from the area, as a result of previous agricultural activities, hunting and poaching as well as severe habitat alteration and degradation. The settlements surrounding the site as well as several informal settlements and associated hunting and poaching limits the suitability of the site for larger mammal species. High levels of hunting were noted on

and surrounding the site with the use of dogs and wire snares as well as several empty shotgun cartridges. Several dog tracks were observed along the existing Eskom servitudes as well as hunting with dogs was observed during the site visit. The collection or harvesting of wood (stumps) and rock material as well as the frequent burning of the vegetation reduces available refuge habitat an exposes remaining smaller terrestrial mammals to increased predation levels. The use of wire snares for high intensity poaching activities will significantly affect remaining smaller mammal species such as rabbits and mongooses. Secondary access roads and vehicles (motor cars, motor cycles, quad bikes) which transverse the area and bisect the valley bottom wetlands increase access to the site as well as potential road fatalities. Major road networks (N14) with high vehicular traffic increase the risk of road fatalities (hedgehogs, hares) of mammals. Smaller mammal species including the South African Hedgehog are extremely vulnerable to feral cats and dogs.

The Yellow and Slender Mongooses and Meerkat/Suricates were observed on the site and prey on the smaller rodents, birds, reptiles and amphibians on the site. Animal burrows (Yellow Mongooses, Ground Squirrel, Suricate, Highveld Gerbil, Multimmamate Mouse and African Molerat) were observed around the sandy sections of the grasslands. Several active Antbear burrow systems were observed within the foothills. Small isolated patches of rocky outcrops are present in some localities and offer suitable habitat for rupicolous mammal species such as Rock Hyrax, Smith's Elephant Shrew, Bushveld Elephant Shrew, Dassie Rat, Smith's Rock Rabbit and Rock Dormouse. Several Chacma Baboons (*Papio ursinus*) were observed. Several rodent burrows (most likely Bushveld Gerbils) were observed within the sandy sections of the alignments.

Various mammal species are likely to occur within the study area. A probable mammal species list of mammals that are likely to occur in study area according to Skinner & (Chimimba 2006) with the assigned level of threat facing each particular species is included as APPENDIX 1. A map was used to correlate the occurrence of the Red Data species with their approximate occurrence within the study area. According to Friedman & Daly (2004) and Skinner & Chimimba (2006), the majority of species within the study area are common and widespread and listed as species of least concern.

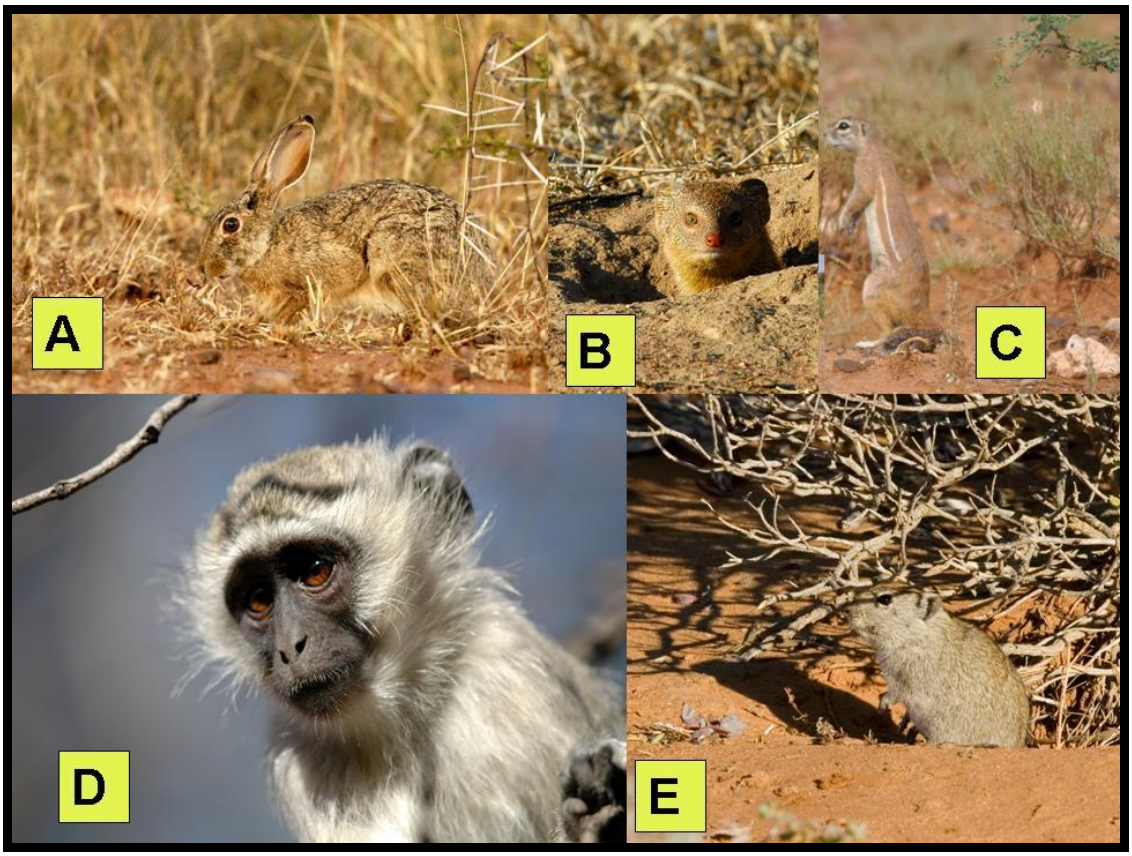


Figure 5. **A conglomerate of photographs displaying mammals species observed adjacent to the proposed alignment. A:** Srub Hare (*Lepus saxatilis*: Yellow Mongoose (*Cynictis penicillata*); **C:** Ground Squirrel (*Xerus inauris*); **D:** Vervet Monkey (*Cercopithecus aethiops*) and **E:** Brant's Whisling Rat (*Paratomys brantsii*).

The majority of larger mammal species are likely to have been eradicated or have moved away from the area, as a result of habitat alteration and degradation as well as illegal hunting and poaching. The collection or harvesting of wood (*Acacia* stumps) and rock material as well as the frequent burning of the grassland and dwarf shrubland vegetation reduces available refuge habitat an exposes remaining smaller terrestrial mammals to increased predation levels. The area is currently utilised for livestock grazing activities. The baiting and non-selective killing of predators has a negative impact on remaining populations. The use of wire snares as well as hunting dogs for high intensity poaching activities will significantly affect remaining mammal species such as rabbits and mongooses. Smaller mammal species are extremely vulnerable to snares and poaching activities as well as feral cats and dogs. Furthermore, sheep grazing observed within the study area influences the existence of small mammals in the area.

According to Bergstrom (2004), the presence of livestock has a negative effect on both small mammal species richness and abundance. Secondary access roads and vehicles around the site as well as major road networks increase the risk of road fatalities. Evidence and observations of the following mammals species were observed during the brief site visit. Yellow mongoose (*Cynictis penicillata*), Cape hares (*Lepus capensis*), Scrub Hare (*Lepus saxatilis*) and South African ground squirrels (*Xerus inauris*) as well as larger burrowing mammals such as Aardvark (*Orycteropus afer*), Porcupines (*Hysterix africaeaustralis*) and Bat eared foxes (*Octocyon megalotis*). Several Blesbok (*Damaliscus pygargus phillipsi*) were observed adjacent to the powerline alignment.

Several mammal species have been downgraded since the conservation assessment undertaken by Friedman & Daly, (2004). Species downgraded to Least Concern included Honey Badger (*Mellivora capensis*), Geoffrey's Horeshoe Bat (*Rhinolophus clivosus*) and the Littledale's Whistling Rat (*Parotomys littledalei*) which were previously listed as Near Threatened.

According to Skinner and Chimimba (2005), the study area falls within the distribution ranges of 3 species which are placed into one of known threatened species (Critically Endangered, Endangered and Vulnerable). The three species are Shreiber's Long-Fingered Bat (*Miniopterus schreibersii*), Dent's Horeshoe Bat (*Rhinolophus denti*) and South African Hedgehog (*Atelerix frontalis*).

Table 2. Mammal species recorded from combined locus = 2823AA, 2823DA, 2723DB, 2723CA and of conservation importance possibly occurring on the proposed site (using habitat availability and distribution as an indicator of presence).

Family	Genus	Species	Subspecies	Common name	Red list category
Canidae	*Canis*	*mesomelas*		Black-backed Jackal	Least Concern
Erinaceidae	***Atelerix***	***frontalis***		**Southern African Hedgehog**	**Near Threatened**
Hystricidae	*Hystrix*	*africaeaustralis*		Cape Porcupine	Least Concern
Leporidae	*Lepus*	*capensis*		Cape Hare	Least Concern
Leporidae	*Lepus*	*saxatilis*		Scrub Hare	Least Concern
Leporidae	*Pronolagus*	*rupestris*		Smith's Red Rock Hare	Least Concern

Macroscelididae	*Elephantulus*	*myurus*		Eastern Rock Elephant Shrew	Least Concern
Macroscelididae	*Elephantulus*	*rupestris*		Western Rock Elephant Shrew	Least Concern
Muridae	*Aethomys*	*namaquensis*		Namaqua Rock Mouse	Least Concern
Muridae	*Gerbilliscus*	*leucogaster*		Bushveld Gerbil	Data Deficient
Nesomyidae	*Saccostomus*	*campestris*		Southern African Pouched Mouse	Least Concern
Nycteridae	*Nycteris*	*thebaica*		Egyptian Slit-faced Bat	Least Concern
Pedetidae	*Pedetes*	*capensis*		South African Spring Hare	Least Concern
Procaviidae	*Procavia*	*capensis*		Rock Hyrax	Least Concern
Rhinolophidae	*Rhinolophus*	*clivosus*		Geoffroy's Horseshoe Bat	Near Threatened
Rhinolophidae	*Rhinolophus*	*damarensis*			Not listed
Rhinolophidae	***Rhinolophus***	***denti***		**Dent's Horseshoe Bat**	**Near Threatened**
Sciuridae	*Xerus*	*inauris*		South African Ground Squirrel	Least Concern
Vespertilionidae	***Miniopterus***	***schreibersii***		**Schreibers's Long-fingered Bat**	**Near Threatened**
Vespertilionidae	*Miniopterus*	*schreibersii*	*natalensis*	Schreibers's Long-fingered Bat	Not listed
Vespertilionidae	*Neoromicia*	*capensis*		Cape Serotine	Least Concern

Threatened Mammal Species

Various mammal species are likely to occur within the study area. A probable mammal species list of mammals that are likely to occur in study area according to Skinner & (Chimimba 2006) with the assigned level of threat facing each particular species is included as APPENDIX 1. A map was used to correlate the occurrence of the Red Data species with their approximate occurrence within the study area. According to Friedman & Daly (2004) and Skinner & Chimimba (2006), the majority of species within the study area are common and widespread and listed as species of least concern. Several mammal species have been downgraded since the conservation assessment undertaken by Friedman & Daly, (2004). Species downgraded to Least Concern including Black-footed Cat (*Felix nigriceps*), Dassie Rat (*Petromus typicus*) and Honey Badger (*Mellivora* capensis) which were previously listed as 'Near Threatened'. No major cave systems were observed

adjacent to the proposed alignments for Dent's Horseshoe Bat and Schreibers Long-fingered Bat. No nocturnal bat surveys were undertaken during the survey. '

Figure 6. The South African Hedgehog has declined in the Kathu area due to habitat transformation from mining activities, road fatalities on the N14, illegal pet trade as well as been killed by dogs.

South African Hedgehog *Atelerix frontalis* (A.Smith, 1831)

Distribution (Southern African Sub-region)

They occur in Namibia, Botswana, Zimbabwe, Lesotho and South Africa. The South African distribution includes the Gauteng, Free State, Limpopo, Northern and Cape Provinces (Skinner and Smithers, 1991).

Habitat

Hedgehogs occur in such a wide variety of habitats that it is difficult to assess its habitat requirements. The one factor that is common to all the habitats in which they occur is dry cover, which they require for resting places and breeding purposes. Habitat must provide a plentiful supply of insects and other foods. Suburban gardens provide these requirements and this may explain their occurrence in this type of habitat. Hedgehogs are predominantly nocturnal, becoming active after sundown,

although, after light rains at the commencement of the wet season, they may be active during daylight hours (Skinner and Smithers, 1991).

Food

Hedgehogs are omnivorous feeding predominantly on invertebrates such as beetles, termites, centipedes, millipedes, moths and earthworms. They will take small mice, lizards and the eggs and chicks of ground-living birds as well as frogs, slugs and some vegetable matter, including fungi (Skinner and Smithers, 1991).

Reproduction

Seasonal breeders, with young being born during the warm, wet summer months from October to March (Skinner and Smithers, 1991).

It is highly unlikely that the proposed Boundary-Ulco powerline alignments provide critical habitat for any of the above-mentioned threatened mammal species.

MAMMAL MANAGEMENT RECOMMENDATION*S*

- Due habitat transformation and destruction as well as the high level of human activity within the proposed it is however unlikely that the study area comprises significant habitat for any larger threatened mammal species. These are restricted to the private game parks in the area.
- All large indigenous tree species should be conserved wherever possible as they form important habitat for arboreal mammal species.
- Activities should be restricted away from any rocky hills and outcrops as well as riparian habitats along the non-perennial drainage lines.
- The conservation and correct management of the Ga-Mogara River's riparian habitats along the proposed servitudes should ensure the conservation of all remaining suitable habitat for wetland/riverine associated mammals on the site (Cape Clawless Otter).
- No hunting or poaching activities must be allowed along the servitudes during all phase of the project.

REPTILES

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe even during intensive field surveys

conducted over several seasons. The majority reptile species are sensitive to severe habitat alteration and fragmentation. Due to current agricultural activities in the area coupled with increased habitat degradation (overgrazing, soil erosion) and disturbances are all causal factors in the alteration of reptile species occurring in these areas. Limited low-lying rock youtcrops occur around the proposed alignments and provide favourable refuges for certain snake and lizard species (rupicolous species). Reptile species recorded within the rocky outcrops included Yellow-Throated Plated Lizard (*Gerrhosaurus flavigularis*), Montane Speckled Skink (*Trachylepis* (*Mabuya*) *punctatissima*), Variegated Skink (*Trachylepis variegata*), Variegated Skink (*Trachylepis variegata*), Western Three-striped Skink (*Trachylepis occidentalis*), Western Rock Skink (*Trachylepis sulcata sulcata*), Southern Rock Agama (*Agama atra*) and Ground Agama (*Agama aculeata*).

Moribund (old abandoned or dead mounds) termite mounds offer important refuges for numerous frog, lizard and snake species (Striped Harlequin Snake). Large number of species of mammal, birds, reptiles and amphibians feed on the emerging alates (winged termites). These mass emergences coincide with the first heavy summer rains and the emergence of the majority of herpetofauna. Termite mounds also provide nesting site for numerous snakes, lizards (varanids) and frogs. Favourable habitat exists throughout most of the study area for various snake species. Indiscriminate killing of all snake species is likely to have resulted in the disappearance of the larger and the more sluggish snake species within the study area. The frequent burning of the site will have a high impact on remaining reptiles. Fires during the winter months will severely impact on reptiles under brumation which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

Figure 7. **A collage of photographs displaying the dominant rupicolous reptile species observed. A, B, & C:** Several breeding male and female Southern Rock Agamas (Agama atra) were observed within the rocky outcrops as well as the **D:** Western Rock Skink (*Trachylepis sulcata sulcata*),

A probable reptile species lists according to habitat and distribution records of Branch (1998a) is presented in APPENDIX 2.

Table 3. Reptiles species recorded during the South African Reptile Conservation Assessment (SARCA) from the combined locus = 2823 AA, 2823 DA, 2723 DB, 2723 CA.

Family	Genus	Species	Subspecies	Common name	Red list category
Agamidae	**Agama*	*aculeata*	*aculeata*	Common Ground Agama	Least Concern (SARCA 2014)
Agamidae	**Agama*	*atra*		Southern Rock Agama	Least Concern (SARCA 2014)
Atractaspididae	*Atractaspis*	*bibronii*		Bibron's Stiletto Snake	Least Concern (SARCA 2014)
Chamaeleonidae	**Chamaeleo*	*dilepis*	*dilepis*	Common Flap-neck Chameleon	Least Concern (SARCA 2014)
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Least Concern (SARCA 2014)
Colubridae	*Dasypeltis*	*scabra*		Rhombic Egg-	Least Concern

				eater	(SARCA 2014)
Colubridae	*Dispholidus*	*typus*	*typus*	Boomslang	Least Concern (SARCA 2014)
Colubridae	*Lycophidion*	*capense*	*capense*	Cape Wolf Snake	Least Concern (SARCA 2014)
Colubridae	*Psammophis*	*brevirostris*		Short-snouted Grass Snake	Least Concern (SARCA 2014)
Colubridae	*Psammophis*	*trinasalis*		Fork-marked Sand Snake	Least Concern (SARCA 2014)
Colubridae	*Telescopus*	*semiannulatus*	*semiannulatus*	Eastern Tiger Snake	Least Concern (SARCA 2014)
Elapidae	*Naja*	*nivea*		Cape Cobra	Least Concern (SARCA 2014)
Gekkonidae	**Ptenopus*	*garrulus*	*garrulus*	Common Barking Gecko	Least Concern (SARCA 2014)
Lacertidae	**Nucras*	*intertexta*		Spotted Sandveld Lizard	Least Concern (SARCA 2014)
Lacertidae	**Pedioplanis*	*lineoocellata*	*lineoocellata*	Spotted Sand Lizard	Least Concern (SARCA 2014)
Scincidae	**Trachylepis*	*variegata*		Variegated Skink	Least Concern (SARCA 2014)
Testudinidae	*Psammobates*	*oculifer*		Serrated Tent Tortoise	Least Concern (SARCA 2014)
Testudinidae	**Stigmochelys*	*pardalis*		Leopard Tortoise	Least Concern (SARCA 2014)
Varanidae	**Varanus*	*albigularis*	*albigularis*	Rock Monitor	Least Concern (SARCA 2014)
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern (SARCA 2014)

*observed during current and previous surveys in the Kathu area.

No threatened reptile species have been recorded from the combined locus = 2823 AA, 2823 DA, 2723 DB, 2723 CA. Four endemic reptile species namely Distant's Ground Agama (*Agama aculeate distanti*), the Marico Gecko (*Pachydactylus mariquensis*), Thin-tailed Legless Skink (*Acontias gracilicauda*) and Greater Padloper (*Homopus femoralis*) have been recorded in the adjacent grid squares. The Southern African Python (*Python natalensis*), Water Monitor (*Varanus niloticus*) and Rock or White-throated Monitors (*Varanus albigularis*) are protected species.

REPTILE MANAGEMENT RECOMMENDATIONS

- No rock removal should occur adjacent to the proposed towers. No termite mounds should be intentionally destroyed. If any moribund termite mounds have to be destroyed due to tower position it should be carefully excavated by hand and pick.

- Any animals rescued or recovered will be relocated in suitable habitat away from the transmission tower and line.
- Trees including stumps; bark and holes in trees are vital habitats for numerous arboreal reptiles (chameleons, snakes, agamas, geckos and monitors).
- The removal of indigenous tree species (*Vachelia erioloba*) as well as clearance of the riparian vegetation along the Ga-Mogara River must be kept to the minimum area required wherever possible.
- Exotic cleared vegetation should form wood piles and logs and stumps. Dead or decaying wood piles should be created as these will provide valuable refuge areas especially due to the clearance of vegetation cover. Logs and stumps also provide important habitats for several reptile species as well as smaller mammals, amphibians, arachnids and scorpions. With time they will eventually be reduced to valuable compost by several animal species. Dead trees and stumps will also be used for nesting purposes by barbets, hoopoes, owls, hornbills as well as perching or hunting platforms for birds like the kingfisher. Any lizards, gecko's, agamids, monitors or snakes encountered should be allowed to escape to suitable habitat away from the disturbance. No reptile should be intentionally killed, caught or collected during any phase of the project.
- Several venomous snake species occur along the proposed lines including Cape Cobra (*Naja nivea*) and Puff Adder (*Bitis arietans*).
- General avoidance of snakes if the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area.
- Appropriate foot wear (sturdy leather boots) should be worn in the field.

AMPHIBIANS

Conservation efforts to protect the planet's vertebrate diversity have been disproportionate for the various groups and have tended to favour mammals and birds. The so-called 'lower vertebrates' such as fish, amphibians and reptiles; generally have a lower public appeal and are typically neglected in conservation programmes, yet these groups are of fundamental importance at an ecosystem level.

Amphibians are an important component of South Africa's exceptional biodiversity (Siegfried 1989) and are such worthy of both research and conservation effort. This is made additionally relevant by international concern over globally declining amphibian populations, a phenomenon currently undergoing intensive investigation but as yet is poorly understood (Wyman 1990; Wake 1991). Amphibians have

declined dramatically in many areas of the world. These declines seem to have worsened over the past 25 years and amphibians are now more threatened than either mammals or birds, though comparisons with other taxa are confounded by a shortage of reliable data.

Most frogs have a biphasic life cycle, where eggs laid in water develop into tadpoles and these live in the water until they metamorphose into juvenile fogs living on the land. This fact, coupled with being covered by a semi-permeable skin makes frogs particularly vulnerable to pollutants and other environmental stresses. Consequently frogs are useful environmental bio-monitors (bio-indicators) and may acts as an early warning system for the quality of the environment.

The biogeographical distribution of amphibians in the greater Kimberly area falls under the Central District. The Central District covers most of Lesotho, Free State and North West Province, together with northern parts of Northern Cape Province. In the west, the southern boundary follows the course of the Gariep River. In the east, the southern boundary lies in the ecotonal Grassy Karoo. In the northwest, the district ends where subtropical woodlands begin, and in the east the boundary follows the interface between sweet grasslands in the west and sour grasslands in the east. Amphibian species richness is generally low in the Central District and tends to decrease toward the west. Species counts just exceed 10 species per grid cell in the eastern extremes and are mostly <6 in the west. Species richness of endemics is <4 species per grid cell over the entire district, and no range-restricted species are present. This district is subdivided into two assemblages namely the Sweet Grasslands and Kalahari assemblages (Alexander *et al.* 2004).

Seven frog species were recorded from the seasonal and permanent (farm dams) wetland habitats around the proposed alignments including Raucous Toad (*Amietophrynus rangeri*), Drakensberg River Frog (*Amietia quecketii*), Cape River Frog (*Amietia fuscgicula*), Bubbling Kassina (*Kassina senegalensis*), Tremelo Sand Frog (Tomopterna cryptotis), Natal Sand Frog (*Tomopterna natalensis*) and Common Platanna (*Xenopus laevis*). All frog species recorded are common and widespread.

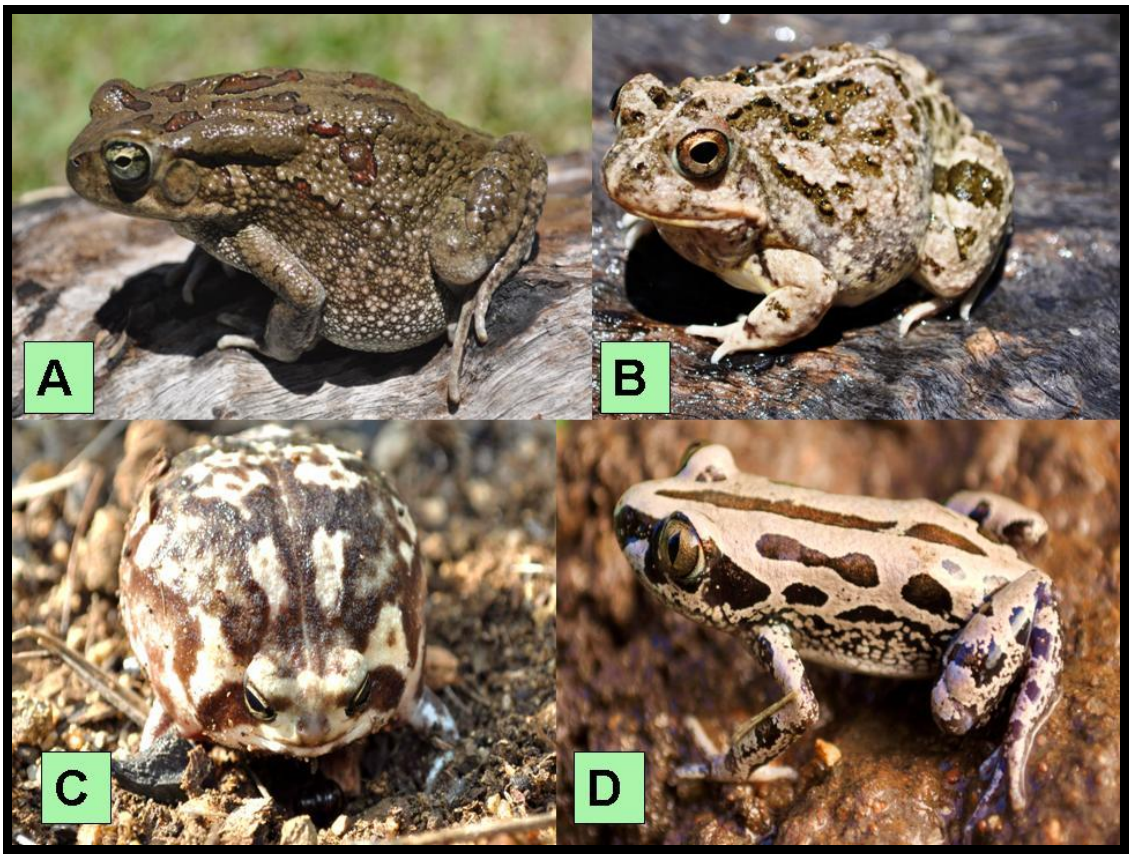


Figure 8. **A conglomerate of photographs displaying the frog species recorded during the current survey. A:** Eastern Olive Toad (*Amietophrynus garmani*) **B:** Tremelo Sand Frog (*Tomopterna cryptotis*); **C:** Bushveld Rain Frog (*Breviceps adspersus*) and **D:** Bubbling Kassina (*Kassina senegalensis*).

Table 4. Frog species recorded during the South African Frog Atlas Project (SAFAP) from the combined locus = 2823 AA, 2823 DA, 2723 DB, 2723 CA.

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Brevicepitidae	*Breviceps*	*adspersus*	Bushveld Rain Frog	Least Concern	No
Bufonidae	*Amietophrynus*	*garmani*	Olive Toad	Least Concern	No
Hyperoliidae	*Kassina*	*senegalensis*	Bubbling Kassina	Least Concern	No
Pyxicephalidae	*Amietia*	*quecketti*	Queckett's or Drakensberg River Frog	Least Concern	Yes
Pyxicephalidae	*Tomopterna*	*cryptotis*	Tremelo Sand Frog	Least Concern	No

Habitat available for sensitive or endangered species

Figure 9. No suitable breeding habitat for Giant Bullfdrogs (*Pyxicephalus adspersus*) was observed along the proposed Manganore-Ferrum powerline alignments.

Giant Bullfrog *(Pyxicephalus adspersus)*

The Giant Bullfrog is currently assigned as a near-threatened species (IUCN Red List category). No Giant Bullfrogs have been recorded from the Kathu- Manganore area and immediate adjacent grid squares during previous surveys as well as during the South African Frog Atlas Project (SAFAP).

AMPHIBIAN MANAGEMENT RECOMMENDATIONS

- Construction activities of the Manganore –Ferrum powerline should be restricted to daylight hours reducing the potential impact on the nocturnal breeding activities of the majority of amphibian species.
- Ideally the installation of the new towers should be undertaken during the dry winter months (May-September) when the majority of amphibian species are dormant.
- The towers must not be placed in any seasonal wetland habitats and should be positioned outside the temporary wet areas of the riparian zone of the Ga-Mogara River.

- As a precautionary mitigation measure it is recommended that the developer and construction contractor as well as an independent environmental control officer (ECO) should be made aware of the possible presence of certain threatened amphibian species (Giant Bullfrog) prior to the commencement of construction of the new line.

DISCUSSION

i. *ENVIRONMENT*

Threatened ecosystems & Protected areas

According to the SANBI data and locality maps no protected or threatened areas are present within the proposed corridors.

Vegetation types

On a small scale the proposed routes fall within the savanna biome and within a larger regional scale the proposed routes are according to Mucina & Rutherford (2006) located within the Eastern Kalahari Bushveld Bioregion (Svk) (Figure 10).

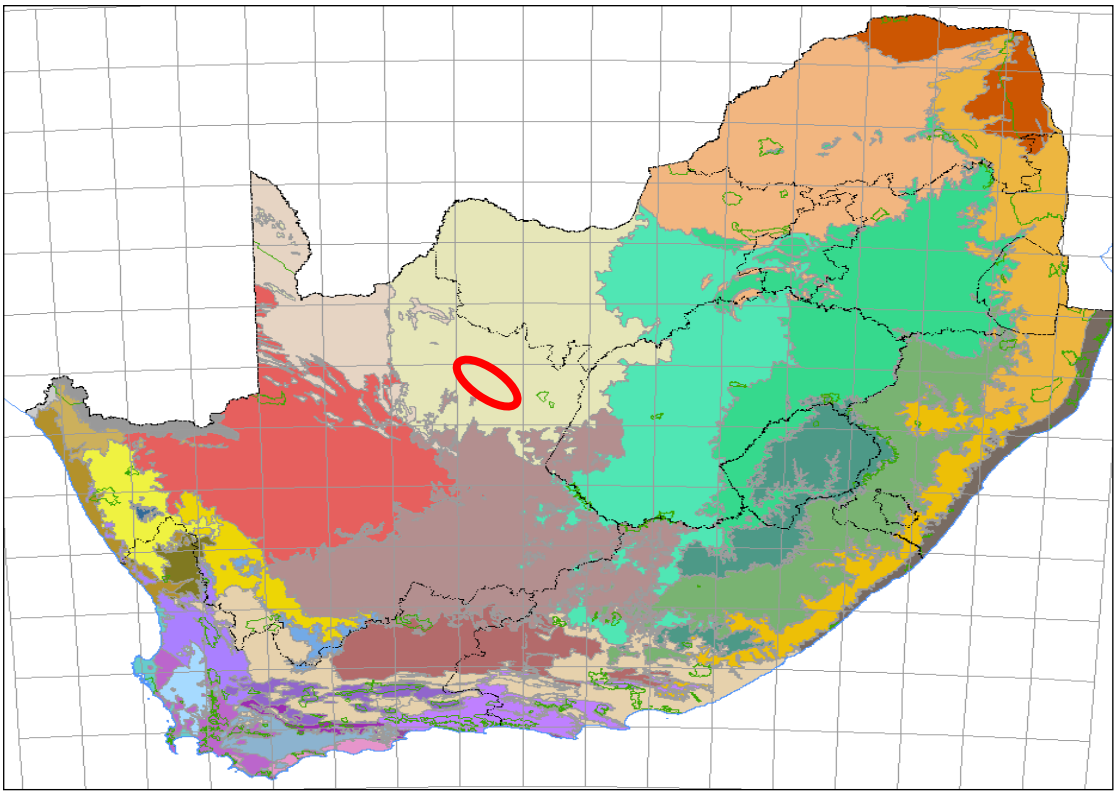


Figure 10. Different Bioregions of South Africa with red circle indicating the proposed routes located within the Eastern Kalahari Bushveld Bioregion (beige).

A Bioregion represents an intermediate level between a biome and a vegetation unit with each bioregion having specific biotic and physical features at a regional scale (Mucina & Rutherford 2006). Each Bioregion has a distinct climatic character that differs from other bioregions.

In terms of vegetation types the proposed routes include the Kuruman Thornveld (SVk9); Kuruman Mountain Bushveld (SVk10), Kathu Bushveld (SVk12) and Postmasburg Thornveld (SVk14) (Mucina & Rutherford 2006).

Kuruman Thornveld (SVk9)

The vegetation is characterised by an open to closed woody layer. The topography ranges from flat sandy (aeolian) plains (sometimes with rocky pavements) to rocky rolling hills with a dense woody layer. The vegetation is dominated by the woody species *Tarchonanthus camphoratus, Grewia flava, Lycium hirsutum, Vachellia erioloba,* the grasses *Eragrostis lehmanniana, Aristida stipitata* and *Aristida meridionalis.*

Important taxa: *Vachellia erioloba*, *V. haematoxylon, Blepharis marginata, Digitaria polyphylla* and *Corchorus pinnatipartitus*

Endemic taxon: *Gnaphalium englerianum*

Although none of this vegetation type is statutorily conserved it is regarded as a least threatened vegetation system with little erosion.

Kuruman Mountain Bushveld (SVk10)

The Kuruman Mountan Bushveld (SVk10) (Mucina & Rutherford 2006) comprises of rolling hills. These hills have ridges with moderate slope midslopes and relatively steep midslopes with different aspects (east / west). The vegetation is mostly open shrubveld with shallow (< 0.3 m), rocky soil of the Mispah soil form with rocky outcrops also dominant in the vegetation type. The vegetation is characterised by the dominance of the shrub *Searsia ciliata* with the grasses *Andropogon chinensis, Andropogon schirensis, Anthephora pubescens, Themeda triandra,* and *Triraphus andropogonoides* co-dominant. The protected geophyte *Boophone disticha* is also present within this vegetation type.

Important taxa: *Lebeckia macrantha, Tarchonanthus obovatus, Euphorbia wilmaniae, Sutera griquensis, Digitaria polyphylla.*

Endemic taxon: *Euphorbia planiceps*

Although none of this vegetation type is statutorily conserved it is regarded as a least threatened vegetation system with little erosion. This vegetation type is mostly used for grazing purposes with grazing evident in some areas.

The scattered low-lying rocky outcrops and hills form important habitat for rupicolous faunal species such as Elephant Shrews, Rock Hyrax, Southern Pygmy Toad as well as several reptile species and are considered as sensitive. The proposed towers should be positioned away from any major rocky outcrop.

Kathu Bushveld (SVk12)

The vegetation and landscape is characterised by red, deep (> 1.2 m), sandy texture, wind blown soil, with medium to tall height (> 3 m) trees dominant on relatively flat Kalahari savanna plains. The vegetation is dominated by the trees *Acacia erioloba, Acacia mellifera* and small tree *Boscia albitrunca.* The grass layer is dominated by the grasses *Schmidtia pappophoroides, Eragrostis lehmanniana, Stipagrostis ciliata* and *Brachiaria nigropedata*. Other prominent species include *Terminalia sericea, Diospyros lycioides, Grewia flava, Aristida congesta, Schmidtia kalahariensis, Gisekia africana, Limeum fenestratum, Heliotropium ciliatum* and *Hermbstaedtia fleckii.*

Important taxa: *Acacia luederitzii* var. *luederitzii, Anthephora argentea, Megaloprotachne albescens, Panicum kalaharense, Neuradopsis bechuanensis..*

Although none of this vegetation type is statutorily conserved it is regarded as a least threatened vegetation system with little erosion. Some sections are already transformed due to iron ore mining activities..

Postmasburg Thornveld (SVk14)

The area comprises flats surrounded by rocky ridges with open shrubby thornveld. The vegetation structure is mostly a dense shrub layer with sparse individual trees and a poorly develop herbaceous layer. The dominant species are *Acacia erioloba, Acacia karroo, Acacia tortilis, Diospyros lycioides, Ziziphus mucronata, Felicia muricata, Digitaria eriantha, Enneapogon scoparius, Eragrostis lehmanniana* and the geophyte *Boophane disticha*.

Important taxa: *Euphorbia bergii, Digitaria polyphylla.*

None of this vegetation type is statutorily conserved, but little is transformed and it is regarded as a least threatened vegetation system with little erosion.

Vegetation units

The study area comprises natural vegetation with mining, agricultural (cattle & other domestic stock) and game farming activities conducted on the land. The area comprises three different vegetation units all mostly natural in species composition and their conservation status is indicated on Figure 12.

The ***Tarchonanthus camphoratus*** **shrubland (Vegetation unit 1)** occurs within the western section of the proposed powerline corridors. The vegetation is natural although some degradation due to grazing is evident in some areas. The soil is deep red sandy with the vegetation covering up to 80% of the area. Due to the flat topography no soil erosion was observed. It seems as many of the taller trees such as *Senegalia mellifera* and some *Vachellia erioloba* trees were previously sprayed with herbicides to open up the woody layer for grazing purposes. This has most probably assisted in the shrub *Tarchonanthus camphoratus* becoming dominant. This shrub is known for its invasive nature in degraded or disturbed areas. This vegetation unit occurs over a large area in this region and is regarded as a common vegetation thype not threatened. Thus from a plant ecological end ecosystem functioning point of view this area has a **low-medium conservation value.**

The vegetation of the ***Vachellia karroo*** **riverine woodland (vegetation unit 2)** is typical of riverine areas. The vegetation is dense and dominated by the woody layer, while the grass layer is well-developed. Large individuals of the declining red data/protected tree *Vachellia erioloba* and other trees are unfortunately negatively affected by the red dust from the iron ore mining in the area (see photo right) This has resulted in the red dust settling on the leaves thereby negatively affecting the photosynthesis of the plants. Due to the low rainfall the dust is never washed off resulting in large numbers of the tree species dying within this stream/riverine area. That is most probably the reason for the shrub layer being dominant since it seems that the larger trees protect them against a large amount of dust. However as soon as these species become tall they are covered with the red dust and then slowly die. The area has a moderate species composition with a good

vegetation cover protecting the soil. Some erosion that naturally occur during high rainfall events are evident. This area due to its water channelling function has a **medium-high conservation value.**

The ***Senegalia mellifera* open shrubland (vegetation unit 3)** comprises the largest section of the proposed corridors. The vegetation has a moderate to low species richness but is degraded and dominated by the shrub *Senegalia mellifera.* The area is mostly used for grazing by animals. From a plant ecological and ecosystem functioning point of view this vegetation unit is regarded as having a **low-medium conservation value.**

Sensitivity analysis

A sensitivity analysis was done for the three vegetation units identified. This was achieved by evaluating the different vegetation units against a set of habitat criteria (Table 5). The results indicate that units 1 & 3 have **medium-low sensitivity** while unit 2 have a **medium sensitivity** (the upper medium score) to disturbance.

Table 5. Sensitivity analysis for the three vegetation units identified along the proposed power line routes (Single scores range between 1 and 10 (the higher the score the more important the criterion).

	Unit 1	Unit 2	Unit 3
Criteria	Tarchonanthus camphoratus shrubland	Vachellia karroo riverine woodland	Senegalia mellifera open shrubland
Presence of protected / red data species	9	9	4
Species richness and composition	5	6	5
Dominant/prominent species ecological status	3	7	7
Sensitivity to disturbance	3	7	4
Conservation status and ecological functioning	4	9	4
Area fragmentation	7	6	6
Medicinal plants	3	4	3
Important topographical features (steep slopes, cliffs etc.)	2	9	2
TOTAL SCORE	**45**	**71**	**44**
Sensitivity rating	**Low-medium**	**Medium**	**Low-medium**

Based on the conservation status and sensitivity analysis a sensitivity map for the proposed corridors were compiles and is indicated in Figure 11.

Figure 11. Ecological sensitivity of the different vegetation units along the proposed corridors (source: Google Earth 2015).

Red data species

Only one red data species which is also a protected species namely *Vachellia erioloba* was found to be present in the study area (Table 6). This species has a conservation status of "declining" due to its removal for fire wood and other agricultural activities.

Table 6. Red data species previously recorded in the quarter degree grid of the study area (Raimondo *et al.* 2009).

Genus	National Status	Habitat	Recorded in study area
Vachellia erioloba	Declining	Savanna, semi-desert and desert areas, deep sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrops	Units 1 & 2
Antimima lawsonii	Rare	Limestone soils.	No suitable habitat
Cleome conrathii	NT	Stony quartzite slopes, usually in red sandy soil, grassland or open to closed deciduous woodland, all aspects	Not found
Drimia sanguinea	NT	Open veld and scrubby woodland in a variety of soil types.	Not found
Eucomis autumnalis	Declining	Damp, open grassland and sheltered places from coast to 2450m.	No suitable habitat
Hoodia gordonii	Declining	Occurs in a wide variety of arid habitats from coastal to mountainous, also on gentle to steep shale ridges, found from dry, rocky places to sandy spots in riverbeds.	Not found

Protected species

The Department of Water Affairs and Forestry (now Department of Forestry and Fisheries) developed a list of protected tree species. In terms of Section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization. The

Department of Agriculture, Forestry and Fisheries (DAFF) will have to be approached to obtain the required permits for the removal of any protected tree species.

One protected species have been recorded during the survey and are listed below in the table below:

Protected species of the study area (ACT 10 of 2004).

Species name	Recorded in study area	Unit/s	National tree number
Vachellia erioloba (Camel thorn)	✓	1 & 2	168

Vachellia erioloba (Camel thorn) grows well in poor soils and in harsh environmental conditions. The camel thorn ranges from a 2 m spiny shrub to a 16 m robust tree. The camel thorn is a competitive species that can displace preferred vegetation. They start flowering in late winter to early spring.

Medicinal species

Four medicinal plant species, have been identified within the study area. These plants occur throughout the southern African region on various soil types and areas and none are threatened species. Two species (*V karroo & S frutescens*) only occur in vegetation unit 2 which is regarded as having a high conservation value.

Plant name	Plant part used	Medicinal use	Vegetation unit
Vachellia karroo	Leaves, bark and gum	Diarrhoea & dysentery Gum: colds, oral thrush & haemorrhage.	2
Sutherlandia frutescens	Leaves	Stomach problems, internal cancers, eye ailments, wounds, colds & chicken pox	2
Tarchonanthus camphoiratus	Leaves & twigs	Stomach trouble, headache, toothache, inflammation	1, 2, 3
Ziziphus mucronata	Roots, bark or leaves	Cough & chest problems; diarrhea; pain relief	1, 2, 3

Alien plant species

A total of five different declared alien invasive species, the tree *Prosopis glandulosa* (unit 2) and the succulents *Opuntia ficus-indica* (unit 3), *Cylindropuntia imbricata*

(formerly *Opuntia imbricata*) (unit 1), the grass *Pennisetum setaceum* (unit 2) and the forb *Argemone mexicana* (unit 2) were found to be present in the study area.

Opuntia ficus-indica is a succulent species with metamorphic stems resembling leaves, while the leaves have been reduced to form thorns. The plant has been used as an important crop plant (for its edible fruits) in many countries throughout the world. It originates from Central America (Mexico) where it is an economically important plant. A spineless variety of the plant was brought into South Africa as fodder and fruit plants many years ago. Subsequently a spiny form has originated from these plants that are not regularly browsed by animals due to the spines. This plant has therefore started invading various areas displacing the natural vegetation around it. Its seeds are furthermore easily dispersed via birds and baboons and other animals that eats its fruits. As a result there are thousands of hectares of land that has no more economic or ecological value due to these areas being infested with these plants.

Prosopis glandulosa is a small to medium-sized tree that originates in the southwestern parts of the United States. The plant can grow well in semi-arid areas and produced fodder of high nutritive value. As a result the plant was brought into South Africa as a fodder production plant, but has unfortunately become invasive and has displaced the natural vegetation of large areas in the semi-arid regions of the country.

Cylindropuntia imbricata (previously *Opuntia)* is a much branched spiny succulent that can grow up to 2m tall. It originates from Mexico and Texas, USA and was brought into the country as an ornamental plant. It now invades karroo, arid savannas and grasslands. The old branches hang downwards and can break off and regrow once it lands on the ground thereby increasing the population density. It further disperses via its fruits that are readily eaten by wild birds, antelopes and baboon.

The grass *Pennisetum setaceum* commonly known as fountain grass originates from Central, East and tropical Africa. It has been introduced into the country as an ornamental grass and is also used to stabilise embankments around buildings. The grass thrives in warmer drier areas and has started invading large sections of our natural vegetation. It also increases the risk of intense wildfires due to its large tufts

that can grow up to 800mm tall. It spreads by seeds that are washed away and dispersed during rainfall events.

Argemone mexicana (Mexican poppy) originates from Mexico. It is an extremely hardy plant that is drought dolerant and can grow in poor soil making it easy to invade areas preventing natural species from growing. It is prolific in disturbed sites and competes with natural species an agricultural crops. This plant also contaminates crop seed and adhere to the wool of sheep rendering it low in value. It can grow up to one meter high and produces a yellow latex that is poisonous to animals and humans.

Opuntia ficus-indica, Cylindropuntia imbricata, Pennisetum setaceum and *Argemone mexicana* are declared category 1 weeds (CARA) and category 1b plants (NEMBA), while *Prosopis glandulosa* a declared category 2 (CARA) and 1b (NEMBA) invader tree. All category 1 plants must be removed and eradicated by the land owner by law, while *Prosopis glandulosa* may not be grown or present on one's property unless a permit is obtained from nature conservation. **It is therefore important that these plants are removed from the different vegetation units and that a programme is implemented on a long-term basis to control the spread of these plants.**

Indigenous invader plant species

One indigenous invader species namely *Acacia mellifera* was found to be present in the study area. This species is however, in these areas part of the natural ecosystem and do not pose a threat to the environment under natural conditions. Where vegetation is disturbed due to overgrazing, agricultural activities, general mismanagement etc., this species can quickly spread, forming dense stands that replace other indigenous species.

ii. *FAUNA*

GENERIC DESCRIPTION OF POTENTIAL IMPACTS OF POWER LINES ON ASSOCIATED FAUNA AS WELL AS RECOMMENDED MITIGATORY MEASURES

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in Southern Africa are electrocution of birds (and other animals) and disturbance and habitat destruction during construction and maintenance activities.

Habitat destruction and disturbance

During the construction phase and maintenance of powerlines, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. As the majority of the alignment occurs within succulent-karroid vegetation dominated by dwarf shrubs and grasses limited vegetation clearance will be required during the operational phase of the project. These activities have an impact on fauna breeding, foraging and roosting in or in close proximity of the servitude, both through modification of habitat and disturbance caused by human activity. The proposed impact will be of **medium-low; short-long term impact** on remaining faunal species.

Mitigation and Recommendations

The following general recommendations are made to minimise the impacts of proposed powerline construction on the immediate environment and remaining **fauna**:

- The proposed alignments should be routed along the existing informal access road as well as degraded and transformed habitats or vegetation units.
- Close site supervision must be maintained during construction.
- During the **CONSTRUCTION** phase workers must be limited to areas under construction within the 22m reserve and access to the undeveloped areas,

especially the riparian zones of the Ga-Mogara River and surrounding open areas must be strictly regulated ("no-go" areas during construction activities).

- All large indigenous tree species especially the protected *Vachelia erioloba* should be conserved wherever possible.
- Provision of adequate toilet facilities must be implemented to prevent the possible contamination of ground (borehole) water in the area. Mobile toilets must be provided in order to minimise unauthorised traffic of construction workers outside of the designated areas.
- All temporary stockpile areas including litter and dumped material and rubble must be removed on completion of construction. All alien invasive plant should be removed from the site to prevent further invasion.
- Firearms or any other hunting weapons must be prohibited on site.
- Contract employees must be educated about the value of wild animals and the importance of their conservation.
- Educational programmes for the contractor's staff must be implemented to ensure that project workers are alerted to the possibility of snakes being found during vegetation clearance. The construction team must be briefed about the management of snakes in such instances. In particular, construction workers are to go through ongoing refresher courses to ensure that protected snakes, such as Southern African Python, are not killed or persecuted when found.
- Severe contractual fines must be imposed and immediate dismissal on any contract employee who is found attempting to snare or otherwise harm remaining faunal species.
- No animals should be intentionally killed or destroyed and poaching and hunting should not be permitted on the site.

VEGETATION/FLORA

All vegetation not interfering with the operation of the line shall be left undisturbed and this included all the smaller shrubs and herbs which don't interfere with the lines. Collection of firewood and traditional medicinal plants is strictly prohibited. No area should be cleared of trees, bushes and other vegetation for the purpose of a camping site.

Management objective

- Minimal disturbance to vegetation where such vegetation does not interfere with construction and operation of the line
- No unnecessary destruction to surrounding vegetation
- Protection of any protected or endangered plant species
- Prevention of litigation concerning removal of vegetation

Measurable targets

- Adequate protection of remaining indigenous plant species
- No litigation due to removal of vegetation without the necessary permits (*Vachelia erioloba*).

Mitigation and recommendation

Remaining indigenous bulbous geophytes should be retained or replanted wherever possible. Where herbicides are used to clear vegetation, specimen-specific chemicals should be applied to individual plants only. General spraying should be prohibited.

All alien vegetation should be eradicated along the servitude. Invasive species (*Prosopis glandulosa; Nicotiana* spp.) should be given the highest priority. No dumping of any materials in undeveloped open areas and neighbouring properties. Activities in the surrounding open undeveloped areas (especially the rocky hills and koppies must be strictly regulated and managed. It is imperative that the construction activities as well as vegetation clearance are restricted to the powerline servitude. The limitation of the disturbance of vegetation cover within the servitude will ameliorate this impact. Impact will be short-long term depending on the amount of vegetation to be cleared. Excessive habitat destruction during construction could reduce the amount of habitat available. This impact is anticipated to be localised, of a long-term nature and of low significance, provided that appropriate mitigation measures are implemented (e.g. the limitation of vegetation clearance within sensitive areas).

REHABILITATION

A suitably qualified rehab specialist should be appointed for the commencement of rehabilitation activities. The specialist should identify areas requiring rehabilitation as well as appropriate seed mixes which are required. Photographic records of the

servitude and access roads prior to construction activities and after the construction phase will be taken to assess the level of rehabilitation and re-vegetation.

Surrounding Farming Activities

Domestic Livestock

Construction activities must be planned carefully so as not to interfere with the calving and lambing season for most animal species. The Contractor's workforce will have to be very careful not to disturb the animals as this may lead to fatalities which will give rise to claims from the Landowners. Interference with any wildlife without the applicable permits shall not be allowed. The Contractor shall under no circumstances interfere with livestock without the Landowner being present. This includes the moving of livestock where they interfere with construction activities. Should the Contractors workforce obtain any livestock for eating purposes, they must be in possession of a written note from the Landowner. Speed limits must be restricted especially on dirt roads (30km/hr) preventing unnecessary road fatalities of surrounding livestock.

Management objective

- Minimise disruption of surrounding farming activities
- Minimise disturbance of fauna
- Minimise interruption of breeding patterns of fauna

Measurable targets

- No hunting and poaching or intentional killing of animals (including snakes, scorpions, spiders)
- No stock losses where construction is underway
- No complaints from Landowners or Nature Conservation
- No litigation concerning stock losses and animal deaths

ACCESS ROADS

Planning of access routes must be done in conjunction between the Contractor, Eskom and the Landowner. All access to private farmland must be negotiated in advance with land-owners. All agreements reached shall be documented in writing and no verbal agreements should be made. The condition of existing access / private roads to be used shall be documented with photographs.

The Contractor shall properly mark all access roads. Markers shall show the direction of travel as well as tower numbers to which the road leads. Unnecessary traversing of adjacent open areas is discouraged. Where required, speed limits shall be indicated on the roads (30km). All speed limits shall be strictly adhered to at all time.

Vehicle access to the powerline servitude must as far as possible be limited to existing roads. If a new access roads need to be constructed it should follow cleared areas such as livestock pathways.

VEGETATION CLEARANCE

Management objective

- Minimise damage to surrounding vegetation
- Minimise damage to topsoil
- Successful rehabilitation of barren areas

Measurable targets

- No damage to vegetation outside the powerline servitude as well as around towers
- No loss of topsoil
- No visible erosion three months after completion of the contract
- All disturbed areas successfully rehabilitated three months after completion of the contract

The object of vegetation clearing is to trim, cut or clear the minimum number of trees and vegetation necessary for the safe mechanical construction and electrical operation of the transmission line. Only an 8m strip may be cleared flush with the ground to allow vehicular passage during construction. No scalping shall be allowed on any part of the servitude road unless absolutely necessary.

Vegetation clearing on tower sites must be kept to a minimum. Any alien invasive trees with large root systems shall be cut manually and removed, as the use of a bulldozer will cause major damage to the soil when the root systems are removed. Stumps shall be treated with herbicide. Smaller vegetation can be flattened with a machine, but the blade should be kept above ground level to prevent scalping. Any

vegetation cleared on a tower site shall be removed or flattened and not be pushed to form an embankment around the tower.

Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion as well as alien invasive vegetation invasion. This is especially relevant adjacent to the non-perennial drainage lines and seasonally inundated depressions. e allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, Eskom's approval for the use of herbicides is mandatory. Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the supplier's specifications. All alien vegetation in the total servitude and densifiers creating a fire hazard shall be cleared and treated with herbicides.

It is recommended that a contractor for vegetation clearing should comply with the following parameters:

- The contractor must have the necessary knowledge to be able to identify protected species Camel Thorn (Vachelia (*Acacia*) *erioloba*; Shepherd's Tree (*Boscia albitrunca*) as well indigenous species not interfering with the operation of the line due to their height and growth rate.
- The contractor must also be able to identify declared weeds and alien species (*Prosopis glandulosa*, Nicotiana* spp.) that can be totally eradicated.
- The contractor must be in possession of a valid herbicide applicators license.

Fire Prevention

The frequent burning of the open woodland and grassland vegetation will have a high impact on remaining reptile species. Fires during the winter months will severely impact on the species undergoing brumation, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

Management objective

- Minimise risk of veld fires
- Minimise damage to grazing
- Prevent runaway fires

Measurable targets

- No veld fires started by the Contractor's work force
- No claims from Landowners for damages due to veld fires
- No litigation

Mitigation and recommendations

No open fires shall be allowed on site under any circumstance. The Contractor shall have fire-fighting equipment available on all vehicles working on site, especially during the winter months.

Threatened animals

At a local scale the study site and surrounding areas comprises limited suitable habitat for any threatened animal species.

Mitigation and recommendations

As a precautionary mitigation measure it is recommended that the developer and construction contractor as well as an environmental control officer should be made aware of the possible presence of certain threatened animal species (Giant Bullfrog, South African Hedgehog) prior to the commencement of construction activities. In the event that any of the above-mentioned species are discovered the animal should not be interfered with and allowed to move away from the construction activities

iii. *IMPACT EVALUATION*

Impact analysis

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and humans. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and disturbance and habitat destruction during construction and maintenance activities. The construction of pylons for the power lines will inevitably have an impact on the surrounding ecosystem. The severity of the impact, however, varies, depending on the nature of the activity and mitigation measures followed. Different impacts on the vegetation will be experienced during construction and operational phase. These impacts on the total ecosystem are listed below and analysed below according to their extent, duration, intensity and probability.

- ***Impact 1 – Loss of natural vegetation***

The construction of pylons will lead to the destruction and loss of vegetation. Vegetation loss can result in degradation of the environment, loss of vegetation cover and resultant erosion and loss of topsoil, increase in water runoff and less water infiltration, loss of habitat for sensitive or secondary species, reduction of species richness and system diversity and eventual loss of ecosystem functioning and species composition. These activities have an impact on fauna breeding, foraging and roosting in or in close proximity of the servitude, both through modification of habitat and disturbance caused by human activity. Thus it is important that no unnecessary destruction of the habitat takes place during any development/construction phase.

- ***Impact 2 – Habitat fragmentation (loss of landscape connectivity)***

Habitat fragmentation refers to destruction of the habitat leading to a discontinuity in a species/populations' the environment. The remaining habitat therefore becomes smaller. The implications of habitat fragmentation is that edge effects along the fragments can cause a further reduction in the habitat while plants and sessile organisms are not able to reproduce anymore that will eventually lead to them dying out. Thus these isolated habitats will become unsuitable to many of the original

species occurring in the area. Species populations can only remain viable if large enough habitat remains or if sizeable corridors exist between the fragments.

- ***Impact 3 – Impacts on vulnerable species***

For the purpose of this report the term "vulnerable species" to threatened, protected, medicinal and red data species. Natural populations of species not regarded as "vulnerable" usually occur in large numbers within various suitable habitats. Vulnerable species are normally species whose habitats have become smaller, usually as a result of human actions, but also as a result of natural disasters (e.g. floods, droughts, fire etc.). The result is that these species are already under stress and any further reduction in their habitat could cause their extinction. Not only will the loss of such a species cause further degradation of the environment and the conservation status of the ecosystem, but it will alter also the functioning of adjacent ecosystems and their species compositions. It is therefore recommended that buffer zones varying from 5m to a 1000m are placed around such species/ecosystems to protect their integrity and survival.

- ***Impact 4 – Establishment of invasive plants and declared weeds***

Weeds, alien invasive and indigenous invasive plants are normally aggressive growers that can out-compete other natural species growing in the environment. These species have superior reproduction and/or vegetative growth mechanisms that enable them to grow and increase faster than other species in the same habitat. Under normal conditions in a stable ecosystem they will not become dominant. However, if a disturbance in the environment takes place whether human induced or natural, these species will normally invade these disturbed areas, displace the few natural species remaining and form a homogeneous stand of vegetation. This could then lead to an uncontrollable spread of these species into the ecosystem as well as adjacent systems. The consequences of alien plant invasions is a loss of soil water, change in nutrient status of the soil, loss of indigenous and climax vegetation, species diversity, change in plant community composition and structure and eventually loss in ecosystem functioning as well as adjacent ecosystems.

Mitigation and recommendations

The following general recommendations are made to minimise the impacts of proposed powerline construction on the **flora** and **fauna**:

- Close site supervision must be maintained during construction.

- During the **construction** phase workers must be limited to areas under construction within the corridor and access to the undeveloped areas, especially the surrounding open areas must be strictly regulated ("no-go" areas during construction activities).
- Provision of adequate toilet facilities must be implemented to prevent the possible contamination of ground (borehole) water in the area.
- All temporary stockpile areas including litter and dumped material and rubble must be removed on completion of construction. All alien invasive plant should be removed from the site to prevent further invasion.
- Contract employees must be educated about the value of wild animals and the importance of their conservation.
- Educational programmes for the contractor's staff must be implemented to ensure that project workers are alerted to the possibility of snakes being found during vegetation clearance. The construction team must be briefed about the management of snakes in such instances. In particular, construction workers are to go through ongoing refresher courses to ensure that threatened snakes, such as Southern African Python, are not killed or persecuted when found.
- Severe contractual fines must be imposed and immediate dismissal on any contract employee who is found attempting to snare or otherwise harm remaining faunal species.
- All vegetation not interfering with the operation of the line shall be left undisturbed this is especially pertinent to the protected and red data Camel Thorn (*Vachellia erioloba*). None of these species may be removed without permission from the DAFF & Nature Conservation.
- Collection of firewood and traditional medicinal plants is strictly prohibited.
- All alien vegetation should be eradicated along the corridor.
- In areas where degradation has taken place as a result of the construction, a suitably qualified ecologist or rehabilitation specialist should be appointed for the commencement of rehabilitation activities. The specialist should identify areas requiring rehabilitation as well as appropriate seed mixes which are required.
- No pylons should be constructed within unit 2 and limited access must be given to staff except for the clearing of alien invasive species.

The construction of pylons for the power lines will inevitably have an impact on the surrounding ecosystem. The severity of the impact, however, varies, depending on the nature of the activity and mitigation measures followed. Different impacts on the vegetation could be experienced during construction and operational phase. These impacts on the total ecosystem are analysed below according to their extent, duration, intensity and probability. Each of these criteria is given a rating in order to quantify the severity of the impact. For impact assessment the potential impacts on the vegetation was assessed by using the NEMA 2006 guidelines and criteria (Table 1) as described under the methods section of this report. The results are presented below:

Tarchonanthus camphoratus shrubland – Unit 1

Impact	Extent	Duration	Intensity	Probability	Score	%
Loss of flora, fauna & habitat	1	1	1	1	**4**	**27**
With mitigation	1	1	1	1	**4**	**27**
Habitat fragmentation	1	2	1	1	**5**	**33**
With mitigation	1	2	1	1	**5**	**33**
Loss of vulnerable species	1	2	2	2	**7**	**47**
With mitigation	1	1	1	1	**4**	**27**
Invasion of invader plants	2	3	2	2	**7**	**47**
With mitigation	1	1	1	1	**4**	**27**
		Average score without mitigation			Low/med	**39**
		Average score with mitigation			Low	**29**

Vachellia karroo riverine woodland – Unit 2

Impact	Extent	Duration	Intensity	Probability	Score	%
Loss of flora, fauna & habitat	1	2	1	1	**5**	**33**
With mitigation	1	1	1	1	**4**	**27**
Habitat fragmentation	1	2	1	1	**5**	**33**
With mitigation	1	2	1	1	**5**	**33**
Loss of vulnerable species	1	2	1	1	**5**	**33**
With mitigation	1	1	1	1	**4**	**27**
Invasion of invader plants	2	3	3	2	**8**	**53**
With mitigation	1	1	1	1	**4**	**27**
		Average score without mitigation			Low/med	**38**
		Average score with mitigation			Low	**29**

Senegalia mellifera open shrubland – Unit 3

Impact	Extent	Duration	Intensity	Probability	Score	%
Loss of flora, fauna & habitat	1	1	1	1	**4**	**27**
With mitigation	1	1	1	1	**4**	**27**
Habitat fragmentation	1	2	1	1	**5**	**33**
With mitigation	1	2	1	1	**5**	**33**
Loss of vulnerable species	1	1	1	1	**4**	**27**
With mitigation	1	1	1	1	**4**	**27**
Invasion of invader plants	2	3	2	2	**7**	**47**
With mitigation	1	1	1	1	**4**	**27**
		Average score without mitigation			Low	**34**
		Average score with mitigation			Low	**29**

The results of the above **impact evaluations** show that the proposed power lines should have no severe (**high**) impacts on the different units with **low-medium** impacts over the **short-medium term** that will be experienced in the different vegetation units (fauna & flora).

The impacts on the loss of flora and habitat will be low to medium due to the areas having few sensitive species (except for the declining *Vachellia erioloba* in units 1 and 2). The expected influence could however be further mitigated by restricting the

clearing of natural vegetation to as small an area as needed for the construction of the pylons.

The fragmentation of the habitat is not expected to be of any significance with normal connectivity between ecosystems still intact due to the relatively small footprint of the pylons. Any fragmentation will also be mitigated by clearing as small an area as possible when constructing the pylons.

Only one red data/protected species (the tree *Acacia erioloba*) was observed in vegetation units 1 and 2 (with large numbers of them already dying due to red iron dust pollution) that could be negatively affected if large numbers are removed or damaged. This will have a local effect on their populations and could be long-term. This could however be mitigated by placing the pylons and powerlines such that as little as possible of these species are affected. A qualified plant ecologist/botanist should participate in a walk-down exercise after the final route has been decided upon and the placement of the pylons have been marked in the field.

Four declared alien invader species were found to be present in these units along the corridors. Thus the clearing of vegetation around the proposed pylon sites could create an opening for these species to invade these sites. This influence will however be site specific and could be mitigated by implementing a long-term monitoring plan whereby any growth of this species are eradicated with immediate effect. The areas affected by the construction activities should also be rehabilitated as soon as the construction is completed. That would also assist in preventing these species establishing. The landowner should also be contacted and requested to implement an eradication programme.

CONCLUSION

Any development will have a negative effect on the natural ecosystem in particular the vegetation thereof. The vegetation of areas where development and building of structures will take place will destroy all vegetation present on the specific area where a structure is planned to be erected. Due to the effect of soil tillage and the complete removal of indigenous vegetation these areas will be totally transformed or destroyed. The effect on the ecosystem and surrounding areas will depend on the planned development activity.

The purpose of any ecological assessment is to determine areas of high sensitivity and to provide guidelines to ensure that the proposed development is ecologically sensitive and to prevent unnecessary destruction of natural ecosystems. It is mostly unavoidable to prevent all development especially power lines to cross and affect sensitive areas. It is therefore important that all possibilities for such power lines are investigated in order to provide ecologically sound recommendations on routes to be followed.

The proposed corridors are located within three different vegetation types that are not regarded as being threatened. The landscape is mostly low flat to undulating areas with sandy plains, while rocky hills and outcrops are present in some areas.

This study investigated the vegetation found along the proposed corridors for the proposed powerline from Manganore to Ferrum. The two alternative corridors were investigated from a plant and faunal ecological point of view.

Large parts of the land is used for mining and the rest for grazing by domestic stock and free roaming game. Although representative of the natural vegetation, none of the units are regarded as very sensitive with large patches of these vegetation types available in other parts of the region.

One does however have to ensure that no unnecessary disturbance of the natural vegetation occurs so as to eliminate an edge effect. None of the impacts assessed for the different vegetation units will have a high negative effect on the environment and no unit was found to be highly sensitive to development.

No national river crosses any part of the proposed corridors.

The declining red data tree *Vachellia erioloba* is present in two vegetation units (1 and 2. It plays an important role in the ecosystem by providing food, shelter and shade to various animal and bird species. It is therefore important that these trees are not unnecessarily removed from the ecosystem. The placement of the pylons should be done in such a way as to avoid damaging these species as far as possible. If single individuals of these species have to be removed, a permit from the Department of Agriculture, Fisheries and Forestry (Forestry Branch) and Nature Conservation will have to be obtained for this purpose. It is recommended that once the final powerline route and pylon positions have been decided on and pegged that a walk down by a qualified plant ecologist is done to determine if any of these protected species must be removed.

Four medicinal plant species were recorded but none are threatened species and are common throughout the area.

Based on this study it is concluded that any of the two proposed alternative corridors could be considered for the construction of the proposed powerlines with no long or medium-term negative effects envisaged. Alternative 1 has most probably the largest sections of land affected by mining that has totally transformed the natural ecosystems and would therefore from a plant ecological point of view have the least impact on the ecosystem especially in the western parts of the corridor near the town of Kathu.

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ANNEXURE 1

Mammal species historically recorded in the area according to Skinner & Chimimba (2005). Actual species lists will most likely contain far fewer species due to high levels of habitat transformation and degradation as well as high levels of human disturbances (hunting and poaching activities). This is especially pertinent to the larger mammal species including predatory species which are considered problem animals to adjacent livestock farmers.

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS (Skinner & Chimimba 2005)
Cape Serotine Bat	*Neoromicia capensis*	Least Concern
Egyptian Slit-faced Bat	*Nycteris thebiaca*	Least Concern
Geoffrey's Horseshoe Bat	*Rhinolophus clivosus*	Least Concern
Egyptian Free-tailed Bat	*Tadarida aegyptiaca*	Least Concern
Reddish-grey Musk Shrew	*Crocidura cyanea*	Data Deficient
Cape Hare	*Lepus capensis*	Least Concern
Scrub Hare	*Lepus saxatilis*	Least Concern
Namaqua Rock Mouse	*Aethomys namaquensis*	Least Concern
Short-tailed Gerbil	*Desmodillus auricularis*	Least Concern
Hairy-footed Gerbil	*Gerbillurus paeba*	Least Concern
Spectacled Dormouse	*Graphiurus ocularis*	Least Concern
Large-eared Mouse	*Malacothrix typica*	Least Concern
Multimammate Mouse	*Mastomys coucha*	Least Concern
Karoo Bush Rat	*Otomys unisulcatus*	Least Concern
Brant's Whistling Rat	*Parotys bransii*	Least Concern
Littledale's Whistling Rat	*Parotomys littledalei*	Least Concern
Pygmy Rock Mouse	*Pteromyscus collinus*	Least Concern
Striped Mouse	*Rhabdomys pumillio*	Least Concern
Round-eared Elephant-Shrew	*Marcoscelides proboscideus*	Least Concern
Cape Ground Squirrel	*Xerus inauris*	Least Concern
Springhare	*Pedetes capensis*	Least Concern
Porcupine	*Hystrix africaeaustralis*	Least Concern
Rock Hyrax	*Procavia capensis*	Least Concern
Suricate	*Suricata suricatta*	Least Concern
South African Hedgehog	***Atelerix frontalis***	**Near-Threatened**
Small Grey mongoose	*Galerella pulverulenta*	Least Concern
Yellow Mongoose	*Cynictis penicillata*	Least Concern
Striped Polecat	*Ictonyx striatus*	Least Concern
Small-spotted Genet	*Genetta genetta*	Least Concern
African Wild Cat	*Felis silverstris*	Least Concern
Black-footed Cat	*Felis nigripes*	Least Concern
Black-Backed Jackal	*Canis mesomelas*	Least Concern

Caracal	*Caracal caracal*	Least Concern
Honey Badger	*Mellivora capensis*	Lower Risk/ Least Concern
Bat-eared Fox	*Otocyon megalotis*	Least Concern
Leopard	*Panthera pardus*	Least Concern
Cape Fox	*Vulpes chama*	Least Concern
Aardwolf	*Proteles critatus*	Least Concern
Common Duiker	*Sylvicapra grimmia*	Least Concern
Steenbok	*Raphicerus campestris*	Least Concern
Klipspringer	*Oreotragus oreotragus*	Least Concern
Springbok	*Antidorcas marsupialis*	Least Concern
Blesbok	*Damaliscus pygargus phillipsi*	Least Concern
Gemsbok	*Oryx gazella*	Least Concern
Aardvark	*Orycteropus afer*	Least Concern

ANNEXURE 2

List of reptiles recorded according to the Reptile Atlas of Southern Africa; 20 species found for the combined locus = 2823AA, 2823DA, 2723DB, 2723CA

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Family	Genus	Species	Subspecies	Common name	Red list category
Agamidae	*Agama*	*aculeata*	*aculeata*	Common Ground Agama	Least Concern (SARCA 2014)
Agamidae	*Agama*	*atra*		Southern Rock Agama	Least Concern (SARCA 2014)
Atractaspididae	*Atractaspis*	*bibronii*		Bibron's Stiletto Snake	Least Concern (SARCA 2014)
Chamaeleonidae	*Chamaeleo*	*dilepis*	*dilepis*	Common Flap-neck Chameleon	Least Concern (SARCA 2014)
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Least Concern (SARCA 2014)
Colubridae	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Least Concern (SARCA 2014)
Colubridae	*Dispholidus*	*typus*	*typus*	Boomslang	Least Concern (SARCA 2014)
Colubridae	*Lycophidion*	*capense*	*capense*	Cape Wolf Snake	Least Concern (SARCA 2014)
Colubridae	*Psammophis*	*brevirostris*		Short-snouted Grass Snake	Least Concern (SARCA 2014)
Colubridae	*Psammophis*	*trinasalis*		Fork-marked Sand Snake	Least Concern (SARCA 2014)
Colubridae	*Telescopus*	*semiannulatus*	*semiannulatus*	Eastern Tiger Snake	Least Concern (SARCA 2014)
Elapidae	*Naja*	*nivea*		Cape Cobra	Least Concern (SARCA 2014)
Gekkonidae	*Ptenopus*	*garrulus*	*garrulus*	Common Barking Gecko	Least Concern (SARCA 2014)
Lacertidae	*Nucras*	*intertexta*		Spotted Sandveld Lizard	Least Concern (SARCA 2014)
Lacertidae	*Pedioplanis*	*lineoocellata*	*lineoocellata*	Spotted Sand Lizard	Least Concern (SARCA 2014)
Scincidae	*Trachylepis*	*variegata*		Variegated Skink	Least Concern (SARCA 2014)
Testudinidae	*Psammobates*	*oculifer*		Serrated Tent Tortoise	Least Concern (SARCA 2014)
Testudinidae	*Stigmochelys*	*pardalis*		Leopard Tortoise	Least Concern (SARCA 2014)
Varanidae	*Varanus*	*albigularis*	*albigularis*	Rock Monitor	Least Concern (SARCA 2014)
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern (SARCA 2014)

ANNEXURE 3

List of frog species recorded during the South African Frog Atlas Project (SAFAP) and of species likely to occur on the site according to Minter et al. 2004. Actual species lists will most likely contain far fewer species due to extensive habitat transformation as well as habitat degradation due to high levels of overgrazing and soil erosion and wetland degradation.

Common Name	**Species**	**Breeding Requirements**
Common River Frog	*Amietia (Afrana) quecketii*	Rivers and permanent water (springs, ponds and farm dams).
Giant Bullfrog	***Pyxicephalus adspersus***	**Temporary pools, pans and vleis, permanent bodies of water such as shallow seasonally inundated margins of farm dams**
Bushveld Rain Frog	*Breviceps adspersus*	Terrestrial breeder eggs deposited in an underground chamber.
Tremelo Sand Frog	*Tomopterna cryptotis*	Shallow permanent streams or vleis in grassland
Bubbling Kassina	*Kassina senegalensis*	Open vleis, pans, dams in grassland
Olive Toad	*Amietophrynus garmani*	Permanent and temporary waterbodies such as streams, dams. Roadside rainpools, quarries, pans, seepages and spongy bogs.
Guttural Toad	*Amietophrynus* (*Bufo*) *gutturalis*	Open vleis, pans, ponds, dams, slow streams
Common Platanna	*Xenopus laevis*	Open vleis, pans, ponds, dams, slow streams