

The Impact on Vertebrates and their Habitats of ESKOM's Proposed Raebetswe Substation on Portion 4 of the Farm Tweefontein 458 JS, Mpumalanga

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by

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REGULATIONS

REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	
1. (1) A specialist report prepared in terms of these Regulations must contain-	√
a) details of-	
i. the specialist who prepared the report; and	
ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	√
c) an indication of the scope of, and the purpose for which, the report was prepared;	√
(cA) an indication of the quality and age of base data used for the specialist report;	√
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	√
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	√
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	√
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	√
g) an identification of any areas to be avoided, including buffers;	√
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	√
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	√
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	√
k) any mitigation measures for inclusion in the EMPr;	√
l) any conditions for inclusion in the environmental authorisation;	√
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	√
n) a reasoned opinion-	√
i. whether the proposed activity, activities or portions thereof should be authorised;	
(iA) regarding the acceptability of the proposed activity or activities and	
ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	√
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	√
q) any other information requested by the competent authority.	√
2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as set in such notice will apply.	√

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ABSTRACT

The footprint of the new Reabetwe substation will be very small (< 1 acre) relative to the adjoining natural terrain, and the environmental loss is thus insignificant and its affect will be benign. The short (90 meters) new in and out powerlines will cross relatively unaltered grassland, but will have no environmental effect once commissioned.

We are of opinion that the conservation status of predominantly terrestrial and small manmade wetland habitats along both the routes under consideration can be rated as "**Medium-low, i.e.** Land on which small sections could be considered for conservation but where the area in general has little conservation value" (See Section 4.4 and 6.1).

In spite of a moderate significance rating (32%) (See Sections 4.6 and 6.2), we are of opinion that the operational in and out powerlines will in fact have no environmental impact. A powerline is a formidable and highly visual structure, but in essence it has no impact on the environment once rehabilitation and ecological processes revert the affected areas to it former status.

Considering on the nature of the development and the fact that it is not even necessary to implement conservation measures, it is most likely that none of the terrestrial vertebrates with their habitat(s) will be displaced or even be negatively affected.

Declaration of Professional Standing and Independence:

We,

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declare that we:

- hold higher degrees in the biological sciences, which allowed registration by S.A. Council for National Scientific Professions (SACNASP) as Professional Ecologist or Zoologists that sanction us to function independently as specialist scientific consultants;
- declare that as per prerequisites of the Natural Scientific Professions Act No. 27 of 2003 this project was our own work from inception and reflects exclusively our observations and unbiased scientific interpretations, and executed to the best of our abilities abide by the Code of Ethics of the SACNASP;
- are committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas we appreciate opportunities to learn through constructive criticism and debate, we reserve the right to form and hold our own opinions within the constraints of our training, experience and results and therefore will not submit willingly to the interests of other parties or change our statements to appease or unduly benefit them;
- are subcontracted as specialist consultants for the project "The Impact on Vertebrates and their Habitats of ESKOM's Proposed Raebetswe Substation on Portion 4 of the Farm Tweefontein 458 JS, Mpumalanga", as Described in this Report;
- have no financial interest in the proposed development other than remuneration for the work performed;
- do not have, and will not have in the future, any vested or conflicting interests in the proposed development;
- undertake to disclose to the consultant and its client(s) as well as to the competent authority any material information that may have the potential to influence any decisions by the competent authority, as required in terms of the Environmental Impact Assessment Regulations 2006;
- reserve the right to only transfer our intellectual property contained in this report to the client(s), (party or company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, we recognise that written consent from the client will be required for any of us to release of any part of this report to third parties.
- In addition, remuneration for services provided by us is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.



A.E. McKechnie

I.L. Rautenbach



J.C.P. van Wyk

1. INTRODUCTION

Limosella Consulting was appointed by Envirolution Consulting (Pty) Ltd to (on behalf of ESKOM) assess the impact on vertebrate diversity and on their habitat(s) of the construction of the Reabetswe Substation and short in/out overhead powerlines on Portion 4 of the Farm Tweefontein 458 JS (the site).

Mitigation measures (if any) to ameliorate the effect of the development are to be argued.

This assignment is in accordance with the 2014 EIA Regulations emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)

2. SCOPE AND OBJECTIVES OF THE STUDY

- To qualitatively and quantitatively assess the significance of the vertebrate habitat components and conservation status along each route;
- Identify and comment on ecological sensitive ecological components (if any);
- Comments on connectivity with natural vegetation and habitats on adjacent areas;
- To provide a list of vertebrates which occur or might occur, and to identify species of conservation importance;
- To highlight potential impacts of the proposed development on vertebrates;
- To, if possible, provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

3. STUDY AREA

ESKOM plans to construct a new 5MW 3kV DC substation with short (ca. 90 meters) in/out high tension overhead powerlines to connect to an existing line (Figure 1). The new substation (at 25° 54' 52.2"S; 029° 47' 03.5"E) will be known as Reabetswe and is located on Portion 4 of the Farm Tweefontein 458 JS, in Ward 7 of the Tshwete Local Municipality, Mpumalanga.

The topography is typical of Highveld short grassland plains and is located on the Farm Tweefontein 458 JS, which is deployed for grazing livestock (Figures 2 and 4). The substation will be sited close to the railway line and its service road; the latter runs parallel to the railway line. The graveled road will also serve as access route to the new installation. Two smaller substations are also close to the railway and service road. The new in/out line will connect via natural grassland to the north-westerly existing high tension line.

A manmade trench along the service road holds water after rains. There are, however, no natural permanent water sources with riparian zone vegetation (Figure 3). From the perspective of vertebrates, only a terrestrial habitat is present, which consists of a good stand of grass which has been heavily grazed during the preceding winter, as such offer poor basal cover.

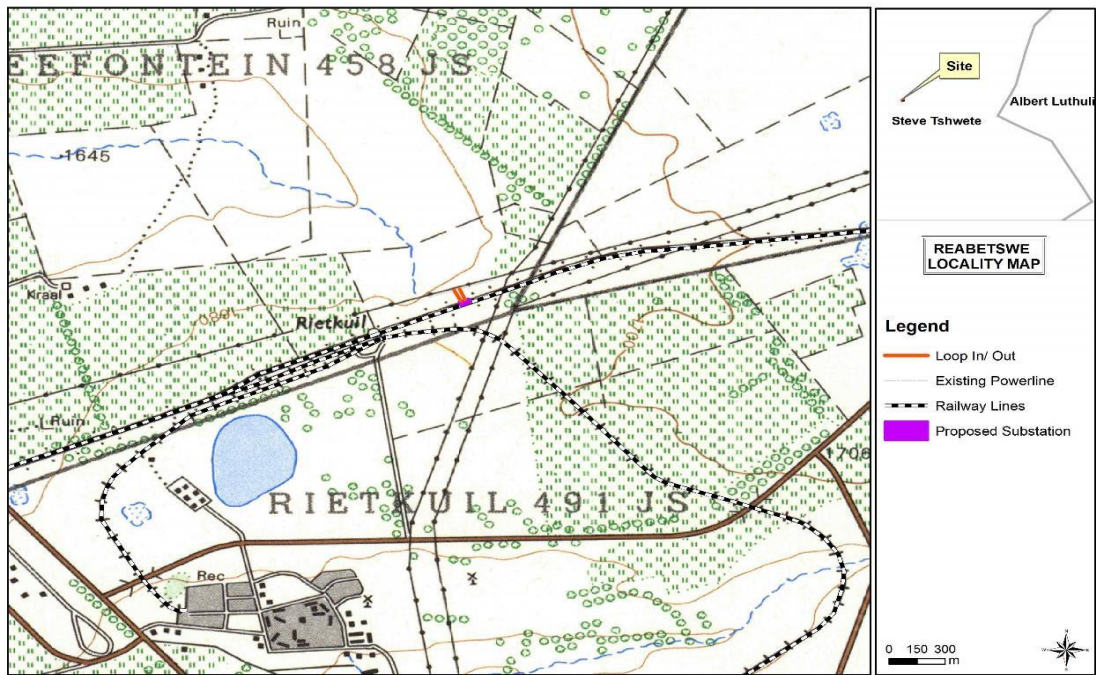


Figure 1: A topocadastral image illustrating the proposed Reabetswe substation and the short in-out loops powerlines.



Figure 2: CBA Map of the Reabetswe Station and the in-out loops to connect to an existing high tension overhead powerline.

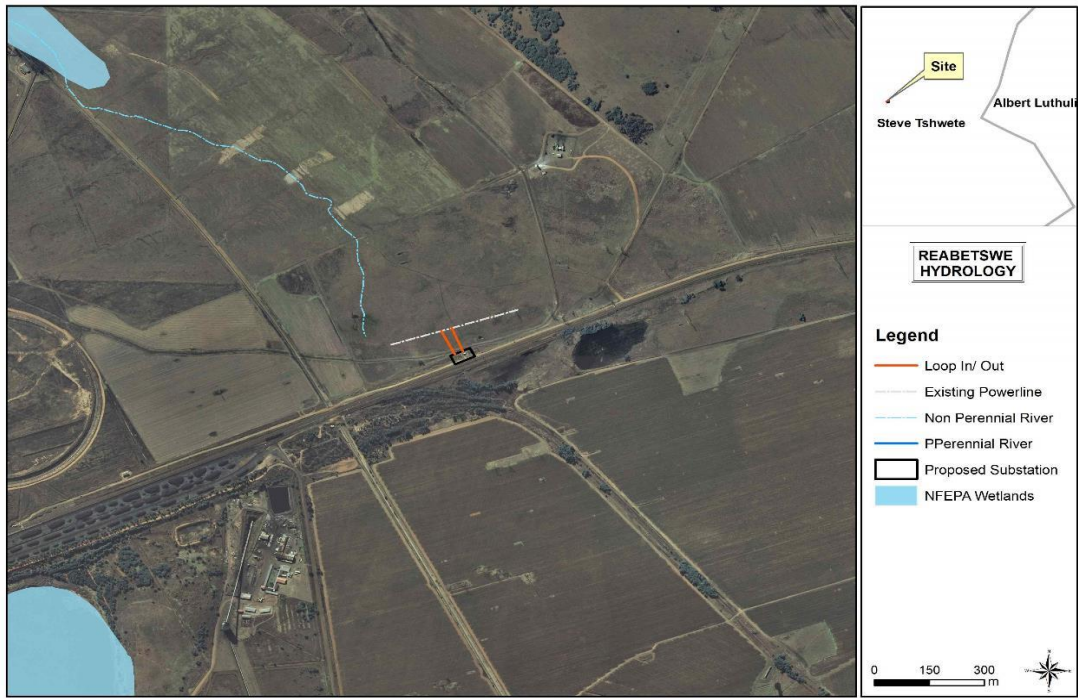


Figure 3: The hydrology of the site and adjoining land.



Figure 4: A north-westerly view from the railway line, overlooking the grassland towards the existing powerline to which the new substation will be connected. The figure in the image provides scale to judge the length of the in/out lines. Note the manmade furrow that holds water seasonally.

4. METHODS

A site visit was conducted on 28 November 2017. During this the observed and derived presence of vertebrates associated with the recognized habitat types of the study site, were recorded. This was done with due regard to the well recorded global distributions of Southern African mammals, birds, reptiles and frogs coupled to the qualitative and quantitative nature of recognized habitats.

Adjacent zones within 500 meters of the two proposed routes were scanned for vertebrates and natural habitats.

4.1 Field Surveys

A mammalogist, ornithologist and herpetologist assessed the biota (Figure 4) on the 28th November 2017. During the fieldwork mammals, birds, reptiles and frogs were identified by visual sightings through random transect walks and patrolling with a vehicle. Habitats were qualitatively and quantitatively defined and also used to deduce species presences. No trapping or mist netting was conducted as the terms of reference did not require such intensive work. In addition, vertebrates were also identified by means of spoor, droppings, burrows, roosting sites or nests.

The weather during the visit was a pleasantly warm, clear summer day with little wind.

The site falls in the Eastern Highveld Grassland biome as defined by Mucina and Rutherford (2006).

Three criteria were used to gauge the probability of occurrence of vertebrates on the study site. These include known distribution range, habitat preference and the qualitative and quantitative presence of suitable habitat.

4.2 Desktop Surveys

As the majority of mammals, reptiles and frogs are secretive, nocturnal, hibernators, migrators and/or seasonal, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season. During the field work phase of the project, these derived lists of occurrences are audited.

The probability of occurrences of mammals, birds, reptiles and frogs was based on their respective geographical distributional ranges and the suitability of on-site habitats. In other words, *high* probability would be applicable to a species with a distributional range overlying the study site as well as the presence of prime habitat occurring on the study site. Another consideration for inclusion in this category is the inclination of a species to be common, i.e. normally occurring at high population densities.

Medium probability pertains to a mammal species with its distributional range peripherally overlapping the study site, or required habitat on the site being sub-optimal. The size of the site as it relates to its likelihood to sustain a viable breeding population, as well as its geographical isolation is also taken into consideration. Species categorised as *medium* normally do not occur at high population numbers, but cannot be deemed as rare.

A *low* probability of occurrence will mean that the species' distributional range is peripheral to the study site and habitat is sub-optimal. Furthermore, some mammals categorised as *low* are generally deemed rare.

4.3 Specific Requirements

Mammals: During the visit the site was surveyed and assessed to assess species richness, and in particular for the potential occurrence of Red Data and/or wetland-associated species such as Juliana's golden mole (*Neamblosomus juliana*), Highveld golden mole (*Amblysomus septentrionalis*), Rough-haired golden mole (*Chrysospalax villosus*), African marsh rat (*Dasymys incomtus*), Angoni vlei rat (*Otomys angoniensis*), Vlei rat (*Otomys irroratus*), White-tailed rat (*Mystromys albicaudatus*), a number of shrews such as the Forest shrew (*Myosorex varius*), Southern African hedgehog (*Atelerix frontalis*), a number of bats such as the Short-eared trident bat (*Cloeotis percivali*), African clawless otter (*Aonyx capensis*), Spotted-necked otter (*Lutra maculicollis*), Marsh mongoose (*Atilax paludinosus*), Brown hyena (*Parahyaena brunnea*), etc.

Birds: Species occurring at the site of the proposed development were assessed as detailed below. Red-listed species were identified using the recent (2015) Red Data Book for South Africa, Lesotho and Swaziland (Taylor et al. 2015).

A desktop study was undertaken in which bird species that potentially occur at the site and in the surrounding areas were identified using data from the first and second South African Bird Atlas Projects (SABAP 1 and 2). SABAP 2 data are based on records for pentads (i.e., 5' X 5'), where SABAP 1 data were based on quarter-degree grid cells (i.e., 15' X 15'). A list of species potentially occurring at the site was developed for the SABAP 2 pentad within which the site falls (2550_2945), as well as adjacent pentads covering the entire area of the Bosmanskop, Woestalleen, Leeufontein power lines. This species list is thus based on an area much larger than the actual development site (Figure 5). This precautionary approach is adopted to ensure that all species potentially occurring at the site, whether resident, nomadic, or migratory, are identified, and that the cumulative impacts of all four powerlines are considered in terms of avifaunal impacts.

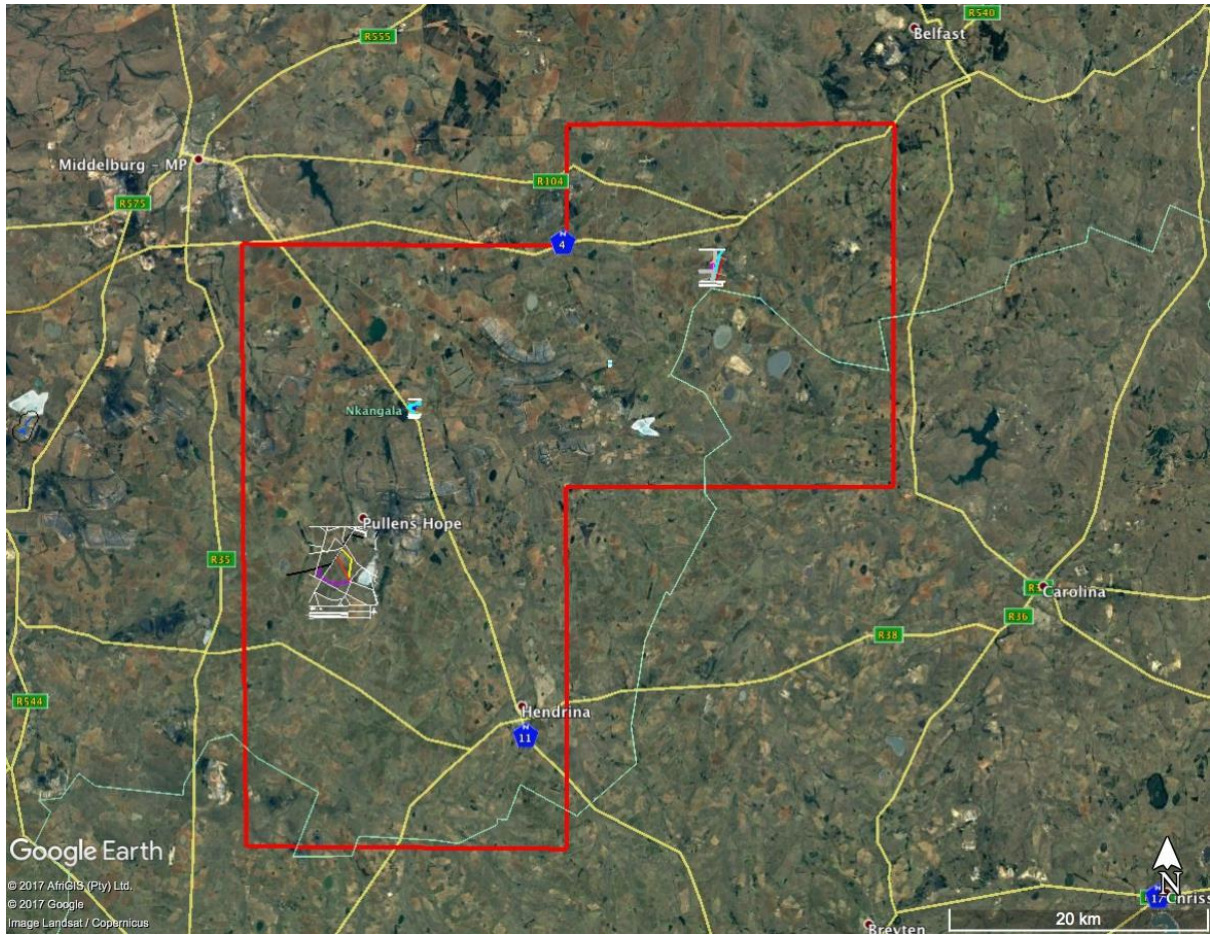


Figure 5: Approximate extent of area included (red square) when generating the list of birds potentially occurring at the site of the proposed Reabetswe power line.

Herpetofauna:

During the visits the site was surveyed and assessed for the potential occurrence of Red Data herpetofauna species in Mpumalanga; (Minter, *et al*, 2004, Alexander & Marais, 2007, Carruthers & Du Preez, 2011, Measey, 2011, Bates, *et al*, 2014 and Du Preez & Carruthers, 2017) such as:

- Giant Bullfrogs (*Pyxicephalus adspersus*);
- Spotted Shovel-nosed Frog (*Hemisus guttatus*);
- Plain Stream Frog (*Strongylopus wageri*);
- Whistling Rain Frog (*Breviceps sopranus*);
- Coppery Grass Lizard (*Chamaesaura aenea*);
- Large-scaled Grass Lizard (*Chamaesaura macrolepis*);
- Giant Dragon Lizard (*Smaug giganteus*);
- Fitzsimons' Flat Lizard (*Platysaurus orientalis fitzimonsi*);
- Breyer's Long-Tailed Seps (*Tetradactylus breyeri*);
- Striped Harlequin Snake (*Homoroselaps dorsalis*);
- Swazi Rock Snake (*Inyoka swazicus*)
- The Southern African Python (*Python natalensis*);
- Nile Crocodile (*Crocodylus niloticus*).

4.4 Assessment criteria

Conservation status of habitats within the study site is subjectively assigned to one of five levels of sensitivity, i.e.

- High:** Ecologically sensitive and valuable land, with high species richness, sensitive ecosystems or Red Data species, that should be conserved and no development allowed.
- Medium-high:** Land where sections are disturbed but that is still ecologically sensitive to development/disturbance.
- Medium:** Land on which low-impact development with limited impact on the ecosystem could be considered, but where it is still recommended that certain portions of the natural habitat be maintained as open spaces.
- Medium-low:** Land on which small sections could be considered for conservation but where the area in general has little conservation value.
- Low:** Land that has little conservation value and that could be considered for developed with little to no impact on the habitats or avifauna.

This approach correlates highly with the empirical Significance ratings as defined below. In some instances the Medium-high, Medium and Medium-high categories are lumped as of Medium Conservation sensitivity.

These five conservation rankings correlate with the significance ratings for the development as discussed in Section 4.6 and are tabulated as follows:

RANKING	65-100	64-36	35-16	15-5	1-4
SIGNIFICANCE	Very High	High	Moderate	Low	Minor
CONSERVATION STATUS	High	Medium-high	Medium	Medium-low	Low

4.5 Significance (Consequence) Rankings

In order to quantitatively express the projected impact of a development, somewhat subjective weighted values of 0 - 5 in Table 1 are deployed. The environmental significance of a development is then calculated using the following formula that allows the development to be:

Significance (Consequence) = (Magnitude + Reversibility + Extent + Duration) X Probability.

Derived values derived are then translated as of Very High, High, Moderate, Low and Minor significance.

- Very High environmental significance 65 – 100 points
- High environmental significance 36 – 64 points
- Moderate environmental significance 16 - 35 points
- Low environmental significance 5 - 15 points
- Minor environmental significance 4 – 1 points

Depending on the nature of the proposed development, significance rankings may be

calculated With Mitigation Measures (WMM) and Without Mitigation Measures (WOMM) to illustrate the predicted effectiveness of proposed mitigation measures.

This technique is more empirical and a useful quantitative tool to compare impacts on locations under consideration for development.

Table 1. Significance values depicting reigning environmental conditions at proposed development sites.

SIGNIFICANCE RANKING MATRIX

RANKING	MAGNITUDE	REVERSIBILITY	EXTENT	DURATION	PROBABILITY
5	Very high/ don't know	Irreversible	International	Permanent	Certain/inevitable
4	High		National	Long term (impact ceases after operational life of asset)	Almost certain
3	Moderate	Reversibility with human intervention	Provincial	Medium term (6-15 years)	Can occur
2	Low		Local	Short term (0 - 5 years)	Unusual but possible
1	Minor	Completely reversible	Site bound	Immediate	Extremely remote
0	None		None		None

- The **Magnitude** of the impact: This will be quantified as either:
 - Low: Will cause a low impact on the environment;
 - Moderate: Will result in the process continuing but in a controllable manner;
 - High: Will alter processes to the extent that they temporarily cease; and
 - Very High: Will result in complete destruction and permanent cessation of processes.
- **Reversibility/ Replaceability:** The degree at which the impact can be **reversible or the lost resource can be replaced.**
- **The Extent of the impact:** This criterion expresses the spatial impact of the impact.
- **The duration (Exposure):** wherein it will be indicated whether:
 - The impact will be immediate;
 - The impact will be of a short tem (Between 0-5 years);
 - The impact will be of medium term (between 5-15 years);
 - The impact will be long term (15 and more years); and
 - The impact will be permanent.
- **The Probability:** which shall describe the likelihood of impact occurring and will be rated as follows:
 - Extremely remote: Which indicates that the impact will probably not happen;
 - Unusual but Possible: Distinct possibility of occurrence;
 - Can Occur: there is a possibility of occurrence;
 - Almost Certain: Most likely to occur; and
 - Certain/ Inevitable: Impact will occur despite any preventative measures put in place.

Depending on the nature of the proposed development, significance rankings may be calculated With Mitigation Measures (WMM) and Without Mitigation Measures (WOMM) to illustrate the predicted effectiveness of proposed mitigation measures.

This technique is more empirical and a useful quantitative tool to compare impacts on locations under consideration for development.

5. RESULTS

5.1 MAMMALS

5.1.1 Mammal Habitat Assessment

Mucina and Rutherford (2006) discuss the peculiar natural plant associations of the area in broad terms. It should be noted that botanical geographers have made immense strides in defining plant associations, whereas this cannot be said of zoologists. The reason is that vertebrate distributions are not very dependent on the minutiae of plant assemblages. Rautenbach (1978 & 1982) found that mammal groupings can at best correlated with botanically defined biomes, such as those by Low and Rebelo (1996 & 1998), and latterly by Mucina and Rutherford (2006). Hence, although the former's work has been superseded by the work of the latter, the definitions of biomes are similar and both remain valid for mammals and are therefore recognized as a reasonable determinant of mammal distribution.

The local occurrences of mammals are, on the other hand, closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges. Sight records and information from residents or knowledgeable locals audit such deductions.

From a mammal habitat perspective, only the terrestrial major habitat type is present. There is a quasi-wetland, which consists of a seasonal stream and its ecologically compromised riparian zones. The manmade trench holds water during the rainy season, and developed a wetland-associated floral assemblage. The wetlands, as they are, are entirely isolated and are thus unlikely to support wetland-associated vertebrates.

There are no bat caves on the site, although it must be emphasised that the stream and the riparian zones are major attractions to bats that use it for drinking and for feeding on the relative abundance of aerial invertebrates.

5.1.2 Expected and Observed Mammal Species Richness

All large mammals (viz. elephants, black and white rhinos, plain's zebras, buffaloes, black wildebeests, herbivores, lions, and spotted and brown hyenas) have decades ago been hunted out for sport or to maximise farming practices. More recently land-use practices (in this instance grazing by livestock) place pressure on the ecological integrity of natural basal cover. Irrespective of the conservation rating of the grassland, it nevertheless provide adequate habitat to vertebrates.

Connectivity between the site and adjoining grasslands is excellent, although the railway line acts as a dispersal barrier in a north-western – south-easterly direction.

Obviously common rupicolous, wetland and arboreal mammals are absent (the water in the manmade trench close to the railway line is seasonal – it does not support typical wetland vegetation along its banks).

No mammals were sighted during the site visit. Table 2 lists 17 mammals which were deduced to reside in the grass strips along the railway line and the transformed grassland. No herbivores and carnivores larger than the yellow mongoose are deemed to be residents. All feral mammal species expected to occur on the study site (e.g. house mice, house rats, dogs and cats) were omitted from the assessment since these cannot be considered when assessing the conservation status nor the impact of the proposed the development along the routes.

The bats listed are common and widespread and considering the availability of suitable roosting sites in the form of farmsteads in the vicinity, can be expected to over fly the site while hunting for aerial invertebrate prey.

The species richness is low which is ascribed to a large (but transformed) terrestrial habitat.

Table 2: Mammal diversity. The species observed or deduced to occupy the site.

	SCIENTIFIC NAME	ENGLISH NAME
	Order Rodentia	
	Family Muridae	
√	<i>Mastomys natalensis</i>	Natal multimammate mouse
√	<i>Mastomys coucha</i>	Southern multimammate mouse
*	<i>Aethomys ineptus</i>	Tete veld rat
*	<i>Saccostomus campestris</i>	Pouched mouse
*	<i>Dendromus melanotis</i>	Grey pygmy climbing mouse
*	<i>Dendromus mesomelas</i>	Brants' climbing mouse
	Order Eulipotypha	
	Family Soricidae	
DD*	<i>Crocidura hirta</i>	Lesser red musk shrew
	Order Chiroptera	
	Family Emballonuridae	
?	<i>Taphozous mauritanus</i>	Mauritian tomb bat
	Family Molossidae	
√	<i>Tadarida aegyptiaca</i>	Egyptian free-tailed bat
	Family Vespertilionidae	
√	<i>Neoromicia capensis</i>	Cape serotine bat
√	<i>Scotophilus dinganii</i>	African yellow house bat
√	<i>Scotophilus viridis</i>	Greenish yellow house bat
	Family Rhinolophidae	
	Family Felidae	
*	<i>Felis silvestris</i>	African wild cat
	Family Viverridae	

*	<i>Genetta genetta</i>	Small-spotted genet
*	<i>Genetta tigrina</i>	SA large-spotted genet
	Family Herpestidae	
√	<i>Cynictis penicillata</i>	Yellow mongoose
√	<i>Galerella sanguinea</i>	Slender mongoose

√ Definitely there or have a *high* probability to occur;

* *Medium* probability to occur based on ecological and distributional parameters;

? *Low* probability to occur based on ecological and distributional parameters.

Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Note: Irrespective of the conservation ranking accorded to the Aardvark by Friedmann and Daly (2004), it is considered as Vulnerable in peri-urban conditions.

5.1.3 Threatened and Red Listed Mammal Species Flagged

By the Scientific Community:

The ecology and population dynamics of the "Data Deficient" (DD) shrew listed in Table 2 has not been adequately studied to provide quantitative field data to empirically assign a conservation ranking, and are thus as a precaution considered as 'Data Deficient' Red Data species. Shrews operate at the apex of the food pyramid via an invertebrate trophic sublevel, which means that their population numbers are significantly lower than that of their prey species in order to maintain sustainable prey population levels. Because of their diet, they are furthermore not readily trapped with conventional bait or traps, which may mean that their numbers are under-estimated. Collecting shrews using drift fences and pitfalls invariably yield better acquisition results than live-trapping, which reiterate the sentiment that shrews numbers are more often than not under-estimated and that many species' conservation status are misconstrued.

No other Red Data or sensitive mammal species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s).

-By the IUCN Red Data List

The compilation of Red Data mammals (Friedman and Daly (editors) 2004) is in fact a contribution to the IUCN initiative. Opinions expressed therein are elucidated above in the overview of the scientific community.

-By the Biodiversity Act No 10 of 2004

Nil

-Endemism:

None of the species purported to be residents of the study site and surrounding areas are endemic to the Mpumalanga Province.

-Formally Prohibited Invasive and Prohibited Species

Nil.

The site of the proposed power line does not fall within an Important Bird Area (Marnewick et al. 2015).

5.2 AVIFAUNA

5.2.1 Avifaunal Habitat Assessment

Avian habitats along the proposed power line route consist entirely of highly transformed agricultural fields, with severe anthropogenic disturbance. There is a large stand of trees immediately to the south. There are also several large dams within 2 km of the site, which means that the possibility of waterfowl moving through the area is a strong possibility.

5.2.2 Expected Avifaunal Species Richness

A total of 270 species have been reported in the area considered for the desktop survey (Figure 5). Of these, 58 are considered highly likely to occur at the site of the proposed power line (Table 3), with a further 45 having a medium likelihood of occurrence, including some waterfowl that could pass through the area en route to the dams to the southwest of the site. Most species occurring at the site are habitat generalists which can use highly disturbed landscapes.

Table 3: Bird species recorded in the area considered for the desktop survey (see Figure 8). The current (2015) status of each red-listed species (“RD”) is provided (NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered), and the likelihood of each species occurring at the site is rated as confirmed, high, medium or low.

English name	Scientific name	RD	Likelihood
Apalis, Bar-throated	<i>Apalis thoracica</i>		Low
Avocet, Pied	<i>Recurvirostra avosetta</i>		Low
Babbler, Arrow-marked	<i>Turdoides jardineii</i>		Low
Barbet, Acacia Pied	<i>Tricholaema leucomelas</i>		Low
Barbet, Black-collared	<i>Lybius torquatus</i>		Low
Barbet, Crested	<i>Trachyphonus vaillantii</i>		Low
Bee-eater, European	<i>Merops apiaster</i>		Medium
Bee-eater, White-fronted	<i>Merops bullockoides</i>		Low
Bishop, Southern Red	<i>Euplectes orix</i>		High

Bishop, Yellow-crowned	<i>Euplectes afer</i>		High
Bokmakierie	<i>Telophorus zeylonus</i>		Medium
Boubou, Southern	<i>Laniarius ferrugineus</i>		Low
Bulbul, Dark-capped	<i>Pycnonotus tricolor</i>		High
Bunting, Cape	<i>Emberiza capensis</i>		Low
Bunting, Cinnamon-breasted	<i>Emberiza tahapisi</i>		Low
Bunting, Golden-breasted	<i>Emberiza flaviventris</i>		Low
Bustard, Denham's	<i>Neotis denhami</i>	VU	Low
Buttonquail, Kurrichane	<i>Turnix sylvaticus</i>		Low
Buzzard, Jackal	<i>Buteo rufofuscus</i>		Medium
Buzzard, Steppe	<i>Buteo vulpinus</i>		High
Canary, Black-throated	<i>Crithagra atrogularis</i>		High
Canary, Cape	<i>Serinus canicollis</i>		High
Canary, Yellow	<i>Crithagra flaviventris</i>		Low
Canary, Yellow-fronted	<i>Crithagra mozambicus</i>		Low
Chat, Anteating	<i>Myrmecocichla formicivora</i>		High
Chat, Familiar	<i>Cercomela familiaris</i>		Low
Cisticola, Cloud	<i>Cisticola textrix</i>		High
Cisticola, Desert	<i>Cisticola aridulus</i>		Low
Cisticola, Lazy	<i>Cisticola aberrans</i>		Low
Cisticola, Levillant's	<i>Cisticola tinniens</i>		Medium
Cisticola, Pale-crowned	<i>Cisticola cinnamomeus</i>		Low
Cisticola, Wailing	<i>Cisticola lais</i>		Low
Cisticola, Wing-snapping	<i>Cisticola ayresii</i>		High
Cisticola, Zitting	<i>Cisticola juncidis</i>		High
Cliff-chat, Mocking	<i>Thamnolaea cinnamomeiventris</i>		Low
Cliff-swallow, South African	<i>Hirundo spilodera</i>		High
Coot, Red-knobbed	<i>Fulica cristata</i>		Low
Cormorant, Reed	<i>Phalacrocorax africanus</i>		Medium
Cormorant, White-breasted	<i>Phalacrocorax carbo</i>		Medium
Coucal, Burchell's	<i>Centropus burchellii</i>		Low
Cursorer, Temminck's	<i>Cursorius temminckii</i>		Low
Crake, Black	<i>Amauornis flavirostris</i>		Low
Crane, Blue	<i>Anthropoides paradiseus</i>	NT	Low
Crombec, Long-billed	<i>Sylvietta rufescens</i>		Low
Crow, Cape	<i>Corvus capensis</i>		Low
Crow, Pied	<i>Corvus albus</i>		High
Cuckoo, Diderick	<i>Chrysococcyx caprius</i>		Medium
Cuckoo, Red-chested	<i>Cuculus solitarius</i>		Low
Darter, African	<i>Anhinga rufa</i>		Low
Dove, Laughing	<i>Streptopelia senegalensis</i>		High
Dove, Namaqua	<i>Oena capensis</i>		Low
Dove, Red-eyed	<i>Streptopelia semitorquata</i>		High
Dove, Rock	<i>Columba livia</i>		High

Drongo, Fork-tailed	<i>Dicrurus adsimilis</i>		Low
Duck, African Black	<i>Anas sparsa</i>		Low
Duck, Comb	<i>Sarkidiornis melanotos</i>		Low
Duck, Fulvous	<i>Dendrocygna bicolor</i>		Low
Duck, Maccoa	<i>Oxyura maccoa</i>	NT	Low
Duck, Mallard	<i>Anas platyrhynchos</i>		Low
Duck, White-backed	<i>Thalassornis leuconotus</i>		Medium
Duck, White-faced	<i>Dendrocygna viduata</i>		Medium
Duck, Yellow-billed	<i>Anas undulata</i>		Medium
Eagle-owl, Cape	<i>Bubo capensis</i>		Low
Eagle-owl, Spotted	<i>Bubo africanus</i>		High
Eagle, Long-crested	<i>Lophaetus occipitalis</i>		Low
Egret, Cattle	<i>Bubulcus ibis</i>		High
Egret, Great	<i>Egretta alba</i>		Low
Egret, Little	<i>Egretta garzetta</i>		Medium
Egret, Yellow-billed	<i>Egretta intermedia</i>		Medium
Falcon, Amur	<i>Falco amurensis</i>		Medium
Falcon, Lanner	<i>Falco biarmicus</i>	VU	Medium
Falcon, Red-footed	<i>Falco vespertinus</i>	NT	Low
Finch, Cuckoo	<i>Anomalospiza imberbis</i>		Low
Finch, Cut-throat	<i>Amadina fasciata</i>		Low
Finch, Red-headed	<i>Amadina erythrocephala</i>		Medium
Finch, Scaly-feathered	<i>Sporopipes squamifrons</i>		Low
Fiscal, Common (Southern)	<i>Lanius collaris</i>		High
Fish-eagle, African	<i>Haliaeetus vocifer</i>		Low
Flamingo, Greater	<i>Phoenicopterus ruber</i>	NT	Low
Flamingo, Lesser	<i>Phoenicopterus minor</i>	NT	Low
Flycatcher, Fiscal	<i>Sigelus silens</i>		Low
Flycatcher, Southern Black	<i>Melaenornis pammelaina</i>		Low
Flycatcher, Spotted	<i>Muscicapa striata</i>		Low
Goose, Egyptian	<i>Alopochen aegyptiacus</i>		High
Goose, Spur-winged	<i>Plectropterus gambensis</i>		Medium
Grass-owl, African	<i>Tyto capensis</i>	VU	Low
Grassbird, Cape	<i>Sphenoeacus afer</i>		Low
Grebe, Black-necked	<i>Podiceps nigricollis</i>		Low
Grebe, Great Crested	<i>Podiceps cristatus</i>		Low
Grebe, Little	<i>Tachybaptus ruficollis</i>		Low
Greenshank, Common	<i>Tringa nebularia</i>		Low
Guineafowl, Helmeted	<i>Numida meleagris</i>		High
Gull, Grey-headed	<i>Larus cirrocephalus</i>		Medium
Hamerkop, Hamerkop	<i>Scopus umbretta</i>		Low
Harrier-Hawk, African	<i>Polyboroides typus</i>		Low
Harrier, Black	<i>Circus maurus</i>	EN	Low
Harrier, Montagu's	<i>Circus pygargus</i>		Low

Harrier, Pallid	<i>Circus macrourus</i>		Low
Helmet-shrike, White-crested	<i>Prionops plumatus</i>		Low
Heron, Black	<i>Egretta ardesiaca</i>		Low
Heron, Black-headed	<i>Ardea melanocephala</i>		High
Heron, Goliath	<i>Ardea goliath</i>		Low
Heron, Green-backed	<i>Butorides striata</i>		Low
Heron, Grey	<i>Ardea cinerea</i>		High
Heron, Purple	<i>Ardea purpurea</i>		Low
Heron, Squacco	<i>Ardeola ralloides</i>		Low
Hobby, Eurasian	<i>Falco subbuteo</i>		Low
Honeyguide, Lesser	<i>Indicator minor</i>		Low
Hoopoe, African	<i>Upupa africana</i>		Medium
House-martin, Common	<i>Delichon urbicum</i>		Medium
Ibis, African Sacred	<i>Threskiornis aethiopicus</i>		Medium
Ibis, Glossy	<i>Plegadis falcinellus</i>		Medium
Ibis, Hadeda	<i>Bostrychia hagedash</i>		High
Ibis, Southern Bald	<i>Geronticus calvus</i>	VU	Medium
Jacana, African	<i>Actophilornis africanus</i>		Low
Kestrel, Greater	<i>Falco rupicoloides</i>		Low
Kestrel, Lesser	<i>Falco naumanni</i>		Medium
Kestrel, Rock	<i>Falco rupicolus</i>		Low
Kingfisher, Brown-hooded	<i>Halcyon albiventris</i>		Low
Kingfisher, Giant	<i>Megaceryle maximus</i>		Low
Kingfisher, Malachite	<i>Alcedo cristata</i>		Low
Kingfisher, Pied	<i>Ceryle rudis</i>		Medium
Kingfisher, Woodland	<i>Halcyon senegalensis</i>		Low
Kite, Black	<i>Milvus migrans</i>		Low
Kite, Black-shouldered	<i>Elanus caeruleus</i>		High
Kite, Yellow-billed	<i>Milvus aegyptius</i>		Low
Korhaan, Blue	<i>Eupodotis caerulescens</i>		Low
Korhaan, Northern Black	<i>Afrotis afroides</i>		Low
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>	VU	Low
Lapwing, African Wattled	<i>Vanellus senegallus</i>		Medium
Lapwing, Blacksmith	<i>Vanellus armatus</i>		High
Lapwing, Crowned	<i>Vanellus coronatus</i>		High
Lark, Botha's	<i>Spizocorys fringillaris</i>	EN	Low
Lark, Eastern Clapper	<i>Mirafra fasciolata</i>		Medium
Lark, Eastern Long-billed	<i>Certhilauda semitorquata</i>		Low
Lark, Flappet	<i>Mirafra rufocinnamomea</i>		Low
Lark, Pink-billed	<i>Spizocorys conirostris</i>		Low
Lark, Red-capped	<i>Calandrella cinerea</i>		High
Lark, Rufous-naped	<i>Mirafra africana</i>		High
Lark, Sabota	<i>Calendulauda sabota</i>		Low
Lark, Spike-heeled	<i>Chersomanes albofasciata</i>		Low

Longclaw, Cape	<i>Macronyx capensis</i>		High
Mannikin, Bronze	<i>Spermestes cucullatus</i>		Low
Marsh-harrier, African	<i>Circus ranivorus</i>	EN	Low
Martin, Banded	<i>Riparia cincta</i>		High
Martin, Brown-throated	<i>Riparia paludicola</i>		High
Martin, Rock	<i>Hirundo fuligula</i>		Medium
Martin, Sand	<i>Riparia riparia</i>		Low
Masked-weaver, Southern	<i>Ploceus velatus</i>		High
Moorhen, Common	<i>Gallinula chloropus</i>		Low
Mousebird, Red-faced	<i>Urocolius indicus</i>		Low
Mousebird, Speckled	<i>Colius striatus</i>		Medium
Myna, Common	<i>Acridotheres tristis</i>		High
Neddicky	<i>Cisticola fulvicapilla</i>		High
Night-Heron, Black-crowned	<i>Nycticorax nycticorax</i>		Low
Oriole, Black-headed	<i>Oriolus larvatus</i>		Low
Ostrich, Common	<i>Struthio camelus</i>		Low
Owl, Barn	<i>Tyto alba</i>		Medium
Owl, Marsh	<i>Asio capensis</i>		Medium
Palm-swift, African	<i>Cypsiurus parvus</i>		High
Paradise-flycatcher, African	<i>Terpsiphone viridis</i>		Low
Paradise-whydah, Long-tailed	<i>Vidua paradisaea</i>		Low
Pigeon, Speckled	<i>Columba guinea</i>		High
Pipit, African	<i>Anthus cinnamomeus</i>		High
Pipit, Long-billed	<i>Anthus similis</i>		Medium
Pipit, Plain-backed	<i>Anthus leucophrys</i>		Low
Plover, Common Ringed	<i>Charadrius hiaticula</i>		Low
Plover, Kittlitz's	<i>Charadrius pecuarius</i>		Low
Plover, Three-banded	<i>Charadrius tricollaris</i>		Low
Pochard, Southern	<i>Netta erythrophthalma</i>		Low
Pratincole, Black-winged	<i>Glareola nordmanni</i>	NT	Low
Prinia, Black-chested	<i>Prinia flavicans</i>		High
Prinia, Drakensberg	<i>Prinia hypoxantha</i>		Low
Prinia, Karoo	<i>Prinia maculosa</i>		Low
Prinia, Tawny-flanked	<i>Prinia subflava</i>		Medium
Quail, Common	<i>Coturnix coturnix</i>		Low
Quailfinch, African	<i>Ortygospiza atricollis</i>		High
Quelea, Red-billed	<i>Quelea quelea</i>		High
Reed-warbler, African	<i>Acrocephalus baeticatus</i>		Low
Reed-warbler, Great	<i>Acrocephalus arundinaceus</i>		Low
Robin-chat, Cape	<i>Cossypha caffra</i>		Medium
Rock-thrush, Cape	<i>Monticola rupestris</i>		Low
Roller, European	<i>Coracias garrulus</i>	NT	Low
Roller, Lilac-breasted	<i>Coracias caudatus</i>		Low
Ruff	<i>Philomachus pugnax</i>		Low

Rush-warbler, Little	<i>Bradypterus baboecala</i>		Low
Sandpiper, Common	<i>Actitis hypoleucos</i>		Low
Sandpiper, Curlew	<i>Calidris ferruginea</i>		Low
Sandpiper, Marsh	<i>Tringa stagnatilis</i>		Low
Sandpiper, Wood	<i>Tringa glareola</i>		Low
Secretarybird	<i>Sagittarius serpentarius</i>	VU	Low
Seedeater, Streaky-headed	<i>Crithagra gularis</i>		Low
Shelduck, South African	<i>Tadorna cana</i>		Low
Shoveler, Cape	<i>Anas smithii</i>		Medium
Shrike, Red-backed	<i>Lanius collurio</i>		Low
Snake-eagle, Black-chested	<i>Circaetus pectoralis</i>		Low
Snipe, African	<i>Gallinago nigripennis</i>		Low
Sparrow-weaver, White-browed	<i>Plocepasser mahali</i>		Low
Sparrow, Cape	<i>Passer melanurus</i>		High
Sparrow, House	<i>Passer domesticus</i>		High
Sparrow, Southern Grey-headed	<i>Passer diffusus</i>		High
Sparrowhawk, Black	<i>Accipiter melanoleucus</i>		Low
Sparrowlark, Chestnut-backed	<i>Eremopterix leucotis</i>		Low
Spoonbill, African	<i>Platalea alba</i>		Medium
Spurfowl, Natal	<i>Pternistis natalensis</i>		Low
Spurfowl, Swainson's	<i>Pternistis swainsonii</i>		High
Starling, Cape Glossy	<i>Lamprotornis nitens</i>		High
Starling, Pied	<i>Spreo bicolor</i>		High
Starling, Red-winged	<i>Onychognathus morio</i>		Medium
Starling, Wattled	<i>Creatophora cinerea</i>		Medium
Stilt, Black-winged	<i>Himantopus himantopus</i>		Low
Stint, Little	<i>Calidris minuta</i>		Low
Stonechat, African	<i>Saxicola torquatus</i>		Medium
Stork, Abdim's	<i>Ciconia abdimii</i>	NT	Low
Stork, Black	<i>Ciconia nigra</i>	VU	Low
Stork, White	<i>Ciconia ciconia</i>		Low
Stork, Yellow-billed	<i>Mycteria ibis</i>	EN	Low
Sunbird, Amethyst	<i>Chalcomitra amethystina</i>		Low
Sunbird, Greater Double-collared	<i>Cinnyris afer</i>		Low
Sunbird, Malachite	<i>Nectarinia famosa</i>		Low
Sunbird, White-bellied	<i>Cinnyris talatala</i>		Low
Swallow, Barn	<i>Hirundo rustica</i>		High
Swallow, Greater Striped	<i>Hirundo cucullata</i>		High
Swallow, Lesser Striped	<i>Hirundo abyssinica</i>		Low
Swallow, Pearl-breasted	<i>Hirundo dimidiata</i>		Low
Swallow, Red-breasted	<i>Hirundo semirufa</i>		Low
Swallow, White-throated	<i>Hirundo albigularis</i>		High
Swamp-warbler, Lesser	<i>Acrocephalus gracilirostris</i>		Low
Swamphen, African Purple	<i>Porphyrio madagascariensis</i>		Low

Swift, African Black	<i>Apus barbatus</i>	Low
Swift, Alpine	<i>Tachymarptis melba</i>	Low
Swift, Horus	<i>Apus horus</i>	Low
Swift, Little	<i>Apus affinis</i>	High
Swift, White-rumped	<i>Apus caffer</i>	High
Tchagra, Black-crowned	<i>Tchagra senegalus</i>	Low
Teal, Cape	<i>Anas capensis</i>	Low
Teal, Hottentot	<i>Anas hottentota</i>	Low
Teal, Red-billed	<i>Anas erythrorhyncha</i>	Low
Tern, Whiskered	<i>Chlidonias hybrida</i>	Low
Tern, White-winged	<i>Chlidonias leucopterus</i>	Low
Thick-knee, Spotted	<i>Burhinus capensis</i>	High
Thrush, Groundscraper	<i>Psophocichla litsipsirupa</i>	Low
Thrush, Karoo	<i>Turdus smithi</i>	Medium
Thrush, Kurrichane	<i>Turdus libonyanus</i>	Low
Thrush, Olive	<i>Turdus olivaceus</i>	Medium
Tinkerbird, Yellow-fronted	<i>Pogoniulus chrysoconus</i>	Low
Tit, Southern Black	<i>Parus niger</i>	Low
Turtle-dove, Cape	<i>Streptopelia capicola</i>	High
Wagtail, African Pied	<i>Motacilla aguimp</i>	Low
Wagtail, Cape	<i>Motacilla capensis</i>	High
Warbler, Willow	<i>Phylloscopus trochilus</i>	Low
Waxbill, Blue	<i>Uraeginthus angolensis</i>	Low
Waxbill, Common	<i>Estrilda astrild</i>	High
Waxbill, Orange-breasted	<i>Amandava subflava</i>	Medium
Waxbill, Swee	<i>Coccyzygia melanotis</i>	Low
Weaver, Cape	<i>Ploceus capensis</i>	Medium
Weaver, Thick-billed	<i>Amblyospiza albifrons</i>	Low
Weaver, Village	<i>Ploceus cucullatus</i>	Medium
Wheatear, Capped	<i>Oenanthe pileata</i>	Medium
Wheatear, Mountain	<i>Oenanthe monticola</i>	Low
White-eye, Cape	<i>Zosterops virens</i>	Low
Whydah, Pin-tailed	<i>Vidua macroura</i>	High
Widowbird, Fan-tailed	<i>Euplectes axillaris</i>	High
Widowbird, Long-tailed	<i>Euplectes progne</i>	High
Widowbird, Red-collared	<i>Euplectes ardens</i>	Low
Widowbird, White-winged	<i>Euplectes albonotatus</i>	Medium
Wood-dove, Emerald-spotted	<i>Turtur chalcospilos</i>	Low
Wood-hoopoe, Green	<i>Phoeniculus purpureus</i>	Low
Woodpecker, Cardinal	<i>Dendropicops fuscescens</i>	Low
Wryneck, Red-throated	<i>Jynx ruficollis</i>	Low

5.2.3 Threatened and Red Listed Bird Species Flagged

A total of 22 threatened or near threatened bird species have been recorded in the area considered for the desktop survey (Table 4). For most of these species, however, the site of the proposed Reabetswe power lines is too transformed for their occurrence to be likely. Nevertheless, the possibility that some of these species may move through the area from time to time must be considered when evaluating the impacts of the proposed power line, although the very short distance involved means that the likelihood of collisions is reduced in comparison with longer lines.

Table 4. Red-listed species whose possible presence at the site of the proposed substations and powerlines was evaluated during the assessment process.

Species	Scientific name	Red Data ¹	NEMBA ²	Assessment of likelihood of presence at site
Stork, Yellow-billed	<i>Mycteria ibis</i>	EN		Unlikely. Habitat not suitable - generally inhabits open, shallow water.
Stork, Abdim's	<i>Ciconia abdimii</i>	NT		Possible. Occurs in grasslands, woodlands and cultivated fields in rural areas. Area too transformed to have high likelihood of hosting this species.
Stork, Black	<i>Ciconia nigra</i>	VU	VU	Unlikely. Usually confined to mountainous areas.
Ibis, Southern Bald	<i>Geronticus calvus</i>	VU	VU	Medium. Occurs in area included in assessment, but not likely to occur in heavily transformed areas.
Flamingo, Greater	<i>Phoenicopterus ruber</i>	NT		Very unlikely. No suitable habitat.
Flamingo, Lesser	<i>Phoenicopterus minor</i>	NT		Very unlikely. No suitable habitat.
Duck, Maccoa	<i>Oxyura maccoa</i>	NT		Very unlikely. No suitable habitat.
Secretarybird	<i>Sagittarius serpentarius</i>	VU		Possible. Too little natural grassland for this area to be important habitat, but may nevertheless occur here from time to time.
Vulture, Cape	<i>Gyps coprotheres</i>	EN	EN	Unlikely. Ranges widely, but unlikely to venture into a heavily transformed urban landscape. However, occurs within 50-100 km of sites, and therefore possible that birds traverse the area from time to time.
Falcon, Lanner	<i>Falco biarmicus</i>	VU		Occurrence possible, but the area is too transformed to be important hunting habitat.

Falcon, Red-footed	<i>Falco vespertinus</i>	NT		Possible. Occurs in open savannas, and may roost in stands of eucalypts.
Marsh-harrier, African	<i>Circus ranivorus</i>	EN	PR	Possible, but highly transformed nature of the landscape and limited habitat (moist primary grassland and marshes) make occurrence unlikely.
Harrier, Black	<i>Circus maurus</i>	EN		Unlikely. Largely out of range for this species, and landscape too transformed.
Finfoot, African	<i>Podica senegalensis</i>	VU		Extremely unlikely – requires slow-flowing water in large river systems
Crane, Grey Crowned	<i>Balearica regulorum</i>	EN	EN	Possible, but landscape too transformed to regularly host this species.
Crane, Blue	<i>Anthropoides paradiseus</i>	NT	EN	Possible, as this species does often forage in agricultural fields.
Crane, Wattled	<i>Buggeranus carunculatus</i>	CR	CR	Possible. Regularly reported in Hendrina / Carolina area, although landscape at site too transformed to host this species.
Bustard, Denham's	<i>Neotis denhami</i>	VU	PR	Unlikely. Recorded in this area, but habitat too transformed.
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>	VU		Possible. Mainly occurs in pristine grasslands, but may venture into agricultural fields.
Pratincole, Black-winged	<i>Glareola nordmanni</i>	NT		Possible. May venture into agricultural fields, but landscape probably too transformed.
Grass-owl, African	<i>Tyto capensis</i>	VU	VU	Unlikely. Outside of core range, and habitats likely too transformed to hold this species.
Roller, European	<i>Coracias garrulus</i>	NT		Very unlikely. No suitable habitat.

¹Current (2015) IUCN Red List Status for South Africa, Lesotho and Swaziland (Taylor et al. 2015). NT = *Near Threatened*; VU = *Vulnerable*; EN = *Endangered*; CR = *Critically Endangered*

²Indicates species listed as Protected (“PR”), Vulnerable (“VU”), Endangered (“EN”) or Critically Endangered (“CR”) in the National Environmental Management: Biodiversity Act, 2004 list of Threatened or Protected Species (2007 version)

5.3 REPTILES AND AMPHIBIANS

5.3.1 Herpetological Habitat Assessment

The vegetation types of the site were analyzed according to Mucina and Rutherford (2006).

Herpetofauna Habitat Assessment:

The local occurrences of reptiles and amphibians are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of reptile and amphibian species by evaluating the habitat types within the context of global distribution ranges. From a herpetological habitat perspective, it was established that two of the four major habitats are naturally present on the study site, namely terrestrial and wetland-associated vegetation cover.

The natural grasslands have been transformed for agricultural purposes. Basal cover include invasive plants and has diggings, gravel road, a railway line, power lines, wire fences and suffer from overgrazing. No moribund termitaria were recorded. These structures are generally good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the reptile and amphibian population density for the study site is lower. At the time of the site visit the basal cover was poor (seasonality) and would not provide adequate cover for small terrestrial herpetofauna.

There is no natural rupicolous habitat, but rock-embedded veldt occurs at some places. Man-made rupicolous habitat exists in the form of a bridge and building. Due to the absence of natural rupicolous habitat, some species like yellow-throated plated lizard, common girdled lizard, common crag lizard, and rock agama were omitted from the species list in Table 5.

Due to the absence of natural arboreal habitat, some species like flap-neck chameleon and tree agama were omitted from the species list in Table 5. A few areas on the other side of the railway line contain invasive trees. Dead logs from exotic trees would provide shelter and food for some herpetofauna.

A few small temporary man-made dams occur at or near both Alternatives, due to some diggings. A large dam occurs on the other side of the railway line in the buffer area (Figure 1). These water sources would provide breeding habitat for several frog species.

Due to a gravel road and a railway line, connectivity is poor to the north of the study site. To the south connectivity is good.

Sight records were also used to compile this herpetofauna report.

Threatened and Red listed Reptile and Amphibian Species

The current status of both the Swazi rock snake and Southern African python in the newest Red Data Book is *Least Concern* (Bates, 2014 *et.al*).

The current status of the giant bullfrog, whistling rain frog and plain stream frog in the newest Red Data list is *Least Concern* (Du Preez & Carruthers, 2017).

The study site falls outside the natural range of the spotted shovel-nosed frog, giant dragon lizard, Fitzsimons' flat lizard, striped harlequin snake and the Nile crocodile. These species should not occur on the study site.

The coppery grass lizard has been recorded near to the study site according to the catalogue records of the Ditsong Museum of Natural History (TVL Museum), but the grass cover is poor and the study site is not suitable for the coppery grass lizard. This species should thus be absent.

The large-scaled grass lizard is found in grassland, especially rocky, grassy hillsides (Branch, 1998). However, the grass cover is too poor to provide suitable habitat for this species. The large-scaled grass lizard should not occur on the study site.

Breyer's long-tailed seps is found in Montane and Highveld grasslands and takes shelter in soil under stones or in moribund termitaria (Bates, 2014). However, the grass cover is poor and no moribund termitaria are found on the study site. This species should not occur on the study site.

Expected and Observed Herpetofauna Species Richness:

Of the 38 reptile species which may occur on the study site (Table 5), none were confirmed during the site visit (Table 6) and of the 20 amphibian species which may possibly occur on the study site (Table 5); one was confirmed during the site visit (Table 6). Table 5 lists the reptiles & amphibians which were observed on or deduced to occupy the site.

The American red-eared terrapin (*Trachemys scripta elegans*) and the Brahminy blind snake (*Ramphotyphlops braminus*) are the only two feral reptile or amphibian species known to occur in South Africa (De Moor and Bruton, 1988; Picker and Griffiths, 2011), but with only a few populations, they are not expected to occur on this particular site.

The species assemblage is typical of what can be expected of habitat that is severely disturbed, but with sufficient habitat to sustain populations. Most of the species of the resident diversity (Table 5) are fairly common and widespread (viz. puff adder, rhombic night adder, common house snake, mole snake, rinkhals, variable skink, guttural toad, bubbling kassina, Boettger's caco and common platanna).

The species richness is fair due to two habitat types occurring on or in the buffer area around the study site.

Table 5: The Reptile and Amphibian species observed on or deduced to occupy the site.

	SCIENTIFIC NAME	ENGLISH NAME
	CLASS: REPTILIA	REPTILES

	SCIENTIFIC NAME	ENGLISH NAME
	Order: TESTUDINES	TORTOISES & TERRAPINS
	Family: Pelomedusidae	Side-necked Terrapins
?	<i>Pelomedusa subrufa</i>	Marsh Terrapin
	Order: SQUAMATA	SCALE-BEARING REPTILES
	Suborder: LACERTILIA	LIZARDS
	Family: Gekkonidae	Geckos
?	<i>Lygodactylus capensis capensis</i>	Common Dwarf Gecko
√	<i>Pachydactylus capensis</i>	Cape Gecko
?	<i>Pachydactylus vansonii</i>	Van Son's Gecko
	Family: Lacertidae	Old World Lizards or Lacertids
?	<i>Nucras lalandii</i>	Delalande's Sandveld Lizard
	Family: Gerrhosauridae	Plated Lizards
?	<i>Gerhosaurus flavigularis</i>	Yellow-throated Plated Lizard
	Family: Scincidae	Skinks
?	<i>Acotias gracilicauda</i>	Thin-Tailed Legless Skink
*	<i>Afroablepharus wahlbergii</i>	Wahlberg's Snake-Eyed Skink
*	<i>Machlus sundevallii sundevallii</i>	Sundevall's Writhing Skink
√	<i>Trachylepis capensis</i>	Cape Skink
√	<i>Trachylepis punctatissima</i>	Speckled Rock Skink
√	<i>Trachylepis varia</i>	Variable Skink
?	<i>Scelotes mirus</i>	Montane Dwarf Burrowing Skink
	Family: Varanidae	Monitors
?	<i>Varanus niloticus</i>	Nile Monitor
	Family: Agamidae	Agamas
√	<i>Agama aculeate distant</i>	Eastern Ground Agama

	SCIENTIFIC NAME	ENGLISH NAME
	Suborder: SERPENTES	SNAKES
	Family: Typhlopidae	Blind Snakes
*	<i>Afrotyphlops bibronii</i>	Bibron's Blind Snake
	Family: Leptotyphlopidae	Thread Snakes
√	<i>Leptotyphlops scutifrons conjunctus</i>	Peter's Thread Snake
	Family: Viperidae	Adders
√	<i>Bitis arietans</i>	Puff Adder
√	<i>Causus rhombeatus</i>	Rhombic Night Adder
	Family: Lamprophiidae	
√	<i>Aparallactus capensis</i>	Black-headed Centipede Eater
?	<i>Atractaspis bibronii</i>	Bibron's Stiletto Snake
?	<i>Homoroselaps lacteus</i>	Spotted Harlequin Snake
√	<i>Boaedon capensis</i>	Common House Snake
?	<i>Lycodonomorphus inornatus</i>	Olive Ground Snake
?	<i>Lycodonomorphus laevisissimus</i>	Dusky-Bellied Water Snake
√	<i>Lycodonomorphus rufulus</i>	Brown Water Snake
*	<i>Lycophidion capense</i>	Cape Wolf Snake
?	<i>Psammophis brevirostris</i>	Short-snouted Grass
√	<i>Psammophis crucifer</i>	Cross-Marked Grass Snake
*	<i>Psammophylax rhombeatus</i>	Spotted Grass Snake
?	<i>Psammophylax tritaeniatus</i>	Striped Grass Snake
?	<i>Amplorhinus multimaculatus</i>	Many-Spotted Snake
√	<i>Duberria lutrix</i>	Common Slug Eater
√	<i>Pseudaspis cana</i>	Mole Snake
	Family: Elapidae	Cobras, Mambas and Others

	SCIENTIFIC NAME	ENGLISH NAME
?	<i>Elapsoidea sundevallii</i>	Sundevall's Garter Snake
√	<i>Hemachatus haemachatus</i>	Rinkhals
	Family: Colubridae	
√	<i>Crotaphopeltis hotamboeia</i>	Red-Lipped Snake
√	<i>Dasypeltis scabra</i>	Rhombic Egg Eater
	CLASS: AMPHIBIA	AMPHIBIANS
	Order: ANURA	FROGS
	Family: Pipidae	Clawed Frogs
√	<i>Xenopus laevis</i>	Common Platanna
	Family: Bufonidae	Toads
√	<i>Sclerophrys gutturalis</i>	Guttural Toad
√	<i>Sclerophrys capensis</i>	Raucous Toad
?	<i>Vandijkophrynus garipeensis</i>	Karoo Toad
?	<i>Sclerophrys pusilla</i>	Flat-Backed Toad
√	<i>Schismaderma carens</i>	Red Toad
	Family: Hyperoliidae	Reed Frogs
√	<i>Kassina senegalesis</i>	Bubbling Kassina
*	<i>Semnodactylus wealii</i>	Rattling Frog
	Family: Microhylidae	Rain Frogs
?	<i>Breviceps mossambicus</i>	Mozambique Rain Frog
	Family Phrynobatrachidae	Puddle Frog
√	<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog
	Family: Ptychadenidae	Grass Frogs
*	<i>Ptychadena porosissima</i>	Striped Grass Frog
	Family: Pyxicephalidae	

	SCIENTIFIC NAME	ENGLISH NAME
√	<i>Amietia delalandii</i>	Common River Frog
*	<i>Strongylopus fasciatus</i>	Striped Stream Frog
*	<i>Strongylopus grayii</i>	Clicking Stream Frog
√	<i>Cocosternum boettgeri</i>	Boettger's Caco
?	<i>Cocosternum nanum nanum</i>	Bronze Caco
?	<i>Cocosternum nanum parvum</i>	Mountain Caco
√	<i>Tomopterna cryptotis</i>	Tremolo Sand Frog
√	<i>Tomopterna natalensis</i>	Natal Sand Frog
?	<i>Tomopterna tandyi</i>	Tandy's Sand Frog

Systematic arrangement and nomenclature according to Bates, *et.al* (2014) & Du Preez & Carruthers (2017).

Red Data species rankings as defined in Branch, 'The Conservation Status of South Africa's threatened Reptiles': 89 – 103. In: G.H. Verdoorn & J. le Roux (editors), 'The State of Southern Africa's Species (2002) and Minter, *et.al*, Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (2004) are indicated in the first column: **CR**= Critically Endangered, **En** = Endangered, **Vu** = Vulnerable, **NT** = Near Threatened, **DD** = Data Deficient. All other species are deemed of **Least Concern**.

Table 6: Reptile and amphibian species positively confirmed on the study site, observed indicators and habitat.

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
<i>Cocosternum boettgeri</i>	Boettger's Caco	Vocalising of males	Aquatic habitat

The Boettger's caco listed in Table 6 should be common on the study site and elsewhere in its range.

6. FINDINGS AND POTENTIAL IMPLICATIONS

The route for the proposed powerline contains two of the four natural herpetofauna habitats, namely terrestrial, and wetlands. It is characterized by invasive plants, diggings, a gravel road, railway line, power lines, fences and is overgrazed.

Species richness: Due to the presence of only two of the four habitat types, the disturbed nature of the site as well as the small size, the study site has a poor number of (58) possible herpetofauna species. It must be emphasized that the species richness is for the general area and NOT for the study site itself.

Endangered species: No Red Data herpetofauna species should occur at Alternative1 or 2.

Sensitive species and/or areas (Conservation ranking):

The man-made diggings filled with water is ecological important. Such an aquatic habitat is deemed to have a *medium* sensitivity.

Habitat(s) quality and extent: The route of the intended powerline has invasive plants, diggings, gravel road, railway line, power lines, wire fences and overgrazing.

Impact on species richness and conservation: The proposed Reabetswe 132kV Chikadee Powerline will have a lasting, but not a significant effect on herpetofauna species richness and conservation. The proposed development will enlarge the footprint of the existing power line network whereas the existing road along the railway line will carry more vehicles.

Connectivity: Due to a gravel road and a railway line, connectivity is poor to the north of the study site. South of the study site is the connectivity very good.

Management recommendation: Nil.

General: From a herpetofauna perspective, there is no objection against the development.

6.1 Conservation status ranking:

The conservation status (see Section 4.4) of the strip of land to be affected by either of the two new high-tension powerline routes under consideration is similar and ranked as “**Medium-low, i.e. Land on which small sections could be considered for conservation but where the area in general has little conservation value**”. There exists no environmental consideration that favours one over the other from the perspective of conservation.

The major consideration for this ranking is the fact that the site is ‘natural’ in character but has been grazed for many decades with concomitant ecological changes.

6.2 Significance (Consequence) ranking:

See Section 4.6 (Significance (Consequence) Rankings) for the procedure to calculate ranking values.

Table 7: The impact of the proposed powerline crossings

<p>Nature: The ecological conservation status of the route is rated as “medium-low”. Environmental impact will only be during construction of the towers and stringing the overhead wires, thereafter ecological rehabilitation will be influenced by adjoining natural areas and land-use practices will continue as presently.</p>

No special precautionary measures are, in our opinion, will be necessary.

In view of the need and nature of the intended development, no mitigation measures are possible.

	Without mitigation	With mitigation
CONSTRUCTION PHASE		
Probability	Almost certain	4
Duration	Short term	2
Extent	Site bound	1
Reversability	Completely reversible	1
Magnitude	Minor	1
Significance		20
Status (positive or negative)	Positive	
OPERATIONAL PHASE		
Probability	Almost certain	4
Duration	Permanent	5
Extent	Local	1
Reversability		1
Magnitude	Minor	1
Significance		32
Status (positive or negative)	Positive	
Reversibility	To avoid reversal of the rehabilitation, active conservation will be required.	
Irreplaceable loss of resources?	The intention is to avoid loss of important resources and functions	
Can impacts be mitigated?	No, only improved	
Mitigation: <ul style="list-style-type: none"> Rehabilitation will depend on effort and resources invested, and permanence will require continued conservation endeavours. 		
Cumulative impacts: Considerable should habitats and connectivity are fully restored.		
Residual Risks: None		

Table 8: Impact assessment – Avifaunal habitat loss

Nature: Avian habitats will be lost in the areas cleared for the substation and servitude involved in this project. In the case of the Reabetswe power line, this impact will be of low severity on account of the small area involved and disturbed nature of the habitats. Additional habitat loss may occur during the construction phase.				
	Without mitigation		With mitigation	
CONSTRUCTION PHASE				
Probability	Highly probable	4	Probable	3
Duration	Short term	2	Short term	2
Extent	Limited to Site	1	Limited to Site	1
Magnitude	Low	2	Low	1
Significance	Low	20	Low	12
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Probable	3	Improbable	2
Duration	Long-term	4	Long-term	4
Extent	Limited to Route	1	Limited to Route	1
Magnitude	Low	1	Low	1
Significance	Low	18	Low	12
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			
Mitigation:				
<ul style="list-style-type: none"> • Minimize areas cleared for towers, construction activities and access roads, and as far as possible use existing roads • Restrict construction activities to area directly below power line 				
Cumulative impacts: Will result in additional loss of habitat in an area that is already highly transformed.				
Residual Risks: None anticipated provided that the mitigation measures are implemented correctly.				

Table 9: Impact assessment – Avifaunal disturbance

Nature: The presence of vehicles and personnel during construction will create disturbance for birds along the route of the proposed line. This disturbance will be most likely manifested through increased stress levels modulated by the stress hormone corticosterone, with consequences for breeding success, immune function and foraging. Further disturbance will occur during the operational phase as a consequence of routine maintenance, but the magnitude of this impact will be lower than during the construction phase.				
	Without mitigation		With mitigation	
CONSTRUCTION PHASE				
Probability	Highly probable	4	Probable	3
Duration	Short term	2	Short term	2
Extent	Limited to Site	1	Limited to Site	1
Magnitude	Low	2	Low	2
Significance	Low	20	Low	15
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Improbable	2	Very improbable	1
Duration	Permanent	5	Permanent	5
Extent	Limited to Route	1	Limited to Route	1
Magnitude	Low	1	Low	1
Significance	Low	14	Low	7
Status (positive or negative)	Negative		Negative	
Reversibility	Moderate		Moderate	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			
Mitigation:				
<ul style="list-style-type: none"> • Construction workers must be instructed to minimise disturbance of birds at all times. • Illegal hunting of birds must be strictly prevented • All construction and maintenance should take place as per Eskom Transmission's environmental best practice standards. 				
Cumulative impacts: Construction activities, and to a lesser extent maintenance activities thereafter, will increase overall levels of human disturbance along the power line route.				
Residual Risks: None anticipated provided that the mitigation measures are implemented correctly.				

Table 10: Impact assessment – Avian collisions

Nature: Avian mortalities and injuries as a result of birds colliding with power lines while in flight.				
	Without mitigation		With mitigation	
CONSTRUCTION PHASE				
Probability	Probable	3	Very improbable	2
Duration	Short term	2	Short term	2
Extent	Limited to Route	1	Limited to Route	1
Magnitude	Low	2	Low	1
Significance	Low	15	Low	8
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Probable	3	Improbable	2
Duration	Permanent	5	Permanent	5
Extent	Limited to Site	1	Limited to Site	1
Magnitude	Low	2	Low	2
Significance	Low	24	Low	16
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			
Mitigation:				
<ul style="list-style-type: none"> Given the very short length of the proposed in/out lines, and their proximity to the existing lines, the installation of bird flight diverters is not deemed necessary for the proposed Reabetswe lines. 				
Cumulative impacts: Collisions caused by power lines have had devastating impacts on the populations of a number of threatened bird species, but the risk posed by the proposed Reabetswe powerline is unlikely to be significant.				
Residual Risks: None.				

Table 11: Impact assessment - Electrocutions

Nature: Avian mortalities and injuries as a result of birds creating short circuits between live wires, or between live wire and tower. Risk generally significant for 132 kV lines.				
	Without mitigation		With mitigation	
CONSTRUCTION PHASE				
Probability	Improbable	2	Improbable	1
Duration	Short term	2	Short term	2
Extent	Limited to Route	1	Limited to Route	2
Magnitude	Low	4	Low	4
Significance	Low	14	Low	8
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Probable	2	Improbable	1
Duration	Permanent	5	Permanent	5
Extent	Limited to Route	1	Limited to Route	1
Magnitude	Moderate	3	Low	3
Significance	Low	18	Low	9
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			
Mitigation:				
<ul style="list-style-type: none"> • Electrocutions are likely on 132 kV towers. In the interests of preventing short circuits caused by excreta, it is recommended that standard Eskom Bird Guards be fitted to all towers in the proposed line. 				
Cumulative impacts: Electrocutions are likely to be a cause of avian mortality unless adequately mitigated, and have contributed significantly to the declines of some threatened species.				
Residual Risks: None.				

Table 12: Impact assessment – Electromagnetic fields

Nature: There is some evidence that the electromagnetic fields generated by power lines have negative effects on avian breeding, as well as on the ability of migrants to navigate				
	Without mitigation		With mitigation	
CONSTRUCTION PHASE				
Probability	Very Improbable	1	Very Improbable	1
Duration	Short term	1	Short term	1
Extent	Limited to Route	1	Limited to Route	1
Magnitude	Low	2	Low	2
Significance	Low	4	Low	4
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Improbable	2	Improbable	2
Duration	Permanent	5	Permanent	5
Extent	Limited to Route	1	Limited to Route	1
Magnitude	Low	2	Low	2
Significance	Low	16	Low	16
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	No			
Mitigation:				
<ul style="list-style-type: none"> • None necessary beyond installation of insulators and shielding following Eskom’s standard guidelines for best practice. 				
Cumulative impacts: Will contribute to widespread EMFs generated by electrical infrastructure. Evidence of negative impacts is limited.				
Residual Risks: None.				

7. LIMITATIONS, ASSUMPTIONS AND GAPS INFORMATION

The Limosella team has sufficient experience and ample access to information sources to confidently compile lists of biota such as presented herein to support conclusions and suggested mitigation measures based on a site visit. In instances where doubt exists, a species is assumed to be a possible occupant (viz. *Suncus* species); -this approach renders the conclusions to be robust. In instances where the possible occurrence has significant ecological implications, an intensive survey is recommended. In view of the latter, it is highly unlikely whether an intensive survey to augment this site visit will add significantly to the data base, and the additional costs are unlikely to warrant the effort.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. Limosella team can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

8. CONCLUSIONS

The footprint of the new Reabetwe substation will be very small (< 1 acre) relative to the adjoining natural terrain, and the environmental loss is thus insignificant and its affect will be benign. The short (90 meters) new in and out powerlines will cross relatively unaltered grassland, but will have no environmental effect once commissioned.

We are of opinion that the conservation status of predominantly terrestrial and small manmade wetland habitats along both the routes under consideration can be rated as “**Medium-low, i.e. Land on which small sections could be considered for conservation but where the area in general has little conservation value**” (See Section 4.4 and 6.1).

In spite of a moderate significance rating (32%) (See Sections 4.6 and 6.2), we are of opinion that the operational in and out powerlines will in fact have no environmental impact. A powerline is a formidable and highly visual structure, but in essence it has no impact on the environment once rehabilitation and ecological processes revert the affected areas to it former status.

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