Eskom Holdings Limited
Eskom Transmission Division

PROPOSED ESTABLISHMENT OF THE ANDERSON-DINALEDI 400 kV TRANSMISSION LINE BETWEEN THE PROPOSED NEW ANDERSON SUBSTATION (FLORA PARK) AND THE DINALEDI SUBSTATION (BRITS)



FLORA AND FAUNA ASSESSMENT



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EXECUTIVE SUMMARY

Flora and Fauna surveys were carried out in October 2010, February 2011 and August 2012 to determine the impacts of the proposed construction of a new 400kV Transmission Line as part of Eskom Holdings Limited Tshwane Strengthening Scheme Project. The proposed transmission line will be constructed in Madibeng Local Municipality (North West) and the City of Tshwane Local Municipality (Gauteng). During the field surveys, it was observed that the majority of the survey area (with the exception of Magaliesberg Protected Natural Environment (MPNE)) had been transformed through agriculture, formal settlements and other forms of infrastructure development, such as powerlines, roads and Telkom lines. The three alternative routes incorporate habitat units that would support a variety of both floral and faunal biodiversity, particularly along the MPNE and riparian habitats.

According to North West State of Environment Report, the North West Province encloses the Grassland Biome and the Savanna Biome. The study area falls within the following vegetation types: Andesite Mountain Bushveld; Gauteng Shale Mountain Bushveld; Gold Reef Mountain Bushveld; Marikana Thornveld; Moot Plains Bushveld and Norite Koppies Bushveld. According to South African National Biodiversity Institute data, Magaliesberg Pretoria Mountain Bushveld, Marikana Bushveld and Witwatersberg Pretoria Mountain Bushveld are listed as threatened terrestrial ecosystems occurring on site.

The proposed transmission lines will traverse the Magaliesberg mountain range, which is a unique mountain range of great ecological, geological and cultural importance and value. In order to preserve this unique area, a section of the Magaliesberg was proclaimed a Protected Natural Environment (PNE) in Administrator's Notice 126 of 4 May 1994 in accordance with section 16 of the Environment Conservation Act, 1989 (Act 73 of 1989). The two provincial departments responsible for controlling and managing the MPNE are the North West Department of Agriculture, Conservation and Environment (NW-DACE) and Gauteng Department of Agriculture, and Rural development (GDARD).

Two Red Data plant species, *Hypoxis hemerocallidea* (Star-flower or African potato) and *Boophane disticha* (Sore-eye flower) were observed in abundance on the study site. These species are listed as ***Declining*** and will have to be relocated to another area of the same habitat during construction. GDARD has developed a Plant and Rescue Policy which deals specifically with the management of Orange listed species and medicinal plants and this

policy should be adopted during the construction of the transmission line. Exotic plant species *Melia azedarach* (Syringa trees), *Lantana camara* (Common lantana) and *Solanum mauritianum* (Bugweed) were common at the site. Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of the invader species be eradicated.

According to National Forests Act 1998 (Act No 84 of 1998), the protected trees that have a geographical distribution that includes the study site are *Acacia erioloba, Boscia albitrunca, Combretum imberbe, Pittosporum viridiflorum, Prunus africana* and *Sclerocarya birrea* subsp *caffra*. Only one protected tree was recorded (*Sclerocarya birrea* subsp *caffra).* Under the Act, *"No person may (a) cut, disturb, damage, destroy or remove any protected tree; or (b) collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister."* The Act does not distinguish between dead and live trees, and so removal of dead wood is also against the law.

Mammals are sensitive to disturbances and habitat destruction and degradation. As such more mammal species would occur on or near the MPNE than near the residential areas. Thirteen mammals were recorded in the study area and records of certain species including Black-backed Jackal and Honey Badger were based on anecdotal information provided by the land owners of affected properties. No sensitive or endangered mammals were visually recorded during the site visits.

In terms of avifauna, the study area falls within the Magaliesberg and Witwatersberg (ZA018) Important Bird Area (IBA). IBAs form a network of sites, at a biogeographic scale, which are critical for the long-term viability of naturally occurring bird populations. The MPNE provides a suitable habitat for Red data bird species that are known to occur in the area. Cape Vultures and eagles are known to occur in the MPNE.

Of the three proposed routes, the Eastern route is regarded as the route alternative that would pose the greatest threat to the overall biodiversity of the area during construction of the proposed transmission line as it traverses through the sensitive areas such as MPNE, and the number of Orange Listed plant species recorded on this route were higher than the other route alternatives. The preferred route in terms of flora and fauna sensitivity would be the Western Route-Western deviation, as most parts of the route are along the main road and existing powerline and are considered less sensitive than the alternative routes in terms

of biodiversity. Resident birds in an area become accustomed to a power line that crosses their flight paths, and learn to avoid it during their everyday activities and hence adding a new power line adjacent to an exisiting line would probably have less impact than putting it in totally new area, where the resident birds are not tey accustomed to overhead lines.The use of existing degraded habitat is preferable and habitat units known to be highly productive in supporting breeding, foraging and roosting sites, such as wetlands and ridges should be avoided.

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QUALITY VERIFICATION

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1. INTRODUCTION

Eskom Holdings Limited is proposing the construction of a new 400kV Transmission Line, and a proposed new 400kV Substation as part of their Tshwane Strengthening Scheme Project. The proposed transmission line will be approximately 40km in length and will run between the proposed new Anderson Substation to the existing Dinaledi Substation which is located approximately 8km North East of Brits. The proposed transmission line will be constructed in two Municipal Areas: Madibeng Local Municipality (North West) and the City of Tshwane Local Municipality (Gauteng).

Nemai Consulting was appointed by Eskom as the independent Environmental Assessment Practitioner (EAP) to undertake Environmental Impact Assessment for the proposed transmission lines. Flora and Fauna surveys were carried out to determine the impacts of the proposed transmission line on the receiving environment. The objective of the Flora and Fauna assessment was to identify sensitive species and their habitats in three proposed alternative routes. The current ecological status and conservation priority of vegetation on the sites were assessed. Potential faunal habitats were assessed in the study area and all mammals and birds found occurring on sites were recorded. Red Data species that are known to occur on sites were also investigated.

The North West Province covers approximately 11,632,000 ha (North West Province State of the Environment Report, 2003). Land use in the North West Province mainly comprises of agriculture, mining, conservation, industrial, commercial, recreational and residential uses. The study area for the proposed transmission line route alternatives is mainly used for agriculture, conservation and tourism, commercial, recreational and residential purposes as well as some vacant land that is not being used at present.

The proposed transmission lines will traverse through the Magaliesberg mountain range, which is a unique mountain range of great ecological, geological and cultural importance and value. In order to preserve this uniqueness of the mountain, a section of the Magaliesberg was proclaimed a Protected Natural Environment (PNE) in Administrator's Notice 126 of 4 May 1994 in accordance with section 16 of the Environment Conservation Act, 1989 (Act 73 of 1989). The two provincial departments responsible for controlling and managing the Magaliesberg Protected Natural Environment (MPNE) are the North West Department of Agriculture, Conservation and Environment (NW-DACE) and Gauteng Department of Agriculture, and Rural development (GDARD).

The study area falls within the Magaliesberg & Witwatersberg Important Bird Area (ZA018) (Barnes, 1998). Important Bird Areas (IBAs) are considered key areas of bird conservation and require protection against unlawful developments and unsustainable development.

This document reports on the findings of field surveys that were undertaken in October 2010, February 2011 and August 2012.

1.1. Objectives of the survey

- To apply relevant literature to determine the diversity and eco-status of the plants, mammals, and birds at the three proposed alternative sites;
- To carry out field surveys to gain an indication of the diversity and eco-status of the above-mentioned taxa which inhabit the proposed study area, as well as the presence of unique habitats that might need further investigation or protection;
- To assess the current habitat and conservation status of plant and animal species in the study sites;
- To comment on ecological sensitive species/areas;
- To assess the possible impacts of the proposed project on these taxa and/or habitats;
- To list the species on site and to recommend necessary mitigation measures in case of occurrence of endangered, vulnerable or rare species or any species of conservation importance;
- To recommend any suitable buffer zones; and
- To provide management recommendations to mitigate negative and enhance positive impacts of the proposed Anderson-Dinaledi transmission lines.

2. RELEVANT LEGISLATION AND GUIDELINES

The following pieces of legislation are relevant to this project.

- Nature Conservation Ordinance, Ordinance 19 of 1974;
- National Parks Act, 1976 (Act 57 of 1976);
- Conservation of Agricultural Resources Act (Act 43 of 1983);
- Environment and Conservation Act (Act 73 of 1989);
- The Constitution, 1996 (Act 108 of 1996) – Section 24;
- The white paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997);

- National Environmental Management Act (Act 107 of 1998);
- National Forests Act (Act No 84 of 1998);
- National Veld and Forest Fire Act (Act 101 of 1998);
- National Environmental Management: Protected Areas Act (Act No 57 of 2003);
- GDARD Plant Rescue Scheme 2006, (amended 2008);
- GDARD Ridge Guidelines September 2001 (as reviewed and updated in January 2004 and April 2006);
- North West Province Biodiversity Conservation Assessment Technical Report Version 1.2 (2009);
- GDARD Minimum Requirements for Biodiversity Assessments (2009);
- Gauteng Conservation Plan version 3.3; and
- National Environmental Management Biodiversity Act (Act 10 of 2004).

3. STUDY AREA

The proposed transmission line will be approximately 40km in length. It will run between the proposed new Anderson Substation to the existing Dinaledi Substation. The Dinaledi Substation is located on Portion 843 of the Farm Roodekopjes of Zwartkopjes 427 JQ, which is located approximately 8km North East of Brits. Three alternative powerline routes have been identified (refer to the locality map, **Figure 1**). A 1km area has been placed around each alternative route, to form the study area/corridor. The proposed transmission lines are situated within the 2527DB and 2527DD quarter degree grid cells (q.d.g.c) within the Gauteng and North West Provinces.

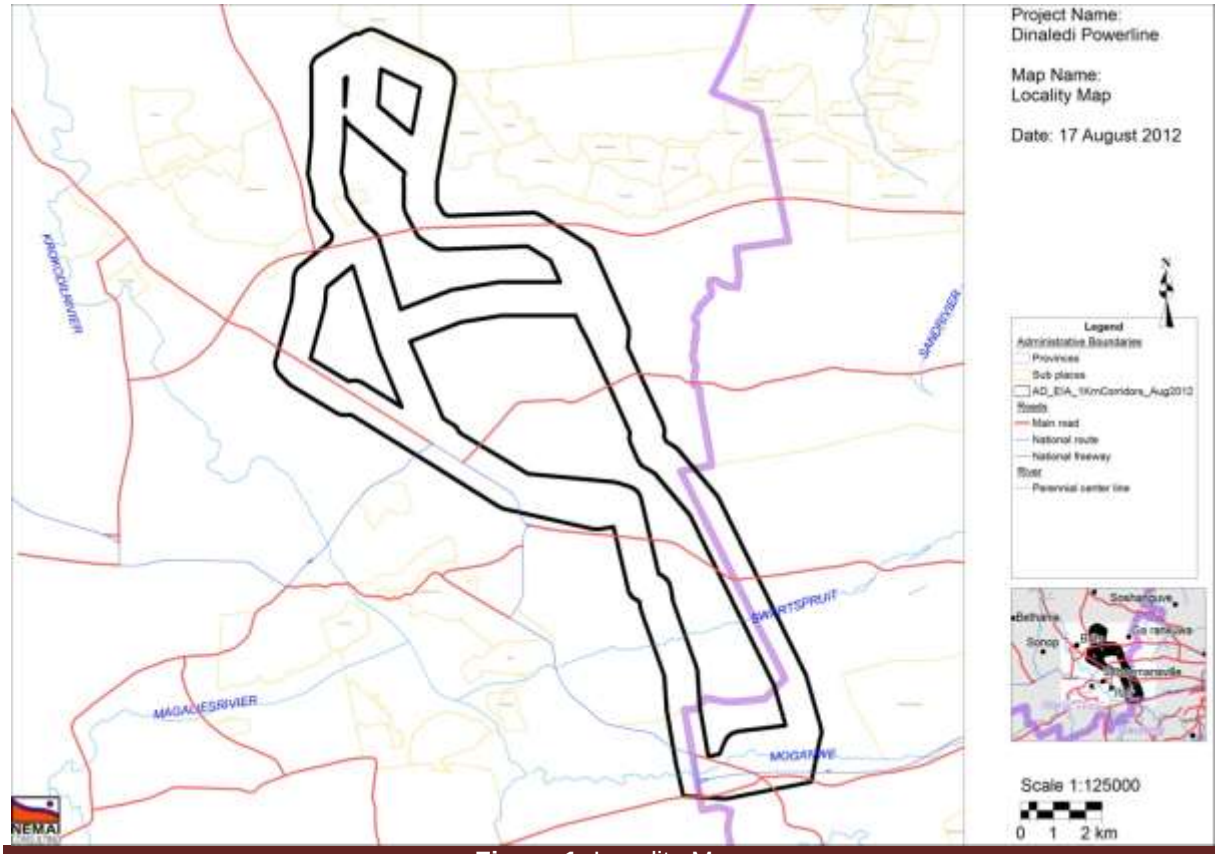

Figure 1. Locality Map

The majority of the proposed transmission alternative routes incorporate an area that forms part of the Magaliesberg rocky ridge system that runs roughly in an east-west direction. The quartzite ridges of Gauteng are one of the most important natural assets in the northern provinces of South Africa. These ridges support a wide diversity of fauna and flora species, some of which are on the Red Data List, rare or endemic. Various other important ecological functions are fulfilled by ridges, particularly important is the recharging of groundwater. Wetlands and rivers along the ridges act as migratory corridors for mobile faunal species and provide essential habitat for pollinators. The ridges also provide a socio-cultural function in that they provide aesthetically pleasing environments that are valued by residents, tourists and recreational users (Pfab, 2001).

Ridges are specialized by high spatial heterogeneity due to the range of differing aspects (north, south, east, west and variations thereof), slopes and altitudes resulting in differing soil characteristics (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions (Samways & Hatton, 2000). Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes (Lowrey & Wright, 1987). Variations in aspect, soil drainage (Burnett *et al*., 1998) and elevation/altitude (Primack, 1995) have been

found to be especially important predictors of biodiversity. According to Tshwane Open Space Framework (2005), Seventy four (74%) percent of the twenty-two (22) globally threatened plant species occur on the ridges and hills of Gauteng, while at least three (3) threatened mammal species, several bird species of conservation concern, three (3) rare reptile species and a Red Data Butterfly inhabit ridges.

All ridges in Gauteng have been classified into four classes (**Table 1**) based on the percentage of the ridge that has been transformed (mainly through urbanization) using the 1994 CSIR/ARC Landcover data. The study area falls within Class 2 of the Gauteng ridges (Gauteng C-Plan 3.3), as indicated in **Figure 2.**

Table 1. Four classes of ridges in Gauteng Province and the percentage of transformation

Ridge type	% of Gauteng ridges	Policy
Class 1 (0-5% transformed) includes Suikerbosrand & parts of Magaliesberg	51%	(a) The consolidation of properties on Class 1 ridges is supported. (b) Further development activities and subdivisions will not be permitted on Class 1 ridges. Only low impact activities with an ecological footprint of 5% or less will be permitted in the 200 metre buffer zone of the ridge.
Class 2 (5-35% transformed) includes parts of Magaliesberg, World Heritage site, Klipriviersberg, Bronberg, Skurweberg	28%	(a) The consolidation of properties on Class 2 ridges is supported. (b) The subdivision of property on Class 2 ridges will not be permitted. Development activities and uses that have a high environmental impact on a Class 2 ridge will not be permitted. (d) Low impact development activities, such as tourism facilities, which comprise of an ecological footprint of 5% or less of the property, may be permitted. (The ecological footprint includes all areas directly impacted on by a development activity, including all paved surfaces, landscaping, and property access and service provision). (e) Low impact development activities on a ridge will not be supported where it is feasible to undertake the development on a portion of the property abutting the ridge.
Class 3 (35-65% transformed) Includes Northcliff/ Roodepoort/ Krugersdorp ridge	9%	(a) The consolidation of properties on Class 3 ridges is supported. (b) The guidelines for Class 2 ridges will be applied to areas of the ridge that have not been significantly impacted on by human activity. The guidelines for Class 4 ridges will be applied to areas of the ridge that have been significantly impacted on by human activity.
Class 4 (65-100% transformed) includes Melville Koppies &	11%	The consolidation of properties on Class 4 ridges is supported.

Ridge type	% of Gauteng ridges	Policy
Linksfield ridge		4 (b) The subdivision of property on Class 4 ridges will not be permitted in areas of the ridge where the remaining contiguous extent of natural habitat is 4ha or more. Further development activities will not be permitted in areas of the ridge where the remaining contiguous extent of natural habitat is 4ha or more.

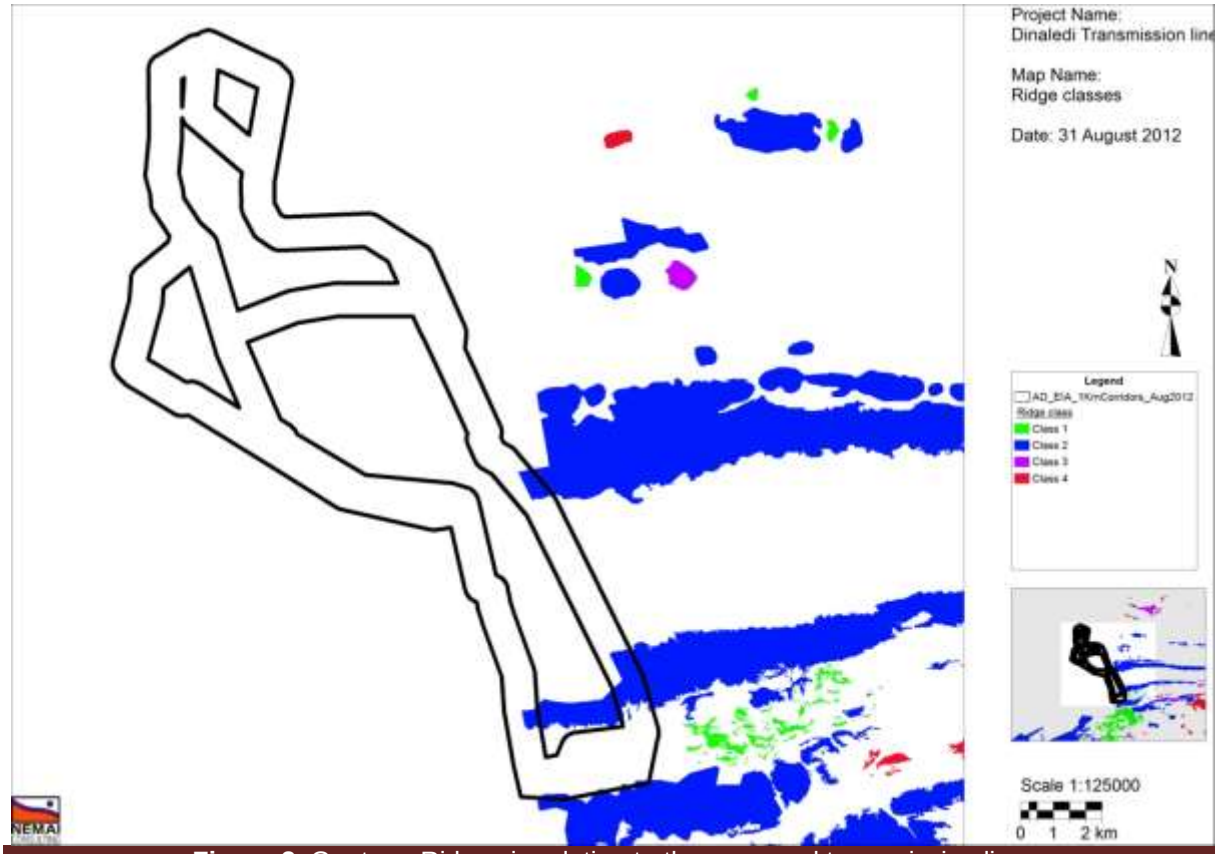

Figure 2. Gauteng Ridges in relation to the proposed transmission line

According to the North West Department of Agriculture, Conservation, Environment and Rural Development (2009), hills and ridges are identified as sensitive habitats in the existing provincial Spatial Development Framework dataset. Type 2 ridges fall within the Dinaledi transmission line route alternatives as indicated in **Figure 3**.

Figure 3. North West hills and ridges (in blue) in relation to the proposed transmission line

4. DESCRIPTIONS OF ROUTE ALTERNATIVES

Three alternative routes have been selected for this transmission line:

Eastern Route Alternative

The Eastern route alternative runs between the existing Dinaledi Substation and the proposed new Anderson Substation. The eastern route alternative originates on Portion 17 of the Schurveberg 488 JQ which is located north-east of Pelindaba. On Portion 17 the route turns in a north eastern direction and traverse Portions 81 and 112 of the Farm Schurveberg 488 JQ. From here the route runs in an eastern direction and traverse Portions 113, 114, 108, 115 and 116 of the Farm Schurveberg 488 JQ.

On Portion 116 of the Farm Schurveberg the route turns in a north eastern direction, and runs in close proximity to the boundaries of Portions 75 and 76 of the Farm Elandsfontein 352 JR for approximately 60m before turning in a northern direction on Portion 76. From here the route traverses Portions 77, 145, and 146 of the Farm Elandsfontein 352 JR. On Portion 146 the route turns slightly in a north western direction and traverse Portions 142, 141, 143, 144, 145, and 78 of the Farm Uitzicht Alias Rietvalei 314 JR. From here the route

continues in a slight north western direction and traverse Portions 65, 62, 270, and 268 of the Farm Kameeldrift 313 JR. From here the route turns further in a north western direction and traverses Portions 324 and 50 of the Farm Rietfontein 485 JQThe route continues in a north western direction and traverses Portion 44 of the Farm Schietfontein 437 JQ and turns further in a north western direction where it traverses Portions 49 and 23 of the Farm Zilkaatsnek 439 JQ. On Portion 23 the route turns in a north eastern direction and runs back to Portion 44 of the Farm Schietfontein 437 JQ. From here the route runs in a slight north western direction in close proximity to the boundary of Portion 44 and traverses Portions 71, 73, 74, 91, 16, and 13 of the Farm Schietfontein 437 JQ. From here the route turns further in a north eastern direction and traverse Portion 15 of the Farm Elandsfontein 440 JQ.

On Portion 15 the route turns in a western direction and traverse Portions 58, 63, 59 and 61 of the Farm Elandsfontein 440 JQ. On Portion 61 the route turns in a north western direction and traverses Portions 18, and 19 of the Farm Elandsfontein 440 JQ. The route turns in a northern direction and traverses Portions 44, 47, and 55 of the Farm Elandsfontein 440 JQ. On Portion 55 of the Farm Elandsfontein 440 JQ (Portion 55 of the Farm Boekenhoutfontein 44-JQ) the route turns slight north east and runs in close proximity to the boundary of Portion 55. On the northern boundary of the Portion 55, the route turns in a north western direction and traverse Portions 855, 854, 853, 852, 851, 850, 849, 848, 847, 846, 845, 844 and 843 of the Farm Roodekopjes of Zwartkopjes 427 JQ. The route terminates on Portion 843 of the Farm Roodekopjes of Zwartkopjes 427 JQ where the Dinaledi Substation is located.

This route alternative traverses the North West Province, and Madibeng Local Municipal area and the Gauteng Province and the City of Tshwane Local Municipal area.

Eastern Route Alternative Deviation

The property of the Xsrata Eland Platinum Mine is located between the Eastern and Western route alternatives. During the Eskom route selection process, one deviation was made to the Eastern Route to accommodate the Eland Platinum Mine. Various deviations were made to the Western Route Alternative which is discussed in detail in Section below. These deviations were created in order to avoid mining areas and to provide the mine with various options on how the route could traverse their property should the routes not interfere with already approved future mine expansions and to avoid traversing surfaces earmarked for future open cast mining.

The deviation to the eastern route originates on Portion 16 of the Farm Schietfontein 437 JQ where it turns from the original eastern route alternative in a north eastern direction, and then in a northern direction from where it traverses Portion 13 of the Farm Schietfontein 437 JQ. The route runs along the eastern boundary of Portion 13 for approximately 1.4km before it turns in a north western direction where it joins the original eastern route alternative on Portion 13.

The Eastern Route Alternative Deviation is located within the North West Province and the Madibeng Local Municipal area. Two properties are directly affected by this proposed route alternative.

The exisiting Lomondt De Wildt 88kV line (with a servitude of 22m) runs along a portion of the eastern route will be decommissioned in 2014. This means that that existing servitude can be used for the new Anderson-Dinaledi transmission line. The Anderson line will require a bigger servitude (i.e. 55m) however parts of the line can be located within the existing servitude.

Central Route Alternative

The Central Route Alternative originates on Portion 843 of the Farm Roodekopjes of Zwartkopjes 427 JQ where the Dinaledi Substation is located. From here it turns in a south western direction and traverses Portions 843, 844, 845, 846, 847, 848, 849, 850, 851, 853, 853, 854 and 855 of the Farm Roodekopjes of Zwartkopjes 427 JQ and Portion 17 of the Farm Elandsfontein 440 JQ. On Portion 17 the route turns in a south eastern direction and traverses Portions 18, 43, 46, 47 and 55 of the Farm Elandsfontein 440 JQ. On Portion 55 of the Farm Elandsfontein 440 JQ (Portion 55 of the Farm Boekenhoutfontein 44-JQ) the route joins the eastern route alternative.

The Central Route Alternative is located within the North West Province and the Madibeng Local Municipal area. A total of 19 properties will be directly affected by this proposed route alternative.

Western Route Alternative

The Western Route Alternative is approximately 31km in length and begins at the same position as the eastern route alternative, on Portion 25 of the Farm Welgedund 491 JQ which one of the alternative properties earmarked for substation construction. The Western Route Alternative runs between the proposed new Anderson Substation which is earmarked

for development north of Pelindaba and the existing Dinaledi Substation which is located approximately 8km north east of Brits.

The Western Route Alternative follows the Eastern Route Alternative for approximately 2.8km before it turns in a north eastern direction on Portion 82 of the Farm Weldaba 567 JQ, and traverses Portion 2 of the Farm Welgedund 491 JQ. On Portion 2, the route turns in a northern direction and runs in close proximity to the boundaries of Portions 2 and 88 of the Farm Welgedund 491 JQ.

From here the route turns in a north easterly direction and traverses Portion 59 of the Farm Rietfontein 485 JQ. On Portion 59 the route turns in a northern direction and traverses Portions 236, 237 and 67 of the Farm Rietfontein 485 JQ. On the northern boundary of Portion 67, the route turns in a north western direction and traverses Portions 218 and 108 of the Farm Rietfontein 485 JQ. On Portion 108 the route turns in a northern direction and traverses Portions 111 and 70 of the Farm Rietfontein 485 JQ. On Portion 70 the route turns in a western direction and traverses Portions 71, 57, 28, 47, and 27 of the Farm Rietfontein 485 JQ, Portions 3 and the Remaining Extent of the Farm Uitval 484 JQ, and Portions 38, 37, 35, 34, 51 and 30 of the Farm Zilkaatsnek 439 JQ. On Portion 30 the route turns in a north western direction and traverses Portions 127, 29, 52, 53, 159, 160, 134 and 108 of the Farm Zilkaatsnek 439 JQ. On Portion 108 the route turns on a northern direction and runs in close proximity to the western boundary of Portion 108 from where it traverses Portion 14 of the Farm Zilkaatsnek 439 JQ.

From here the route traverses Portion 0 (or the Remaining Extent) of the Farm Elandsfontein 440 JQ. The route turns in a north eastern direction and traverses Portion 52 of the Farm Elandsfontein 440 JQ. From here the route continues in a north eastern direction and traverses Portions 707, 0, 626, 163, 164, 165, 166, 167, 168, 169, 568, 860, and 814 of the Farm Roodekopjes of Zwartkopjes 427 JQ. On Portion 814 the route turns into an eastern direction where it traverses Portion 843 of the Farm Roodekopjes of Zwartkopjes 427 JQ. The route terminates on Portion 843 of the Farm Roodekopjes of Zwartkopjes 427 JQ where the Dinaledi Substation is located.

The Western Route Alternative is located within the North West Province and the Madibeng Local Municipal area. A total of 49 properties will be directly affected by this proposed route alternative.

Western Route Alternative deviations

As mentioned previously, the property of the Xstrata Eland Platinum Mine is located between the Eastern and Western route alternatives. During the Eskom route selection process, one deviation was made to the Eastern Route to accommodate the Eland Platinum Mine, and two of the three deviations to the Western Route alternative were made to accommodate the Eland Platinum Mine. These deviations were created in order to avoid mining areas and to provide the mine with various options on how the route could traverse their property to avoid already approved future mine expansions and surfaces earmarked for future open cast mining. The third deviation made to the Western Alternative was created as this deviation follows existing roads and powerline infrastructure.

Western Route Alternative – Deviation 1 (Western Deviation)

This deviation originates on Portion 104 of the Farm Zilkaatsnek 439 JQ from where it links from the Western Route Alternative Deviation 3 (Southern Deviation). From the point of origin, the route runs in a north western direction and traverses Portions 93, 92, 91, 90, 105, 106, 107and 85 of the Farm Hartebeesfontein 445 JQ.

From here the route traverses the suburb of Madibeng where it traverses Erf 2. From here the route traverses Portions 207, 60, 97, and 96 of the Farm Hartebeesfontein 445 JQ. On Portion 96 the route turns in an eastern direction and traverses Portion 137 of the Farm Hartebeesfontein 445 JQ. On Portion 137 the route turns in a north easterly direction and traverses Portions 101, 184, 176, 175, 174, 191, 100, and 46 of the Farm De Kroon 444 JQ. On Portion 46 the route turns in a north westerly direction and traverses Portions 231, 173, 52, 51, 122, and 121 of the Farm De Kroon 444 JQ and Portion 81 of the Farm Elandsfontein 440 JQ. On the northern boundary of Portion 81 the route turns further in a north easterly direction and traverses Portions 2, 24, 10, 64 and 0 of the Farm Elandsfontein 440 JQ. This deviation terminates on Portion 0 of the Farm Elandsfontein 440 JQ where it joins the original Western Route Alternative.

The Western Route Alternative – Deviation 1 (Western Deviation) is located within the North West Province and the Madibeng Local Municipal area. A total of 35 properties will be directly affected by this proposed route alternative.

Western Route Alternative – Deviation 2 (Eastern Deviation)

This deviation originates on Portion 14 of the Farm Zilkaatsnek 439 JQ where it links to the original Western Route Alternative. From here the route runs in an eastern direction and traverses a very small section of Portion 0 (or Remaining Extent) of the Farm Elandsfontein

440 JQ. On Portion 0 the route turns back to traverse Portion 14 of the Farm Zilkaatsnek 439 JQ and continues in an eastern direction to traverse Portions 113, 86, 88, 89, 87, 80 and 98 of the Farm Zilkaatsnek 439 JQ. On Portion 98 the route turns in a north eastern direction where it intersects with the original Eastern Route alignment on Portion 13 of the Farm Schietfontein 437 JQ and joins the Eastern Route Deviation on Portion 13 of the Farm Schietfontein 347 JQ.

The Western Route Alternative – Deviation 2 (Eastern Deviation) is located within the North West Province and the Madibeng Local Municipal area. A total of 11 properties will be directly affected by this proposed route alternative.

Western Route Alternative – Deviation 3 (Southern Deviation)

This deviation originates on Portion 70 of the Farm Rietfontein 485 JQ where it links from the original Western Route Alternative. From here the route turns in a western direction and traverses Portions 71, 186, 185, 28, 47, and 27 of the Farm Rietfontein 485 JQ and Portions 3 and Portion 0 (Remaining Extent) of the Farm Uitval 484 JQ. From here the route traverses Portions 2, 127 and 105 of the Farm Zilkaatsnek 439 JQ. On Portion 105 the route turns in a north western direction and runs in close proximity to the boundary of Portion 104 of the Farm Zilkaatsnek 439 JQ.

On Portion 104 the route turns in a northern direction where it intersects with the original Western Route Alternative on Portion 108 of the Farm Zilkaatsnek 439 JQ. The route then turns in a north eastern direction where it joins the original Western Route Alternative on Portion 108 of the Farm Zilkaatsnekl 439 JQ.

The Western Route Alternative – Deviation 3 (Southern Deviation) is located within the North West Province and the Madibeng Local Municipal area. A total of 14 properties will be directly affected by this proposed route alternative.

5. LIMITATIONS

The constraints or limitations to the survey included:

- GDARD Conservation Plan (C-Plan) version 3.3 was used with caution as it is only covers the Gauteng province;
- The majority of threatened plant species are extremely seasonal and only flower during specific periods of the year;

- The majority of threatened faunal species are extremely secretive and difficult to survey even during thorough field surveys conducted over several seasons;
- The Magaliesberg EMF was used with caution as the ground-truthing surveys do not cover the proposed study area; and
- Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage and Nemai Consulting can thus not accept responsibility for conclusions and mitigation measures made in good faith based information gathered or databases consulted at the time of the investigation.

6. VELD TYPE DESCRIPTION

The study area falls within the savanna biome (Rutherford & Westfall, 1994) and indicated in **Figure 4** below. Mucina & Rutherford (2006) classified the study area as comprised of the following vegetation type units: Andesite Mountain Bushveld, Gauteng Shale Mountain Bushveld, Gold Reef Mountain Bushveld, Marikana Thornveld, Moot Plains Bushveld, and Norite Koppies Bushveld, as indicated in **Figure 5**.

Figure 4. Biome in the study area

Figure 5. Vegetation units found in the study area

Landscape character and conservation status associated with each of the vegetation types are tabled below (**Table 2**):

Table 2. Vegetation types found in the study area with associated landscape and conservation status

Vegetation Type	Associated Landscape Character	Conservation Status
Andesite Mountain Bushveld	Undulating landscape with hills and valleys.	Least Threatened
Gauteng Shale Mountain Bushveld	Low broken ridges varying in steepness with high surface rock cover.	Vulnerable
Gold Reef Mountain Bushveld	Rocky hills and ridges often west-east trending.	Least Threatened
Marikana Thornveld	Valleys and slightly undulating plains with some low hills.	Endangered
Moot Plains Bushveld	Plains and some low hills.	Vulnerable
Norite Koppies Bushveld	Plains, koppies and noritic outcrops.	Least Threatened

6.1 Andesite Mountain Bushveld

The Andesite Mountain Bushveld occurs in four provinces: Gauteng, North-West, Mpumalanga and Free State. Its altitude varies between 1 350 – 1 800 metres. It is a dense, medium-tall thorny bushveld with a well developed grass layer on slopes and some valleys in an undulating landscape. Mean Annual Precipitation ranges between 550 mm in the southwest to about 750 mm in the northeast. Frost is frequent in winter but less on the ridges and hills than in flat areas (Mucina & Rutherford 2006).

Conservation status

Currently this vegetation unit is considered to be ***Least threatened*** with a conservation target of 24%. About 7% is statutorily conserved mainly in the Suikerbosrand Nature Reserve and the MPNA. An additional 1–2% is conserved in other reserves mainly in the Hartbeesthoek Radio Astronomy Observatory. Some 15% is already transformed, mainly due to cultivation and some urban development (Mucina & Rutherford 2006).

6.2 Gauteng Shale Mountain Bushveld

This vegetation unit occurs in Gauteng and North-West provinces. It is distributed mainly on the ridge of the Gatsrand south of Carletonville, Westonaria and Lenasia. It also occurs as a narrow band along the ridge that runs from a point between Tarlton and Magaliesberg in the west, through Sterkfontein, Pelindaba, Atteridgeville to Klapperkop and south-eastern Pretoria in the east. The altitude varies from 1 300–1 750 m (Mucina & Rutherford 2006).

Gauteng Shale Mountain Bushveld occurs on low broken ridges varying in steepness and generally with a high surface rock cover. The vegetation is a short (3 – 6 m), semi-open thicket, dominated by a variety of woody species such as *Acacia caffra*, *Rhus leptodictya*, *Cussonia spicata* and *Englerophytum magalismontanum*. The understory is dominated by a variety of grasses such as *Cymbopogon pospischilii*) and *Digitaria eriantha.* (Some of the ridges form plateaus that carry scrubby grassland. The geology consists of shale and andesite from the Pretoria group (Transvaal supergroup) (Mucina & Rutherford 2006).

Conservation status

Currently this vegetation unit is considered to be ***vulnerable***. Less than 1% is statutorily conserved in nature reserves, including, the Skanskop and Hartbeesthoek Nature Reserves, Magaliesberg Nature Area and Groenkloof National Park. Additionally, over 1% is conserved in other reserves including the John Nash Nature Reserve, Cheetah Park and Hartbeesthoek Radio Astronomy Observatory. About 21% is transformed mainly by urban

development, mines and quarries, agriculture and plantations. Wattles are a common invasive plant in places (Mucina & Rutherford 2006).

6.3 Gold Reef Mountain Bushveld

The Gold Reef Mountain Bushveld occurs mostly on rocky hills and ridges that are often west-east facing slopes. It occurs along a thin band of east-west running quartzite ridges located south of the Pilanesberg National Park. The tree and shrub layers are typically continuous with a herbaceous layer dominated by grasses. The endemic succulent shrub *Aloe peglera* and the succulent herb *Frithia pulchra* are represented in this vegetation type. Some of the representative tree species include: *Cathium gilfilanii, Mystroxylon aethiopicum, Acacia caffra, Protea caffra*. The herbs include the *Helichrysum nudifolium, Pellaea calomelanos* and *Senecio venosus* (Mucina & Rutherford 2006).

Conservation status

The vegetation type is listed as ***least threatened*** with approximately 22% of the 24% conservation target conserved in the Rustenburg, Wonderboom and Suikerbosrand Nature Reserves.

6.4 Marikana Thornveld

Marikana thornveld occurs at an altitude between 1050 m and 1450 m. It is described as open *Acacia karroo* woodland, occurring in valleys and slightly undulating plains with some lowland hills. Shrubs are denser along drainage lines, on termitaria and rocky outcrops or in other habitats protected from fire. The climate is moderate and this is a strongly seasonal summer-rainfall region with very dry winters. The mean annual precipitation is 600 – 700 mm with incidence of frost frequent in winter (Mucina & Rutherford, 2006).

Conservation status

The conservation status of this vegetation type is ***endangered***, with 48% transformed and industrial development is a major threat to the remainder. Its conservation target is 19%, with less than 1% of it statutorily conserved in the Magaliesberg Nature Area and Onderstepoort Nature Reserve. More than 48% has already undergone transformation due to cultivation, mines, and building of roads. Agricultural and industrial developments are a threat of land transformation. Alien invasive plants occur in high densities particularly along drainage lines (Mucina & Rutherford, 2006).

6.5 Moot Plains Bushveld

Moot Plains Bushveld occurs in North-West and Gauteng Provinces and the main belt occurs immediately south of the Magaliesberg from the Selons River Valley in the west through Maanhaarrand, filling the valley bottom of the Magalies River, proceeding east of the Hartebeestpoort Dam between the Magaliesberg and Daspoort mountain ranges to Pretoria. It also occurs as a narrow belt immediately north of the Magaliesberg from Rustenburg in the west to just east of the Crocodile River in the east: also south of the Swartruggens–Zeerust line (Mucina & Rutherford 2006).

Conservation status

Currently this vegetation type is considered ***Vulnerable*** with a conservation target of 19%. Some 13% is currently statutorily conserved mainly in the Magaliesberg Nature Area. About 28% is transformed mainly by cultivation, and development of urban and built-up areas. There are scattered occurrences of sometimes dense patches of various alien plants such as *Cereus jamacaru, Eucalyptus* species*, Jacaranda mimosifolia, Lantana camara, Melia azedarach* and *Schinus* species. Erosion is mainly very low to low or moderate in some areas (Mucina & Rutherford 2006).

6.6 Norite Koppies Bushveld

The Norite Koppies Bushveld occurs in North-West and Gauteng Provinces and is embedded in Marikana Thornveld, north of the Magaliesberg, on rocky hills between Rustenburg and Pretoria with the highest hills (e.g. Kareepoortberg) near Brits. The altitude is about 1 100–1 350 m (Mucina & Rutherford 2006).

Conservation status

Norite Koppies Bushveld is listed as ***Least threatened*** with a conservation target of 24%. None is conserved in statutory reserves but 4% is conserved in De Onderstepoort Nature Reserve. About 10% is transformed especially at the unit fringes, mainly by mining as well as urban and built-up developments and cultivated areas. Mining is primarily through granite quarries on koppies, but also affects surrounding lower-lying areas. Areas close to human settlements are often severely disturbed and many woody species may have been harvested from these areas for fuel or building materials. Weeds, including a number of declared aliens, are common in these disturbed sites (Mucina & Rutherford 2006).

7. DESCRIPTION OF CBA'S FOR THE NORTH WEST PROVINCE

Critical Biodiversity Areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI, 2007). These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making tools. The primary purpose of CBA's is to inform land-use planning and the land-use guidelines attached to CBA's aim to promote sustainable development by avoiding loss or degradation of important natural habitat and landscapes in these areas and the landscape as a whole. CBA's can also be used to inform protected area expansion and development plans. The use of CBA's here follows the definition laid out in the guideline for publishing bioregional plans (Anon, 2008):

"Critical biodiversity areas (CBAs) are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses".

"Ecological support areas (ESA's) are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas."

The guideline for bioregional plans defines three basic CBA categories based on three high-level land management objectives which were adapted for the North West Province (**Table 3**).

Table 3: A framework for linking spatial planning categories (CBAs) to land-use planning and decision-making guidelines based on a set of high-level land biodiversity management objectives. Adapted from the guideline for bioregional plans (Anon, 2008).

CBA category	Land Management Objective
PA & CBA 1	**Natural landscapes**: • Ecosystems and species fully intact and undisturbed • These are areas with high irreplaceability or low

CBA category	Land Management Objective
	flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. • These are landscapes that are at or past their limits of acceptable change
CBA 2	**Near-natural landscapes**: • Ecosystems and species largely intact and undisturbed. • Areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets. • These are landscapes that are approaching but have not passed their limits of acceptable change.
Ecological Support Areas (ESA)	**Functional landscapes**: • Ecosystems moderately to significantly disturbed but still able to maintain basic functionality. • Individual species or other biodiversity indicators may be severely disturbed or reduced. • These are areas with low irreplaceability with respect to biodiversity pattern targets only.
Other Natural Areas (ONA) and Transformed	**Production landscapes**: manage land to optimize sustainable utilization of natural resources.

The study area has been given a CBA 1 and CBA 2 status as indicated in **Figure 6** below.

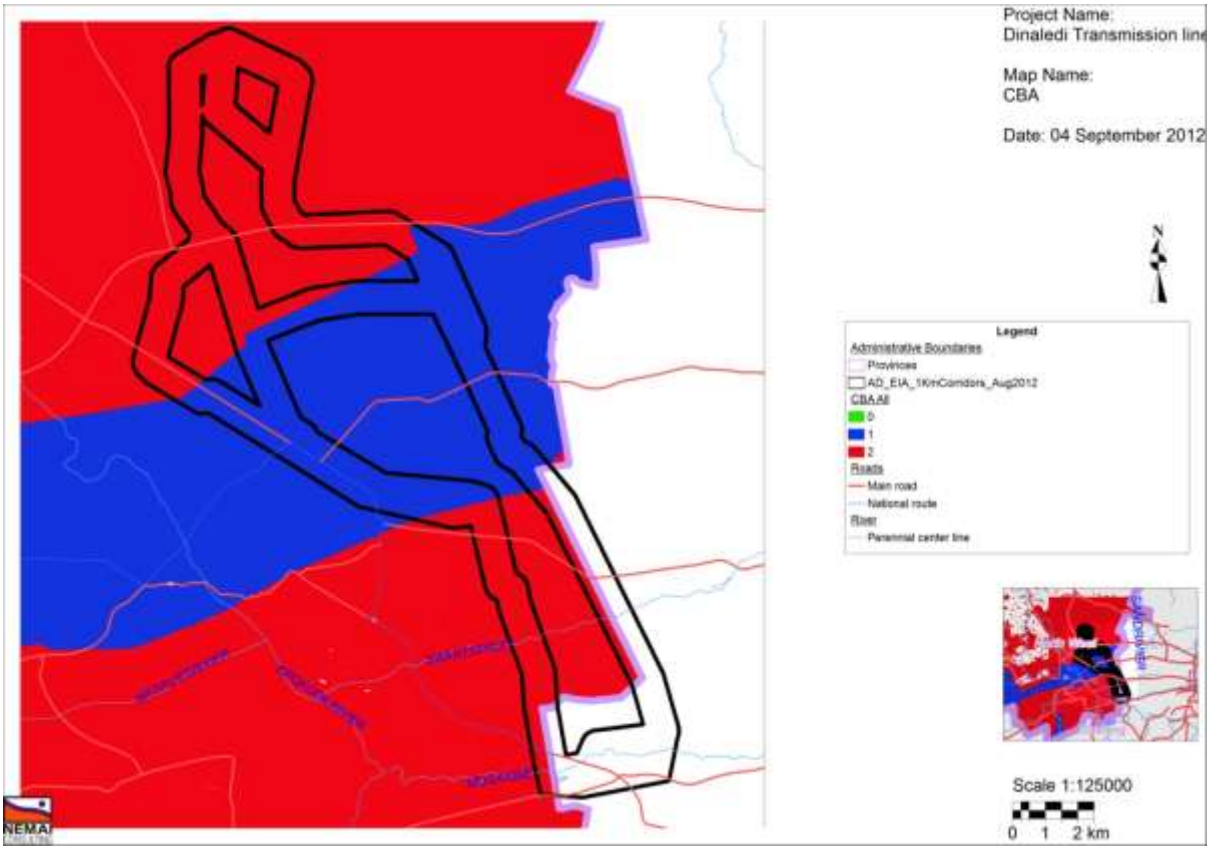

Figure 6. North West Critical Biodiversity Area (CBA 1 in blue and CBA 2 in red) in relation to the study area

8. DESCRIPTION OF CBA'S FOR THE GAUTENG PROVINCE

Gauteng Conservation Plan 3.3 described the study area as falling within a Critical Biodiversity Area (CBA) and Ecological Sensitive Area (ESA). The CBAs in the study area are *Irreplaceable Areas* and *Important Area* (**Figure 7).** According to Tshwane Open Space Framework (2005), an *Irreplaceable Site* is essential in meeting targets set for the conservation of biodiversity in Gauteng, whilst an *Important Site* is designated as important for the conservation of biodiversity in Gauteng, its significance however being subject to ground truthing.

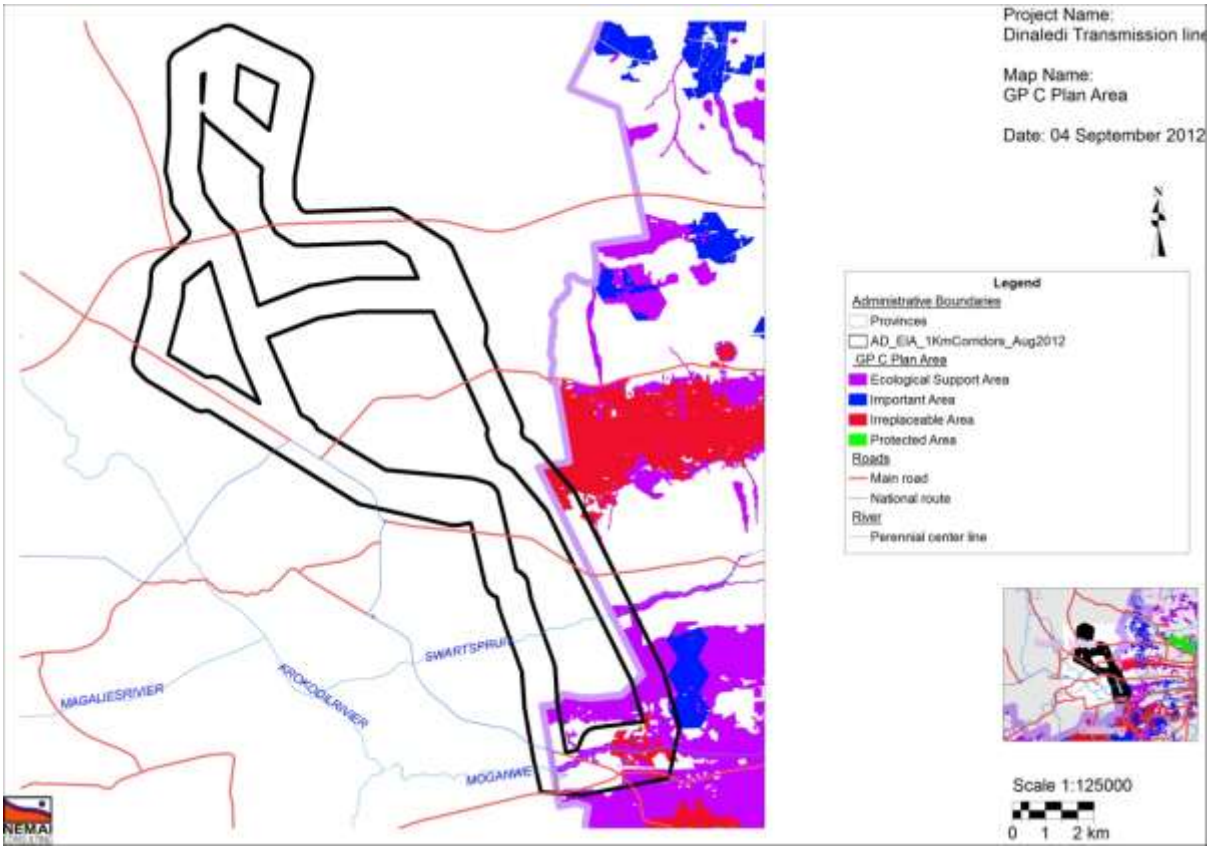

Figure 7. Gauteng Critical Biodiversity Area in relation to the study area

9. PROTECTED AREA

The proposed transmission alternative lines will traverse through the Magaliesberg Protected Natural Environment (MPNE), Magaliesberg Natural Area and Wonderboom Municipal Nature Reserve as indicated in **Figure 8**. According to Greater Pretoria Metropolitan Council (2001), the MPNE is considered to be almost 100 times older than Mount Everest and has unique geology, topography and bio diverse habitats as well as heritage features. The areas

proclaimed as PNE are mostly privately owned and no formal fence clearly demarcates the MPNE boundary. This adds to the ad hoc nature of management and activities especially on the edges of the MPNE. The different ecological systems that occur in the study area include mountainous areas, streams, rivers, indigenous woodland and grassland floral communities and these ecological systems are observed in the MPNE.

Figure 8. Protected Areas in the study area

10. THREATENED TERRESTRIAL ECOSYSTEMS

The first national list of threatened terrestrial ecosystems for South Africa was gazetted on 9 December 2011 (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). It listed all the threatened or protected ecosystems in South Africa in terms of four categories; critically endangered (CR), endangered (EN), vulnerable (VU), or protected. The purpose of listing these ecosystems is primarily to reduce the rate of ecosystem and species extinction, as well as preventing further degradation and loss of structure, function, and composition of these ecosystems. It is estimated that threatened ecosystems make up 9.5% of the ecosystems in the country, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% (SANBI, 2011).

The South African National Biodiversity Institute (SANBI) in conjunction with the Department of Environmental Affairs and Tourism (DEAT) released a draft report in 2009 entitled "Threatened Ecosystems in South Africa: Descriptions and Maps", to provide background information on the above List of Threatened Ecosystems. The purpose of this report was to present a detailed description of each of South Africa's ecosystems and to determine their status using a credible and practical set of criteria. The following criteria were used in determining the status of threatened ecosystems:

- Irreversible loss of natural habitat.
- Ecosystem degradation and loss of integrity.
- Limited extent and imminent threat.
- Threatened plant species associations.
- Threatened animal species associations.
- Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan.

Marikana Bushveld and Witwatersberg Pretoria Mountain Bushveld are listed as the terrestrial threatened ecosystems occurring on site (**Figure 9**).

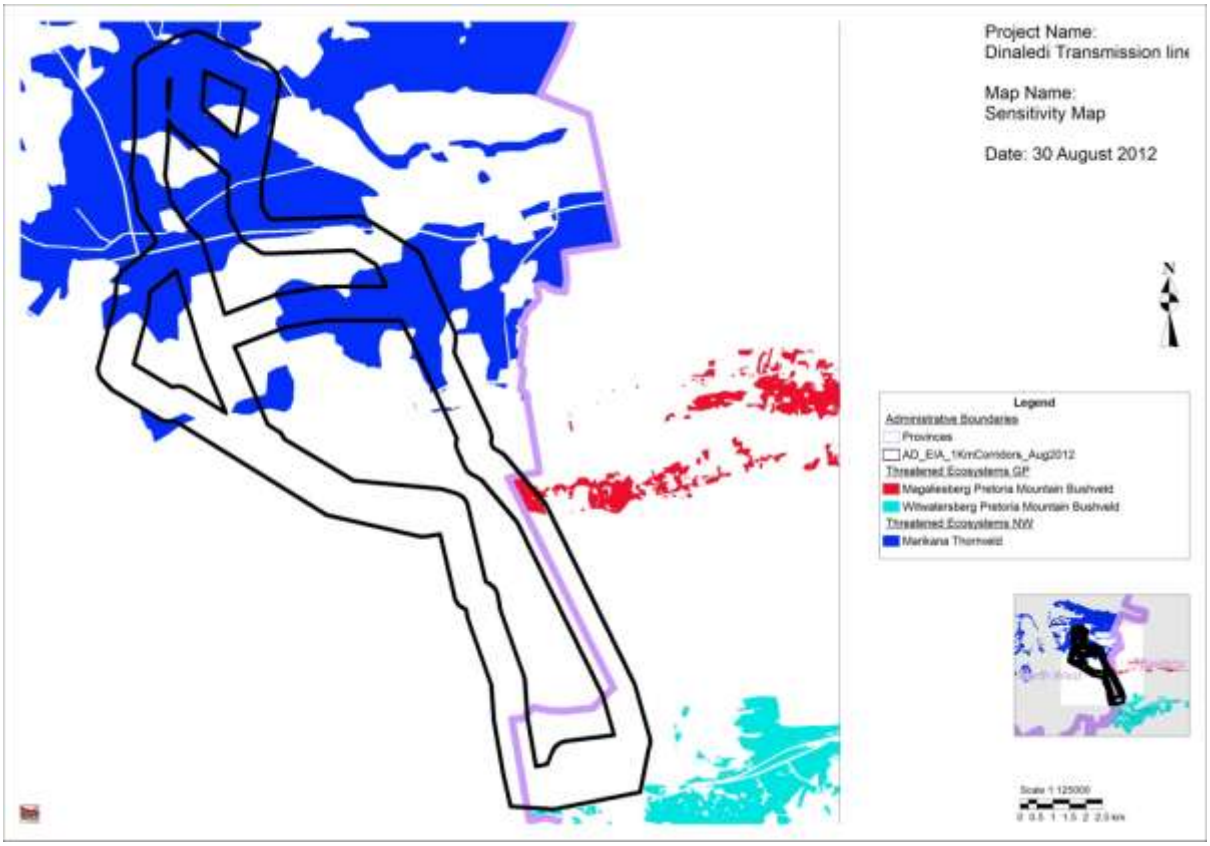

Figure 9. Threatened Terrestrial Ecosystems in the proposed transmission line

The description of the three Threatened Terrestrial Ecosystems follows below:

10.1 Witwatersberg Pretoria Mountain Bushveld (GP10)

The key biodiversity features include Red or Orange Listed plants, for example, *Melolobium subspicatum, Delosperma gautengense, Holothrix randii*; Red or Orange Listed mammals, such as Schreiber's Long-fingered Bat; Red or Orange Listed birds such as White-backed Night-Heron and African Finfoot; Red or Orange Listed reptiles for example the Striped Harlequin Snake; and five vegetation types including the Andesite Mountain Bushveld, Carletonville Dolomite Grassland, Gauteng Shale Mountain Bushveld, Marikana Thornveld and Rand Highveld Grassland. The Apies River, Hennops River, Moganwe, Swartbooispruit, Walkerspruit, Waterkloofspruit, and unnamed wetlands are also key features of the ecosystem (Gauteng C-Plan Version 2 (2006)).

Conservation status

Witwatersberg Pretoria Mountain Bushveld has an ecosystem threat status of ***Critically Endangered (CR).*** The remaining natural area of the 19 000 ha ecosystem area(%) is 74%. Only 2% of the original area is protected. There are 22 threatened or endemic plant and animal species in the area (Gauteng C-Plan Version 2 (2006)).

10.2 Marikana Thornveld (SVcb6)

Marikana Thornveld occurs on plains from the Rustenburg area in the west, through Marikana and Brits to the Pretoria area in the east. It is open *Acacia karroo* woodland, occurring in valleys and slightly undulating plains, and some lowland hills. Shrubs are denser along drainage lines, on termitaria and rocky outcrops or in other habitat protected from fire.
The ecosystem is found in Magaliesberg Nature Area and in other reserves, mainly in De Onderstepoort Nature Reserve (Gauteng C-Plan Version 2 (2006)).

Conservation Status

The ecosystem threat status is ***Vulnerable*** (VU). The remaining natural area of the ecosystem is 55% of 253 000 ha. There are no known species of special concern, and no part of the ecosystem is conserved at present (Gauteng C-Plan Version 2 (2006)).

10.3 Magaliesberg Pretoria Mountain Bushveld (GP6)

The Magaliesberg Pretoria Mountain Bushveld occurs in Pretoria north including Pretoria and Silverton (2528CA and 2528CB respectively). The ecosystem is delineated by the Magaliesberg ridge system and associated koppies. It houses 18 threatened or endemic plant and animal species. The key biodiversity features include Red or Orange Listed plants such as *Aloe peglerae* and *Delosperma leendertziae.* The Red or Orange Listed mammals include species such as the Short-eared Trident Bat. The Southern African Python is a Red Listed reptile that occurs on this ecosystem. Rivers in the ecosystem include the Apies River, Hartbeesspruit, Moretele River, Pienaars River, and Sand River Gauteng C-Plan Version 2 (2006)).

Conservation Status

The Ecosystem threat status of Magaliesberg Pretoria Mountain Bushveld is ***Critically Endangered*** and 84 % of the original area of the ecosystem (10 000 ha) remains. Approximately 1% of the ecosystem is protected in the Wonderboom Nature Reserve Gauteng C-Plan Version 2 (2006)).

11. METHODOLOGY

The White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997) and the National Environmental Management Act 1998 (Act No 107 of 1998) specify that due care must be taken to conserve and avoid negative impacts on biodiversity, as well as the sustainable, equitable and efficient use of biological resources.

11.1 Flora

Flora assessment consisted of two complementary approaches:

- A desktop analysis of literature review, photographs, topographical maps, and Google Earth imagery; and
- Site visits were conducted in October 2010, February 2011 and August 2012.

Satellite imagery of the area was obtained from Google Earth and was studied in order to get a three dimensional impression of the topography and land use and also to identify potential "hot-spots" or specialized habitats e.g. patches of undisturbed vegetation, river crossings and rocky ridges.

The Pretoria Computerised Information System (PRECIS) lists of Red Data plants recorded in the 2527DB and 2527DD quarter degree grid squares were obtained from South African National Biodiversity Institute (SANBI) (http://posa.sanbi.org/searchspp.php accessed on 03

September 2012). The lists were consulted to verify the record of occurrence of the plant species seen in the vicinity of the proposed study area. The sites sampled are also only a very small portion of the whole grid and so habitats suitable for certain species in the PRECIS lists may not be present at the areas sampled. The vegetation map published in Mucina & Rutherford (2006) was consulted to identify vegetation units that are found in the study area. The desktop component of the study of the habitats of the red-data-listed and other species of conservation importance known to occur in the area was conducted before the site visits.

The habitats of the study areas were inspected in a random zigzag fashion, paying particular attention to areas that at first sight appeared to be sensitive. All general observations were noted such as trees, shrubs, grasses and herbs (forbs). The habitats suitable for Red Data listed species known to occur in the quarter degree grid squares were examined intensively for the presence of such species. Attention was also paid to the occurrence of alien species and declared weeds. Field guides such as Pooley (1998), Pooley (2005), van Wyk *et al.,* (1997) and van Oudshoorn (1999) were utilised during the field work.

According to van Oudtshoorn, (1999), a grass species reacts to grazing in one of two ways: it can either become more or less abundant. **Table 4** describes the classification of grasses.

Table 4. Classification of grasses (van Oudtshoorn, 1999).

Class	Description	Examples
Decreasers	Grasses that are abundant in good veld, but that decrease in number when the veld is overgrazed or undergrazed.	*Themeda trianda, Digitaria eriantha*
Increaser 1	Grasses that are abundant in underutilised veld. These grasses are usually unpalatable, robust climax species that grow without any defoliation	*Hyperthelia dissoluta, Trachypogon spicatus*
Increaser 2	Grasses that are abundant in overgrazed veld. These grasses increase due to the disturbing effect of overgrazing and include mostly pioneer and subclimax species	*Aristida adscensionis, Eragrostis rigidor*
Increaser 3	Grasses that are commonly found in overgrazed veld. These are usually unpalatable, dense climax grasses	*Sporobolus africanus, Elionurus muticus*
Invaders	All plants that are not indigenous to an area. These plants are mostly pioneer plants and are difficult to eradicate	*Arundo donax*

Exotic and invasive plant species were categorised according to the framework laid out by The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983). CARA defines weeds as alien plants, with no known useful economic purpose that should be eradicated. Invader plants, also considered by the Act, can also be of alien origin but may serve useful purposes as ornamentals, as sources of timber, or may have other benefits such as

medicinal uses (Henderson, 2001). These plants need to be managed and prevented from spreading.

Alien and invasive plant species can be grouped three categories:

- Category 1 plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in Regulation 15.D of the CARA.
- Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.
- Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.

The planting of Category 2 and 3 plants should be confined to demarcated areas under controlled conditions of cultivation (Bromilow, 1995 & 2010).

11.2 Mammals

As the majority of mammals are secretive, nocturnal, hibernators, the distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on field guides, scientific literature, and databases. This can be done irrespective of season. Magaliesberg Protected Environment: Environmental Management Framework and Plan – Status Quo Report (2007) and Hokka (2006), were used to ascertain the Red Data mammals that are expected to occur in 2527DB and 2527DD grids.

Site visits were conducted during the months of February, August, and October and during these visits the observed and derived presence of mammals 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, coupled with the qualitative and quantitative nature of recognized habitats. The adjoining properties were also scanned for important fauna habitats.

During the site visits mammals were identified by visual sightings through random transect walks. Terrestrial and arboreal rats, mice, squirrels, and opossums (non-volant small mammals) were sampled using LFAHD-P Sherman large folding aluminium heavy duty

perforated traps (23x7.5x9cm/250grams) (**Figure 10**) that were set approximately 20 m apart and baited with oats and butter and were left overnight. Placement of traps were either on the ground near areas of potential foraging activity such as logs and base of trees, or on vines and low branches situated above the ground. In addition, mammals were also identified by means of spoor, droppings, burrows or roosting sites. Locals were interviewed to confirm occurrences or absences of species.

Figure 10. Sherman traps used for small mammals such as rats and mice

The few patches of grasslands on site offer suitable foraging habitat for numerous small mammals such as *Lepus saxatalis* (Scrub Hare), *Rhabdomys pumilio* (Four-striped Mouse) and *Mastomys coucha* (Southern Multimammate Mouse). During the field visits, the study area was surveyed and assessed for the potential occurrence of Red Data species associated with the study area such as Southern African hedgehog (*Atelerix frontalis*).

11.3 Avifauna

The presence of suitable habitat was used to deduce the likelihood of presence or absence of species, based on scientific literature, field guides and databases. The likely occurrence of key bird species was verified according to Southern African Bird Atlas Project 2 from the University of Cape Town's Animal Demographic Unit for the grid cells 2527DB and 2527DD. It must be emphasized that the specific habitat(s) found on site may not suit the particular Red Data species, even though it has been recorded for the quarter degree grid cells.

Site visits were conducted to record the presence of bird species associated with the habitat systems on the study site and to identify possible sensitive areas. Birds were identified in several ways: visually, by call, roosting sites and feathers and by also using 10X42 Bushnell Waterproof binoculars and where necessary verified from *Sasol Birds of Southern Africa* (Sinclair *et al*., 2005) and *The Chamberlain guide to birding Gauteng* (Marais & Peacock, 2008). The study sites were surveyed on foot and in the process sightings were recorded through random transect walks. The adjoining properties were also scanned for important bird habitats and species.

12. RESULTS AND DISCUSSIONS

12.1 Flora

12.1.1 Protected trees

In terms of the National Forests Act 1998 (Act No 84 of 1998) certain tree species can be identified and declared as protected. The Department of Water Affairs and Forestry (now Department of Agriculture, 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 protected trees that have a geographical distribution that includes the two sites are *Acacia erioloba, Boscia albitrunca, Combretum imberbe, Pittosporum viridiflorum, Prunus africana,* and *Sclerocarya birrea* subsp *caffra*. Only one protected tree was recorded, *i.e. Sclerocarya birrea* subsp *caffra* (**Figure 11**)*.*

Figure 11. Marula tree recorded along the proposed routes

12.1.2 Desktop study results

The proposed transmission line is located within the 2527DB and 2527DD quarter degree squares in terms of the 1:50 000 grid of South Africa. SANBI used this grid system as a point of reference to determine any Red Data plant species or any species of conservation importance occurring in South Africa. This can be used to determine lists of species which could potentially occur within an area. **Table 5** provides details on the Red Data plant species which have been recorded in 2527DB and 2527DD grid cells. The statuses allocated to the species are defined in **Table 6** below. It is, therefore, imperative, during the construction phase, that detailed searches for these rare/threatened and protected species are made during the appropriate time of year when plants are likely to be visible.

Table 5. Red data plant species recorded in grid cells 2527DB and 2527DD.

Family	Species	Conservation Status	Form
Amaryllidaceae	*Boophone disticha*	Declining	Geophyte
Aquifoliaceae	*Ilex mitis var. mitis*	Declining	Shrub
Asteraceae	*Callilepis leptophylla*	Declining	Herb
Capparaceae	*Cleome conrathii*	Near Threatened	Herb
Fabaceae	*Melolobium subspicatum*	Vulnerable	Dwarf shrub
Gunneraceae	*Gunnera perpensa.*	Declining	Herb
Hyacinthaceae	*Bowiea volubilis. Subsp. Volubilis*	Vulnerable	Climber
Hyacinthaceae	*Drimia sanguinea (Schinz) Jessop*	Near Threatened	Geophyte
Hypoxidaceae	*Hypoxis hemerocallidea*	Declining	Geophyte
Orchidaceae	*Habenaria mossii*	Endangered	Geophyte
Amaryllidaceae	*Crinum macowanii Baker*	Declining	Geophyte

Family	Species	Conservation Status	Form
Apocynaceae	*Stenostelma umbelluliferum*	NT	Herb
Crassulaceae	*Adromischus umbraticola subsp. Umbraticola*	NT	Dwarf shrub

Table 6. Definitions of Red Data status (Raimondo *et al.* 1999)

Endangered	A taxon is **Endangered** when the best available evidence indicates that it meets any of the five IUCN criteria for Endangered, and is therefore facing a very high risk of extinction in the wild.
Vulnerable	A taxon is **Vulnerable** when the best available evidence indicates that it meets any of the criteria any if the five IUCN criteria for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened	A taxon is **Near Threatened** when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future.
Rare	A taxon is **Rare** when it meets any of the four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and doesn't not qualify for a category of threat according to five criteria.
Declining	A taxon is **Declining** when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population.

12.1.3 Plant communities recorded in the study area

The following plant communities were identified during the field visit and are described below.

Eastern Route Alternative and Eastern Route Alternative Deviation

Powerlines are linear in nature and that means that they pass through a variety of habitat types, topographies and climatic zones. This means that a variety of vegetation types, and therefore habitat integrity, will be affected by the proposed development. These route alternatives will traverse through sensitive areas such as the MPNE, Wonderboom Municipal Nature Reserve, and Magaliesberg & Witwatersberg IBA. The The decommissioning of Lomondt De Wildt 88kV line (with a servitude of 22m) in 2014, which runs along a portion of the eastern route, will not have an impact when chosing the alternative for this project as the species of conservation importance recorded falls within this line. The following plant species (**Table 7**) were recorded in these route alternatives.

Table 7. Plant species recorded in Eastern Route Alternative and Eastern Route Alternative Deviation

Scientific name	Common name	Ecological status	Form
Acacia karoo	Sweet thorn		Tree
Acacia xanthophloea	Fever tree	Medicinal	Tree

Scientific name	Common name	Ecological status	Form
Aloe greatheadii var *greatheadii*		Medicinal	Succulent
Aloe zebrina		Medicinal	Succulent
Alternanthera pungens	khakiweed	exotic	Herb
Amaranthus hybridus	Pigweed	Weed	Herb
Andropogon eucomus	Snowflake grass	Increaser 2	Grass
Andropogon huillensis	Large Silver Andropogon	Increaser 1	Grass
Agave sisalana	sisal	Declared Invader (Category 2)	Shrub
Argemone ochroleuca	White-flowered poppy	Declared Weed Category 1)	Herb
Arundo donax	Spanish reed	Declared Weed Category 1)	
Argyrolobium stipulaceum			Herb
Aristida junciformis	Ngongoni Three-awn	Exotic	Grass
Asparagus aethiopicus			Shrub
Asparagus laricinus	Cluster-leaved Asparagus		Tree
Bauhinia variegata	Orchid Tree		Tree
Berkheya setifera	Buffalo-tongue Berkheya	Medicinal	Herb
Bidens formosa	Cosmos	Weed	Herb
Buddleja saligna	False olive		Tree
Burkea africana	Wild Seringa		Tree
Boophane disticha	Fan-leaved Boophane	Medicinal	Herb
Campuloclinium macrocephalum	Pom pom weed	Declared Weed (Category 1)	Herb
Celtis africana	White Stinkwood		Tree
Cereus jamacara	Queen of the night	Declared Weed (Category 1)	Herb
Chorisia speciosa			Tree
Combretum molle	Velvet bushwillow		Tree
Conyza bonariensis		Weed	Herb
Crassula dependens			Herb
Crinum graminicola	Grass Crinum		Herb
Ctenium concinnum	Sickle grass	Increaser 1	Grass
Cymbopogon excavatus	Broad-leaved Turpentine Grass	Increaser 1	Grass
Cynodon dactylon	Couch Grass	Increaser 2	Grass
Cussonia spicata	Common cabbage tree		Tree
Cyperus longus		Medicinal	Sedge
Datura stramonium	Common thorn apple	Declared Weed (Category 1	shrub
Dichrostachys cinerea	Sickle bush		Shrub
Diospyros lycioides	Bluebush		Tree
Dombeya rotundifolia	Common wild pear		Tree

Scientific name	Common name	Ecological status	Form
Digitaria eriantha	Common Finger Grass	Decreaser	Grass
Elephantorrhiza elephantina	Elephant's root	Medicinal	Shrublet
Englerophytum magalismontanum	Transvaal milkplum	Medicinal	Shrub
Elionurus muticus	Wire Grass	Increaser 3	Grass
Eragrostis curvula	Weepong Love Grass	Increaser 2	Grass
Erythria lysistemon	Aloe coral tree		Tree
Erythria zeyheri	Ploughbreaker	Medicinal	Shrub
Eucalyptus camaldulensis	Red River Gum	Declared Invader (Category 2)	Tree
Ficus ingens	Red-leaved ficus		Tree
Gerbera piloselloides.	Small yellow gerbera	Medicinal	Herb
Gomphrena celosioides	Batchelor's Button	Weed	Herb
Gomphocarpus fruticosus			Herb
Grewia flavescens	Sandpaper raisin		Shrub
Haplocarpha scaposa	False gerbera	Medicinal	Herb
Harpochloa falx	Caterpillar Grass	Increaser 1	Grass
Helichrysum aureonitens	Golden everlasting	Medicinal	Herb
Hibiscus trionum	Bladder Hibiscus	Medicinal	Herb
Hyparrhenia hirta	Common Thatching Grass	Increaser 1	Grass
Hypochaeris radicata	Hairy wild lettuce	Weed	Herb
Hypoxis rigidula	Silver-leaved star-flower		Herb
Hypoxis hemerocallidea	Star-flower	Declining/Medicinal	Herb
Imperata clyndrica	Cotton Wool Grass	Increaser 1	Grass
Indigofera hilaris	Red indigo bush		Herb
Jacaranda mimosifolia	Jacaranda	Declared Invader (Category 3)	Tree
Kirkia acuminata	White seringa		Tree
Lantana camara	Lantana	Declared Weed (Category 1)	Shrub
Ledebouria ovatifolia		Medicinal	Herb
Ledebouria cooperi	Copper's squil		Herb
Leonotis leonurus	Wild dagga	Medicinal	Herb
Mangifera indica	Mango		Tree
Mariscus congestus		Cultural	Herb
Melia azedarach	Persian Lilac/Syringa	Declared Invader (Category 3)	Tree
Melinis repens	Natal Red Top	Increaser 2	Grass
Morus alba	White mulberry	Declared Invader (Category 3)	Tree
Mundulea sericea	Cork bush		Tree
Olea europaea subsp. *africana*	Wild olive		Tree
Opuntia ficus-indica	Prickly pear	Declared Weed (Category 1)	Shrub
Oxalis obliquifolia	Oblique-leaved Sorrel		Herb

Scientific name	Common name	Ecological status	Form
Paspalum dilatum	Dallis grass	Exotic	Grass
Persicaria lapathifolia	Spotted Knotweed	Weed	Herb
Pinus patula	Patula pine	Declared Invader (Category 2)	Tree
Plantago longissima			Herb
Plantago major	Broadleaved ribwort	Weed/Medicinal	Herb
Pennisetum setaceum	Fountain grass	Declared Weed (Category 1)	Grass
Peltophorum africanum	Weeping wattle		Tree
Populus x canescens	Grey poplar	Declared Invader (Category 2)	Tree
Pogonarthria squarrosa	Herringbone Grass	Increaser 2	Grass
Phoenix reclinata	Wild date palm		Tree
Phragmites australis	Common reed		Reed
Protea caffra	Common sugarbush	Medicinal	Tree
Pseudognaphalium luteo-album	Jersey Cudweed	Medicinal	Herb
Pyracantha coccinea	Red firethorn	Invader	Tree
Rapanea melanophloeos	Cape beech		Tree
Ricinus communis	Caster-oil plant	Declared Invader (Category 2)	Shrub
Rhynchosia totta	Yellow carpet bean		Herb
Richardia brasiliensis	Tropical Richardia	Weed	Herb
Salix babylonica	Weeping willow	Declared Invader (Category 2)	Tree
Scadoxus puniceus	Blood Lily	Medicinal	Herb
Schoenoplectus corymbosus			Sedge
Sclerocarya birrea subsp *caffra*	Marula	Protected Tree	Tree
Searsia pyroides	Common wild currant		Tree
Searsia lancea	Karee		Tree
Senecio venosus			Herb
Sesbania punicea	Red sesbania	Declared Weed (Category 1)	Shrub
Stoebe vulgaris	Bankrupt bush		Shrub
Setaria sphacelata var. *sphacelata*	Common Bristle Grass	Decreaser	Grass
Solanum mauritianum	Bugweed	Declared Weed (Category 1)	Shrub
Solanum panduriforme	Bitter Apple	Medicinal	Shrub
Sporobolus africanus	Ratstail Dropseed	Increaser 3	Grass
Stoebe vulgaris	Bankrupt bush		Shrub
Strychnos spinosa	Spiny Monkey Orange	Medicinal	Tree
Tagetes minuta	Tall Khaki Weed	Weed	Herb
Themeda triandra	Red Grass	Decreaser	Grass
Typha capensis	Bulrush		Aquatic herb
Tristachya leucothrix	Hairy Trident Grass	Increaser 1	Grass
Trema orientalis	Pigeonwood		Tree

Scientific name	Common name	Ecological status	Form
Urochloa mossambicensis	Bushveld signal grass	Increaser 2	Grass
Ulmas parviflora	Chinese ela	Declared Invader (Category 3)	Tree
Vangueria infausta	Wild medlar		Shrub
Verbena bonariensis	Tall Verbena	Weed	Herb
Veronica anagallis-aquatica		Weed	Herb
Xysmalobium undulatum	Milkwort	Medicinal	Herb
Ximenia americana	Blue sourplum	Medicinal	Shrub
Zinnia peruviana	Redstar Zinnia	Weed	Herb
Ziziphus mucronata	Buffalo-thorn		Tree

Two species, *Hypoxis hemerocallidea* and *Boophane distacha,* declared as "Protected" by the Nature Conservation Ordinance 1974 (No. 19 of 1974) were recorded along this route during the surveys. These two plant species are listed in Raimondo *et. al.* (2009) as Declining. A species is regarded as Declining when it does not qualify for categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population (Raimondo *et.al.* 2009). The 'threatening' process associated with African potato is the illegal harvesting. The two species mentioned are used for medicinal purposes. According to Pooley (1998), *Boophane disticha* is used by traditional healers to treat pain and wounds. According to Pooley (1998), the traditional healers use African potato (*Hypoxis hemerocallidea*) in traditional medicine to treat dizziness, headaches, and mental disorders and in western medicine, this species is used to treat cancers, inflammation and HIV. There is concern that this species is being collected illegally and unsustainably, causing a decline in populations.

Species of *Sclerocarya birrea* subsp. *caffra* (Marula) were recorded along the proposed route. This species is protected according to National Forests Act 1998 (Act No 84 of 1998). A permit is required from the Department of Agriculture, Forestry and Fisheries (DAFF) to uproot or relocate these plants.

Central Route Alternative

The koppie/ridge, through which the proposed transmission will traverse, provides a suitable habitats for Red Data listed species. The following plant species (**Table 8**) were recorded in this route alternative.

Table 8. Plant species recorded in Central Route Alternative

Scientific name	Common name	Ecological status	Form
Acacia karoo	Sweet thorn		Tree

Scientific name	Common name	Ecological status	Form
Aloe greatheadii var *greatheadii*		Medicinal	Succulent
Alternanthera pungens	khakiweed	exotic	Herb
Andropogon eucomus	Snowflake grass	Increaser 2	Grass
Asparagus aethiopicus			Shrub
Asparagus laricinus	Cluster-leaved Asparagus		Tree
Berkheya setifera	Buffalo-tongue Berkheya	Medicinal	Herb
Ctenium concinnum	Sickle grass	Increaser 1	Grass
Cynodon dactylon	Couch Grass	Increaser 2	Grass
Dichrostachys cinerea	Sickle bush		Shrub
Dombeya rotundifolia	Coomon wild pear		Tree
Gomphocarpus fruticosus			Herb
Grewia flavescens	Sandpaper raisin		Shrub
Haplocarpha scaposa	False gerbera	Medicinal	Herb
Harpochloa falx	Caterpillar Grass	Increaser 1	Grass
Hyparrhenia hirta	Common Thatching Grass	Increaser 1	Grass
Hypoxis rigidula	Silver-leaved star-flower		Herb
Ledebouria ovatifolia		Medicinal	Herb
Melia azedarach	Persian Lilac/Syringa	Declared Invader (Category 3)	Tree
Peltophorum africanum	Weeping wattle		Tree
Pseudognaphalium luteo-album	Jersey Cudweed	Medicinal	Herb
Richardia brasiliensis	Tropical Richardia	Weed	Herb
Sclerocarya birrea subsp caffra	Marula	Protected Tree	Tree
Searsia lancea	Karee		Tree
Setaria sphacelata var. Sphacelata	Common Bristle Grass	Decreaser	Grass
Sporobolus africanus	Ratstail Dropseed	Increaser 3	Grass
Themeda triandra	Red Grass	Decreaser	Grass
Vangueria infausta	Wild medlar		Shrub
Ziziphus mucronata	Buffalo-thorn		Tree

Species of *Sclerocarya birrea* subsp. *caffra* (Marula) were recorded along the proposed route and this species, as previously mentioned, is protected according to National Forests Act 1998 (Act No 84 of 1998). No Red Data or Orange-Listed plant species were recorded on this route.

Western Route Alternative, Deviations Western, Eastern and Southern

The western route alternative incorporates the existing powerlines, mostly along the R511 to Brits and passes through the Xstrata Eland Platinum Mine. The vegetation on this route is

highly disturbed due to previous construction of the transmission lines and is dominated by weeds and alien invasive species such as *Melia azedarach, Opuntia ficus-indica, Campuloclinium macrocephalum,* and *Solanum mauritianum* (**Figure 12**). Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of the invader species be removed and eradicated (Henderson, 2001). There are methods to eradicate alien invasive species, such as

- Mechanical methods – felling, removing or burning invading alien plants;
- Chemical methods – using environmentally safe herbicides;
- Biological control – using species-specific insects and diseases from the alien plant's country of origin and
- Integrated control – combinations of the above three approaches. Often an integrated approach is required in order to prevent enormous impacts (http://www.dwaf.gov.za/wfw/default.aspx).

Figure 12. Alien invasive plant species recorded along the proposed routes

The sensitive areas that the proposed route will traverse are the Magaliesberg Natural Area, MPNE, and Magaliesberg & Witwatersberg IBA. The following plant species (**Table 9**) were recorded on this route.

Table 9. Plant species recorded in Western Route Alternative, Deviations Western, Eastern and Southern

Scientific name	Common name	Ecological status	Form
Acacia karoo	Sweet thorn		Tree
Acacia xanthophloea	Fever tree	Medicinal	Tree
Aloe greatheadii var *greatheadii*		Medicinal	Succulent
Aloe zebrina		Medicinal	Succulent
Alternanthera pungens	khakiweed	exotic	Herb
Andropogon eucomus	Snowflake grass	Increaser 2	Grass
Agave sisalana	sisal	Declared Invader (Category 2)	Shrub
Argemone ochroleuca	White-flowered poppy	Declared Weed (Category 1)	Herb
Asparagus aethiopicus			Shrub
Asparagus laricinus	Cluster-leaved Asparagus		Tree
Bauhinia variegata	Orchid Tree		Tree
Berkheya setifera	Buffalo-tongue Berkheya	Medicinal	Herb
Bidens formosa	Cosmos	Weed	Herb
Campuloclinium macrocephalum	Pom pom weed	Declared Weed (Category 1)	Herb
Celtis africana	White Stinkwood		Tree
Cereus jamacara	Queen of the night	Declared Weed (Category 1)	Herb
Chorisia speciosa			Tree
Conyza bonariensis		Weed	Herb
Ctenium concinnum	Sickle grass	Increaser 1	Grass
Cymbopogon excavatus	Broad-leaved Turpentine Grass	Increaser 1	Grass
Cynodon dactylon	Couch Grass	Increaser 2	Grass
Cyperus longus		Medicinal	Sedge
Datura stramonium	Common thorn apple	Declared Weed (Category 1	shrub
Dichrostachys cinerea	Sickle bush		Shrub
Dombeya rotundifolia	Common wild pear		Tree
Digitaria eriantha	Common Finger Grass	Decreaser	Grass
Englerophytum magalismontanum	Transvaal milkplum	Medicinal	Shrub
Erythria lysistemon	Aloe coral tree		Tree
Eucalyptus camaldulensis	Red River Gum	Declared Invader (Category 2)	Tree
Ficus ingens	Red-leaved ficus		Tree
Gerbera piloselloides.	Small yellow gerbera	Medicinal	Herb
Gomphrena celosioides	Batchelor's Button	Weed	Herb
Gomphocarpus fruticosus			Herb
Gladiolus ellioti			Herb

Scientific name	Common name	Ecological status	Form
Grewia flavescens	Sandpaper raisin		Shrub
Haplocarpha scaposa	False gerbera	Medicinal	Herb
Harpochloa falx	Caterpillar Grass	Increaser 1	Grass
Helichrysum aureonitens	Golden everlasting	Medicinal	Herb
Hibiscus trionum	Bladder Hibiscus	Medicinal	Herb
Hyparrhenia hirta	Common Thatching Grass	Increaser 1	Grass
Hypochaeris radicata	Hairy wild lettuce	Weed	Herb
Hypoxis rigidula	Silver-leaved star-flower		Herb
Imperata cylindrica	Cotton Wool Grass	Increaser 1	Grass
Indigofera hilaris	Red indigo bush		Herb
Jacaranda mimosifolia	Jacaranda	Declared Invader (Category 3)	Tree
Lantana camara	Lantana	Declared Weed (Category 1)	Shrub
Lippia javanica			Herb
Leonotis leonurus	Wild dagga	Medicinal	Herb
Mangifera indica	Mango		Tree
Melia azedarach	Persian Lilac/Syringa	Declared Invader (Category 3)	Tree
Melinis repens	Natal Red Top	Increaser 2	Grass
Morus alba	White mulberry	Declared Invader (Category 3)	Tree
Mundulea sericea	Cork bush		Tree
Opuntia ficus-indica	Prickly pear	Declared Weed (Category 1)	Shrub
Paspalum dilatum	Dallis grass	Exotic	Grass
Pinus patula	Patula pine	Declared Invader (Category 2)	Tree
Plantago major	Broadleaved ribwort	Weed/Medicinal	Herb
Pennisetum setaceum	Fountain grass	Declared Weed (Category 1)	Grass
Peltophorum africanum	Weeping wattle		Tree
Phragmites australis	Common reed		Reed
Protea caffra	Common sugarbush	Medicinal	Tree
Pseudognaphalium luteo-album	Jersey Cudweed	Medicinal	Herb
Quercus palustris		Declared Invader (Category 3)	Tree
Ricinus communis	Caster-oil plant	Declared Invader (Category 2)	Shrub

Scientific name	Common name	Ecological status	Form
Rhynchosia totta	Yellow carpet bean		Herb
Richardia brasiliensis	Tropical Richardia	Weed	Herb
Scadoxus puniceus	Blood Lily	Medicinal	Herb
Schoenoplectus corymbosus			Sedge
Sclerocarya birrea subsp caffra	Marula	Protected Tree	Tree
Searsia pyroides	Common wild currant		Tree
Searsia lancea	Karee		Tree
Senecio venosus			Herb
Sesbania punicea	Red sesbania	Declared Weed (Category 1)	Shrub
Stoebe vulgaris	Bankrupt bush		Shrub
Setaria sphacelata var. Sphacelata	Common Bristle Grass	Decreaser	Grass
Solanum mauritianum	Bugweed	Declared Weed (Category 1)	Shrub
Solanum panduriforme	Bitter Apple	Medicinal	Shrub
Sporobolus africanus	Ratstail Dropseed	Increaser 3	Grass
Stoebe vulgaris	Bankrupt bush		Shrub
Strychnos spinosa	Spiny Monkey Orange	Medicinal	Tree
Tagetes minuta	Tall Khaki Weed	Weed	Herb
Themeda triandra	Red Grass	Decreaser	Grass
Typha capensis	Bulrush		Aquatic herb
Tristachya leucothrix	Hairy Trident Grass	Increaser 1	Grass
Urochloa mossambicensis	Bushveld signal grass	Increaser 2	Grass
Vangueria infausta	Wild medlar		Shrub
Verbena bonariensis	Tall Verbena	Weed	Herb
Zinnia peruviana	Redstar Zinnia	Weed	Herb
Ziziphus mucronata	Buffalo-thorn		Tree

Only one protected plant species was recorded on this proposed route, *Sclerocarya birrea* subsp. *Caffra* (Marula). A permit from DAFF will be required during construction, should this route be considered as the preferred option.

12.1.4 Medicinal plants and Red Data Listed plant species

According to National Environmental Management Biodiversity Act 2004 (Act No 10 of 2004), there is a dire need to conserve biodiversity in each province and as such, natural or indigenous resources must be utilised sustainably. Along the proposed transmission line there are a number of plants that are used to provide medicinal products and for which, in some cases, there is merit in protecting or translocating them before the proposed powerline commences. For example, according to Pooley (1998), traditional healers use African potato in traditional medicine to treat dizziness, headaches, and mental disorders and in western

medicine, this species is used to treat cancers, inflammation and HIV. While many of these plants are indigenous or exotic weeds that have medicinal value and for which no action is necessary with respect to conservation purposes, others are considered to have high economic value and are considered in need of protection. GDARD has a plant and rescue programme, which has been developed for the removal of plants of horticultural and medicinal value from any development site. Recovery plans are designed to reverse the decline of a threatened or endangered species and eventually bring the population to a self-sustaining level.

No Red Data plant species were recorded in this study. This could be attributed to the destruction and fragmenting of natural habitats and in some alternative routes, disturbance from human settlements. Only two species of conservation importance (Orange listed species) was recorded on site, *Hypoxis hemerocallidea* (**Figure 13**) and *Boophane disticha*. These Orange listed plant species recorded should be removed on site and planted in the nursery prior construction and re-introduced after construction.

Figure 13. *Hypoxis hemerocallidea* recorded along the proposed routes

12.1.5 Habitat available for species of conservation importance

Data sourced from SANBI indicates those plants species on the Red Data List that are known to occur on or surrounding the powerline and their probability of occurrence is indicated in **Table 10**. The probability of occurrence is based on the suitable habit where the species is likely to occur. The proposed powerline route is largely transformed and degraded and some of the species likely to occur may not be found.

Table 10. Red and Orange Listed plant species (amended January 2009) and their targets used in C-Plan 3 (Pfab & Victor, 2002)

Species	Conservation status	Flowering season	Suitable habitat	Probability of Occurrence
Habenaria mossii (G.Will.) J.C.Manning	Endangered	March-April	Open grassland on dolomite or in black sandy soil.	Unlikely
Stenostelma umbelluliferum (Schltr.) S.P.Bester & Nicholas	Near Threatened	September-March	Deep black turf in open woodland mainly in the vicinity of drainage lines.	Unlikely
Bowiea volubilis Harv. Ex Hook.f. subsp. *Volubilis*	Vulnerable	Sept – April	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	Likely
Adromischus umbraticola C.A.Sm. subsp. *Umbraticola*	Near Threatened	September-January	Rock crevices on rocky ridges, usually south-facing, or in shallow gravel on top of rocks, but often in shade of other vegetation.	Likely
Boophane disticha (L.f.) Herb.	Declining	October-January	Dry grassland and rocky areas.	Very likely
Drimia sanguinea (Schinz) Jessop	Near Threatened	August-December	Open veld and scrubby woodland in a variety of soil types.	Likely
Callilepis leptophylla Harv.	Declining	August-January & May	Grassland or open woodland, often on rocky outcrops or rocky hillslopes.	Likely
Crinum macowanii Baker	Declining	October-January	Grassland, along rivers, in gravelly soil or on sandy flats.	Likely
Hypoxis hemerocallidea Fisch., C.A.Mey. & Avé-Lall.	Declining	September-March	Occurs in a wide range of habitats, from sandy hills on the margins of dune forests to open rocky grassland;	Very likely
Gunnera perpensa L.	Declining	October-March	In cold or cool, continually moist localities, mainly	Likely

Species	Conservation status	Flowering season	Suitable habitat	Probability of Occurrence
			along upland streambanks.	
Ilex mitis (L.) Radlk. Var. *mitis*	Declining	October-December	Riverbanks, streambeds, evergreen forests.	Likely
Cleome conrathii Burtt Davy	Near Threatened	May	On stony slopes, usually on sandy soil, open to closed deciduous woodland, quartzites, red sandy soil, all aspects, 1515m.	Likely
Melolobium subspicatum Conrath	Vulnerable	October-May	Grassland.	Unlikely

12.2 Fauna

This faunal survey focused mainly on mammals, and birds of the study area. The survey focused on the current status of threatened animal species occurring, or likely to occur within the study area, describing the available and sensitive habitats. Faunal data was obtained during field surveys of the proposed transmission lines carried out on foot in accessible areas. The data was supplemented by previous surveys conducted in similar habitats, literature investigations, and historic data. Different habitats were explored to identify any sensitive or endangered species. Mammal names are as used by Stuart & Stuart (1998) & Skinner & Chimimba (2005), and bird names by Hockey *et al.* (2005).

12.2.1 Mammals

According to the Magaliesberg Protected Environment: Environmental Management Framework and Plan – Status Quo Report (2007), 90 indigenous mammal species occur in the Magaliesberg. The Sable Antelope (*Hippotragus niger*) is one of the mammal species, which historically naturally occurred within the area, that was re-introduced into the MPNE. According to Hokka (2006), the following large mammal species have been recorded in the MPNE (**Table 11).** The conservation statuses of these species were based on Friedmann & Daly (2004).

Table 11. Red Data Mammal Species recorded in the MPNE (Hokka, 2006).

Species	Common Names	Red Listed Status
Suncus infinitesimus	Least dwarf shrew	Indeterminate
Atelerix frontalis	South African hedgehog	Rare
Proteles cristatus	Aardwolf	Rare

Species	Common Names	Red Listed Status
Hyaena brunnea	Brown hyaena	Rare
Panthera pardus	Leopard	Rare
Mellivora capensis	Honey badger	Vulnerable
Ourebia ourebi	Oribi	Vulnerable

Lists of potential mammal species in the proposed transmission line routes were compiled from a desktop survey from Virtual Museum of African Mammals (**Table 12)** (http://vmus.adu.org.za/vm_view_db.php). This list is therefore based on all historical recordings of mammalian species relevant to the area and recorded in grid cells 2527DB and 2527DD. Due to the fact that the grid cells cover greater area than the proposed alternative routes, the list is likely to overestimate the occurrence of mammal species in the area and thus should be viewed as a guideline for further investigation. The probability of occurrence is based on suitable habitat and the associated threats.

Table 12. Large mammals which could be found on the study area, recorded from 2527DB and 2527DD (Virtual Museum of African Mammals).

Family	Scientific Name	Common name	Probability of Occurrence
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Likely
Cercopithecidae	*Cercopithecus aethiops pygerythrus*	Vervet Monkey	Likely
Giraffidae	*Giraffa camelopardalis camelopardalis*	Giraffe	Unlikely
Bovidae	*Tragelaphus strepsiceros*	Kudu	Likely
Canidae	*Canis mesomelas*	Black-backed Jackal	Likely
Viveridae	*Genetta maculata*	Common Large-spotted Genet	Likely
Felidae	*Caracal caracal*	Caracal	Likely
Equidae	*Equus burchellii*	Plains Zebra	Unlikely
Bovidae	*Connochaetes taurinus taurinus*	Blue Wildebeest	Unlikely
Suidae	*Phacochoerus africanus*	Warthog	Likely
Bovidae	*Aepyceros melampus*	Impala	Likely

Mammals recorded on site

Mammal species diversity was low across the alternative sites. Good habitat cover is present, especially along the rivers and mountains, and therefore a wide diversity of small to medium mammalian species is expected to flourish. Riparian vegetation promotes ecological functionality as the river forms an ecological corridor that highly-mobile species would utilize for migratory purposes. Mammals are sensitive to disturbances and habitat destruction and degradation and as such more species would occur on or near the MPNE than near the

residential areas. Settlement areas have negated the possibility of encountering any medium to large mammals. The presence of dogs in the study area, especially on the western route, poses a threat to the presence of mammals on sites**. Table 13** indicates 13 mammals observed in the study area. The species marked with an asterix (*****) are records based on anecdotal information provided by the land owners of the affected properties and not necessarily observed by the project team. No sensitive or endangered mammals were visually recorded during the site visits.

Table 13. Mammals recorded on the proposed transmission lines.

Common name	Species	Route alternative
Impala	*Aepyceros melampus*	Eastern Route Alternative
Kudu	*Tragelaphus strepsiceros*	Eastern Route Alternative, Western Route Alternative
Black-backed Jackal*****	*Canis mesomelas*	Eastern Route Alternative
Scrub Hare	*Lepus saxatilis*	Eastern Route Alternative, Western Route Alternative
African Mole-rat	*Cryptomys hottentotus*	Eastern Route Alternative, Western Route Alternative
Springhare	*Pedetes capensis*	Eastern Route Alternative, Western Route Alternative
Bushveld Gerbil	*Tatera leucogaster*	Eastern Route Alternative, Western Route Alternative
Yellow Mongoose	*Cynictis penicillata*	Eastern Route Alternative, Western Route Alternative
Common Duiker	*Sylvicapra grimmia*	Eastern Route Alternative, Western Route Alternative
Honey Badger*	*Mellivora capensis*	Eastern Route Alternative, Western Route Alternative
Chacma Baboon	*Papio ursinus*	Eastern Route Alternative, Western Route Alternative
Vervet Monkey	*Cercopithecus aethiops pygerythrus*	Eastern Route Alternative, Western Route Alternative
Blesbok (**Figure 14**)	*Damaliscus pygargus phillipsi*	Western route-West Alternative
Juliana's Golden Mole*	*Ambysomus julianae*	Eastern Route Alternative, Western Route Alternative
Leopard*	*Panthera pardus*	Eastern Route Alternative, Western Route Alternative

Figure 14. Blesbok observed in Western route-West Alternative

The construction of new proposed transmission lines will have negative impacts on the habitat of these mammals recorded on sites but mitigation measures should be put in place to restore the loss of vegetation. The species that the proposed transmission lines would potentially impact most are the mobile species that remain within open areas and are free to migrate in or out of the region.

12.2.2 Avifauna

Conservation and planning tools were consulted for relevancy for this project, and found that one Important Bird Area (IBA) occurs in the study area, *i.e*. Magaliesberg & Witwatersberg IBA (ZA018) (**Figure 15**). Important Bird Areas (IBAs) form a network of sites, at a biogeographic scale, which are crucial for the long-term viability of naturally occurring bird populations (Barnes, 2000). This large IBA includes the magisterial districts of the former Bophuthatswana, Brits, Rustenburg, Swartruggens, Ventersdorp, Koster and Oberholzer. The Magaliesberg range extends in an arc from just south of Rustenburg in the west to Hartbeespoort Dam near Pretoria in the east. Most of the area falls within the MPNE. Within the IBA, several publicly owned protected areas occur. Protected areas within the IBA

include the Diepsloot Nature Reserve, controlled by the Johannesburg Municipality, which lies 10 km south of Hartbeespoort Dam; Rustenburg Nature Reserve, which is 2 km south-west of the town; Mountain Sanctuary Park and Hartbeespoort Dam Nature Reserve as well as several private reserves and conservancies. According to Wesson (2006), total 46.6% of the bird species recorded for the southern African sub region (including Botswana, Lesotho, Mozambique south of the Zambesi River, Namibia, South Africa, Swaziland and Zimbabwe) have been recorded from the Magaliesberg.

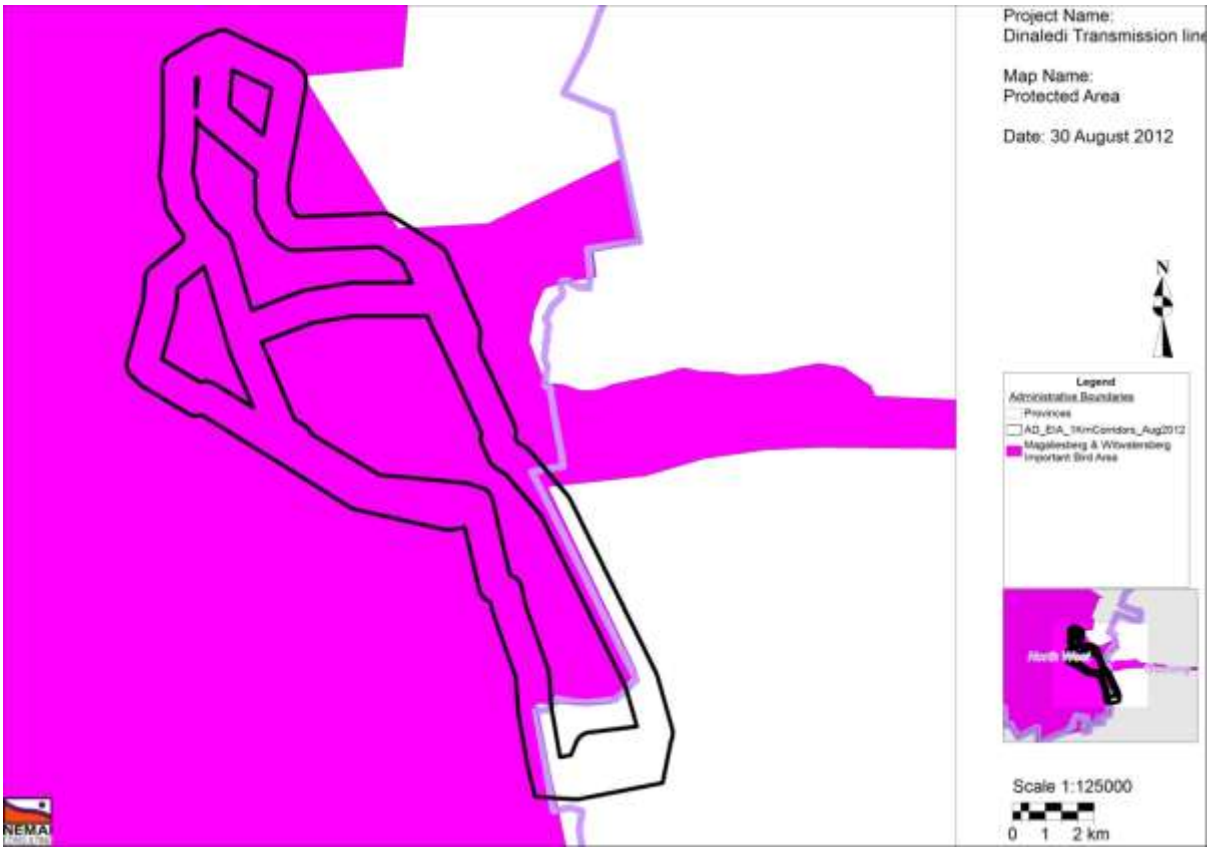

Figure 15. Magaliesberg and Witwatersberg (ZA018) Important Bird Area (IBA)

Human activities have transformed habitats in South Africa to a point where few pristine examples remain (Low & Rebelo, 1996). Continuing pressure on sensitive ridges is largely responsible for the decline of avifaunal species. Observations regarding the number and diversity of birds will provide valuable input to sound management practices for the fast changing environment.

The proposed transmission lines fall within the savanna biome. The savanna biome is rich in large raptors, such as the white-backed vulture, Cape vulture, Martial eagle, Tawny eagle, Lappet-faced vulture, Brown Snake Eagle, Black-chested Snake Eagle, Steppe Buzzard,

African Harrier Hawk, and African Hawk Eagle. A list of Red Data bird species that could possibly occur within the study area is included in **Table 14**. This list was adopted from the South African Bird Atlas Project (SABAP 2) from the Avian Demographic Unit (ADU), University of Cape Town and includes all the bird species recorded in grid cells 2527DB and 2527DD. However, the specific habitat(s) found on site may not suit the particular Red Data species, even though it has been recorded for the quarter degree. For example, the Cape Vulture occurs along the Magaliesberg but will not favour the habitat found within the Pretoria CBD, both of which are both in the same grid. Red Data bird species were selected and categorised according to Barnes (2000). The probability of occurrence was based on the available suitable habitat of that bird species.

Table 14. Red Data species list recorded in grid cells 2527DB and 2527DD

Species code	Common name	Conservation status	Preferred Micro habitat	Probability of Occurrence
50	Pink-backed Pelican	Vulnerable	Favours freshwater and saline lakes and lagoons, open water in marshes, mangrove creeks, sheltered coastal waters	Highly unlikely
84	Black Stork	Near Threatened	Associated with rivers, dams and cliffs.	Likely
90	Yellow-billed Stork	Near Threatened	Associated with water – dams, wetlands, rivers, marshes, even small pools.	Unlikely
96	Greater Flamingo	Near Threatened	Large bodies of shallow water, both inland and coastal; saline and brackish waters preferred	Highly unlikely
97	Lesser Flamingo	Near Threatened	Larger brackish or saline inland and coastal waters	Highly unlikely
118	Secretarybird	Near Threatened	Prefer open grassland, densities low in maize growing areas	Highly unlikely
122	Cape Vulture (Griffon)	Vulnerable	Grassland, Savanna, Hills and Ridges	Occur on site
123	White-backed Vulture	Vulnerable	Savanna and bushveld	Likely
138	Ayres Hawk-Eagle	Near Threatened	Forest and plantations	Unlikely
140	Martial Eagle	Vulnerable	Savanna, woodlands, semiarid shrubland	Likely
172	Lanner Falcon	Near Threatened	Open grassland, woodland	Unlikely
208	Blue Crane	Vulnerable	Present in pockets of remaining grassland and wetlands	Highly unlikely

Species code	Common name	Conservation status	Preferred Micro habitat	Probability of Occurrence
346	Yellow-throated Sandgrouse	Near Threatened	Short-grass plains, usually not far from water; also recently burnt ground, cultivated fields, especially on black clay soils	Likely
393	African Grass-Owl	Vulnerable	Found in rank grass adjacent to wetlands	Highly unlikely
430	Half-collared Kingfisher	Near Threatened	Fast-flowing streams with clear water and well-wooded banks	Likely
772	Red-billed Oxpecker	Near Threatened	Savanna and bushveld	Likely

Birds recorded on site

Loss of habitat remains one of the biggest threats to birds and the environment in South Africa and the rest of the world. A number of distinct ecological systems occur in the study area. These include mountainous areas, streams and river courses, indigenous woodland and grassland floral communities. Sensitive ecological and natural systems also occur along the MPNE. **Table 15** lists bird species recorded in the study area. The species marked with an asterix (*****) were based on anecdotal information provided by the land owners of potentially affected properties.

Table 15. Bird species recorded in the study area

Species	Common name	Route alternative
Apus barbatus	African black swift	Eastern Route Alternative, Western Route Alternative
Ardea melanocephala	Black-headed heron	Eastern Route Alternative, Western Route Alternative
Bostrychia hagedash	Hadeda ibis	Eastern Route Alternative, Western Route Alternative
Bubulcus ibis	Cattle Egret	Eastern Route Alternative, Western Route Alternative
Cercomela familiaris	Familiar Chat	Eastern Route Alternative, Western Route Alternative
Charadrius pallidus	Three-banded plover	Eastern Route Alternative, Western Route Alternative
Cisticola juncidis	Zitting Cisticola	Eastern Route Alternative, Western Route Alternative
Columba guinea	(Speckled) Rock pigeon	Eastern Route Alternative, Western Route Alternative
Corythaixoides concolor	Grey go-away-Bird (Lourie)	Eastern Route Alternative, Western Route Alternative
Corvus albus	Pied Crow	Eastern Route Alternative, Western Route Alternative
Elanus caeruleus	Black-shouldered Kite	Eastern Route Alternative, Western Route Alternative

Species	Common name	Route alternative
Euplectes orix	Southern Red Bishop	Eastern Route Alternative, Western Route Alternative
Gyps africanus*	White-backed vulture	Eastern Route Alternative
Gyps coprotheres*	Cape vulture	Eastern Route Alternative
Hirundo cucullata	Greater Striped Swallow	Eastern Route Alternative, Western Route Alternative
Lanius collaris	Common Fiscal	Eastern Route Alternative, Western Route Alternative
Lamprotornis nitens	Cape Glossy Starling	Eastern Route Alternative, Western Route Alternative
Numida meleagris	Helmeted guineafowl	Eastern Route Alternative, Western Route Alternative
Mirafra africana	Rufous-naped Lark	Eastern Route Alternative, Western Route Alternative
Phylloscopus trochilus	Willow Warbler	Eastern Route Alternative, Western Route Alternative
Ploceus velatus	Southern masked-Weaver	Eastern Route Alternative, Western Route Alternative
Polemaetus bellicosus*	Martial eagle	Eastern Route Alternative, Western Route Alternative
Pternistes swainsonii	Swainson's spurfowl (francolin)	Eastern Route Alternative, Western Route Alternative
Pycnonotus tricolor	Dark-capped (Blackeyed) Bulbul	Eastern Route Alternative, Western Route Alternative
Sigelus silens	Fiscal Flycatcher	Eastern Route Alternative
Struthio camelus	Common Ostrich (**Figure 16**)	Eastern Route Alternative
Streptopelia senegalensis	Laughing Dove	Eastern Route Alternative, Western Route Alternative
Streptopelia capicola	Cape Turtle-Dove	Eastern Route Alternative, Western Route Alternative
Streptopelia semitorquata	Red-eyed Dove	Eastern Route Alternative, Western Route Alternative

Figure 16. Ostrich recorded on eastern route alternative

Interactions of birds with transmission lines

Electrical infrastructures constitute an important edge between nature and man. Negative interactions between wildlife and electrical infrastructures take many forms, but the two most familiar problems in southern Africa are electrocution of birds and collision of birds with transmission lines (Van Rooyen, 2004). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure and disturbance and habitat destruction during construction and maintenance activities. It is however a common rule that large and heavy-bodied terrestrial bird species are more at risk of being affected in a negative way when interacting with transmission lines (Van Rooyen, 2007). These include the following:

Electrocution

Electrocution happens when a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen, 2007).

According to Van Rooyen (2007), transmission lines are known to act as roosting and breeding sites for species such as Bald Ibis, Martial Eagles, Tawny Eagles, African White-backed Vultures, and even occasionally Verreaux's Eagles. Lappet-faced Vultures are known to using transmission lines as roosts, especially in areas where large trees are scarce while Cape Vultures have also taken to roosting on transmission lines in certain areas in

large numbers. Other types of electrocutions happen by means of so-called “birdstreamers”, often referred to as bird pollution. This happens when a bird, especially when taking off, excretes and thereby causing a short-circuit or electrical fault through the fluidity excreta (Van Rooyen, 2007). Other species also likely to be affected include those prone towards roosting on pylons such as the Black Stork (*Ciconia nigra*).

Collision

Collisions with earthed wires have probably accounted for most “bird-transmission line” interactions in South Africa. In general, the earthed wires are much thinner in diameter when compared to the live components, and therefore less visible to approaching birds. Many of the species likely to be affected include heavy, large-bodied terrestrial species such as cranes, storks, flamingos, bustards, korhaans and a variety of water birds that are not very agile or manoeuvrable once airborne. These species, especially those with the habit of flying with outstretched necks (e.g. cranes, most species of storks and flamingos) find it difficult to make a sudden change in direction while flying – resulting in the bird flying into the wires. Areas where bird collisions are likely to be high could be ameliorated by marking the lines with bird devices such as “bird diverters” and “bird flappers” to increase the visibility of the lines (Van Rooyen, 2007). According to African Centre for Energy and Evironment (2003), Bird Flappers have proven to be more effective than the Bird Flight Diverter. In South Africa, It has been found that more collisions are common with shield wire than collions with the overhead conductor and birds usually avoid the highly visible bundled conductor on higher voltage overhead lines but fail to recognise the smaller shield wire (Alonso & Alonso, 1999a).

Site disturbances, habitat destruction and displacement of species.

This is important to all species, but in terms of conservation priorities is most pertinent to RDL species identified within the area. Initial destruction and then the maintenance of vegetation clearing within servitudes have a greater impact within savanna areas than in grassland-dominated areas. Grasslands are allowed to re-establish within the servitudes following completion of the construction phases, whereas savanna areas are not allowed to re-establish.

There are positive interactions between overhead powerlines and avifauna as well (van Rooyen, 2004):

1. Pylons can provide a safe nesting and perching sites away from predators. Some Lesser kestrel colonies have been shown to use overhead lines almost exclusively as perching sites;

2. Pylons can also provide nesting sites within areas devoid of tall trees. This has enabled certain species to expand their range.

Description of avifaunal habitat units

Many avifaunal species are adaptable as they are habitat generalists and can therefore accommodate a certain degree of habitat degradation and transformation (Harrison *et al.,* 1997). Other species are extremely habitat specific and have to rely on certain habitat units for breeding, hunting or foraging and roosting. Habitat-specific species are sensitive to environmental change, with destruction of habitat being the leading cause of species decline worldwide (Barnes, 2000). Untransformed habitats on site, especially along the eastern route, offer suitable habitat for any larger terrestrial birds as well as certain smaller raptor species. Potential nesting sites for raptors were searched for during fieldwork but none found. Within the vegetation types found in the study area and immediate surrounding areas, three major bird habitat systems were identified.

Patches of remaining grasslands

The majority of the natural grasslands in the area have been transformed into human settlements but patches of natural grasslands do remain on site (**Figure 17**). The Secretarybird (*Sagittarius serpentarius*) is amongst the Red Data Listed species recorded from the region that readily utilize the open grasslands and since this habitat has been transformed, there is little possibility that this species still continue living in the study area. Many habitat generalist species utilize this habitat type predominantly for foraging and hunting purposes. The disturbances of the topsoil layers also very often allow for greater foraging for insectivorous species. The farmland habitat type, however, is not a habitat type that is relied upon by any avifaunal species for survival, but opportunistic species that migrate between agricultural fields could be adversely affected by collisions with overhead lines that they intercept (van Rooyen, 2004).

Figure 17. Patches of remaining natural grasslands

Hills, ridges and woodland areas

The new proposed transmission lines will traverse through woodland habitat, which varies between broadleaved woodland, *Acacia*-dominated woodland, and open woodland with small scattered *Acacia* trees. The bird species within this habitat generally include a great variety of arboreal passerines, such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and weavers, as well as arboreal non-passerines such as doves, cuckoos and woodpeckers. Many of these species make use of the thorny nature of these trees to build their nests (**Figure 18**). Acacia trees typically attract many insects and in turn attract a good diversity of typical bird species found in *Acacia* savanna. The Black-shouldered kite (**Figure 19**), was recorded in the eastern route alternative. Even though bird species such as Owls and Red-listed Cape vultures (*Gyps coprotheres*) (Vulnerable) were not observed during field visits, these species have been previously sighted on Portion 25 of the Farm Welgedund 491 JQ and also on the Farm Rietfontein 485 JQ. The Cape vulture is known to forage over open grassland and woodland and is dependent on tall cliffs for breeding. Suitable habitat is available in the MPNE. Ridges and Hills (**Figure 20**) represent important habitat for number of bird species such as raptors and swifts/swallows. Raptors will be prevalent along ridges and likely to hunt along the ridge edge, which result in them distracted by prey, and making them vulnerable to collisions.

Figure 18. *Acacia* trees provide habitats for bird species

Figure 19. Black-shouldered kite was observed in the eastern alternative route

Figure 20. Hills and ridges on site

Rivers and associated riparian zones

The study area includes one of the significant sensitive faunal habitats – riparian vegetation, which could be suitable habitat for bird species that utilize this habitat type. Riparian habitats (**Figure 21**) are of particular importance for birds in the study area especially where the area is largely transformed. Areas with reeds, sedges or grassy tangles are suitable for Common Waxbills (*Estrilda astrilda),* Bishops and various warblers (Marais & Peacock, 2008). Water bodies also represent sensitive areas because they provide habitat for a wide variety of terrestrial and aquatic species, particularly avifauna. Very little birdlife was observed along the two rivers during the site visit, but species such as kingfishers, cormorants and herons are expected to frequent the river, with Half-collared Kingfishers also likely to be present from time to time. The reed beds will provide important potential breeding sites for many of the bishops and weavers that were observed. Wooded riparian habitats along the Moganwe River, Hennekop rivers and Swatspruit may provide suitable habitats for various species such as African darter, various cormorants, kingfishers, bee-eaters, and numerous smaller species. Rivers also present feeding areas for fish eating raptors like African Fish Eagle. Any river or stream represents an important flight path for many brid species.

Figure 21. Moganwe River provides habitats for water-dependent bird species

13. ECOLOGICAL SENSITIVITY ANALYSIS OF THE STUDY AREA

The objective of the ecological sensitivity analysis is to specify the location and extent of all sensitive areas on the proposed alternative routes that must be protected from transforming land uses. Sensitivity is the vulnerability of a habitat to any impact, ridges and wetlands would be more vulnerable to development than would a sandy plain. Magaliesberg Pretoria Mountain Bushveld, Marikana Bushveld and Witwatersberg Pretoria Mountain Bushveld are listed as the terrestrial threatened ecosystems occurring on site. Ecosystem status is based on how much of an ecosystem's original area remains intact, relative to certain thresholds (Driver *et al.* 2004).

The following criteria were used to identify sensitive areas within the study area:

- Protected Areas and Important Bird Areas (**Figure 22**);
- Threatened Terrestrial Ecosystems (**Figure 23**);
- Any koppies and ridges (**Figure 24 and Figure 25**);
- Rivers and wetlands (**Figure 26**) and
- Species of conservation importance (**Figure 27**).

Figure 22. Proposed transmission line routes in relation to Protected Areas and IBA

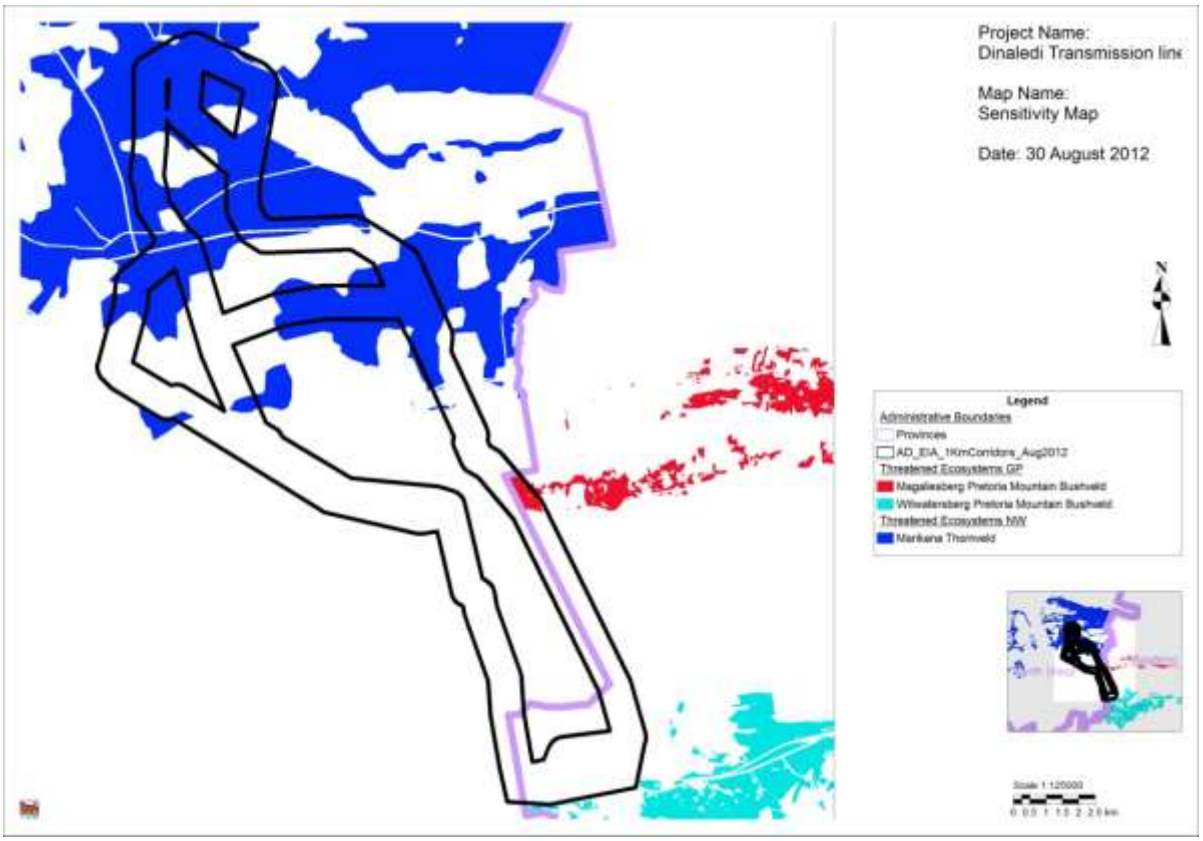

Figure 23. Proposed transmission line routes in relation to threatened terrestrial ecosystems

Figure 24. Proposed transmission line routes in relation to ridges in Gauteng province

Figure 25. Proposed transmission line routes in relation to ridges in Gauteng province

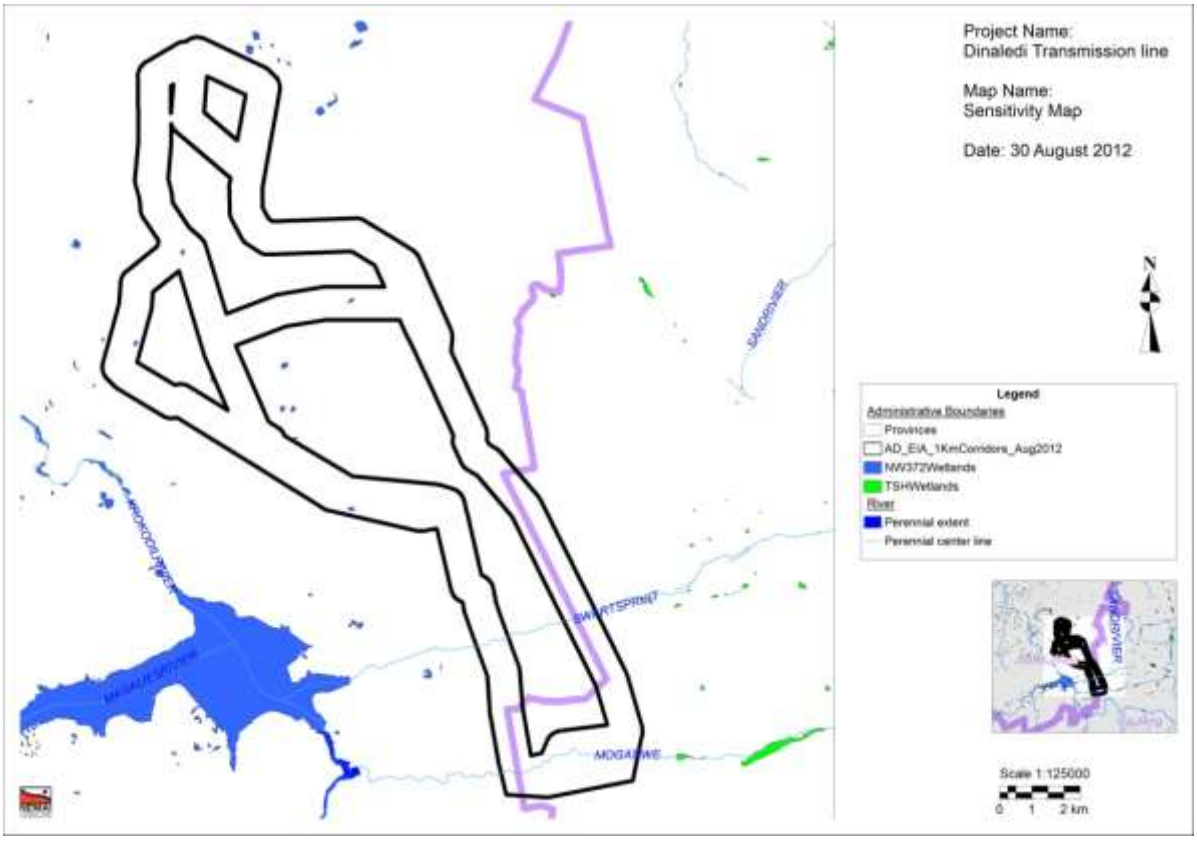

Figure 26. Proposed transmission line routes in relation to rivers and wetlands

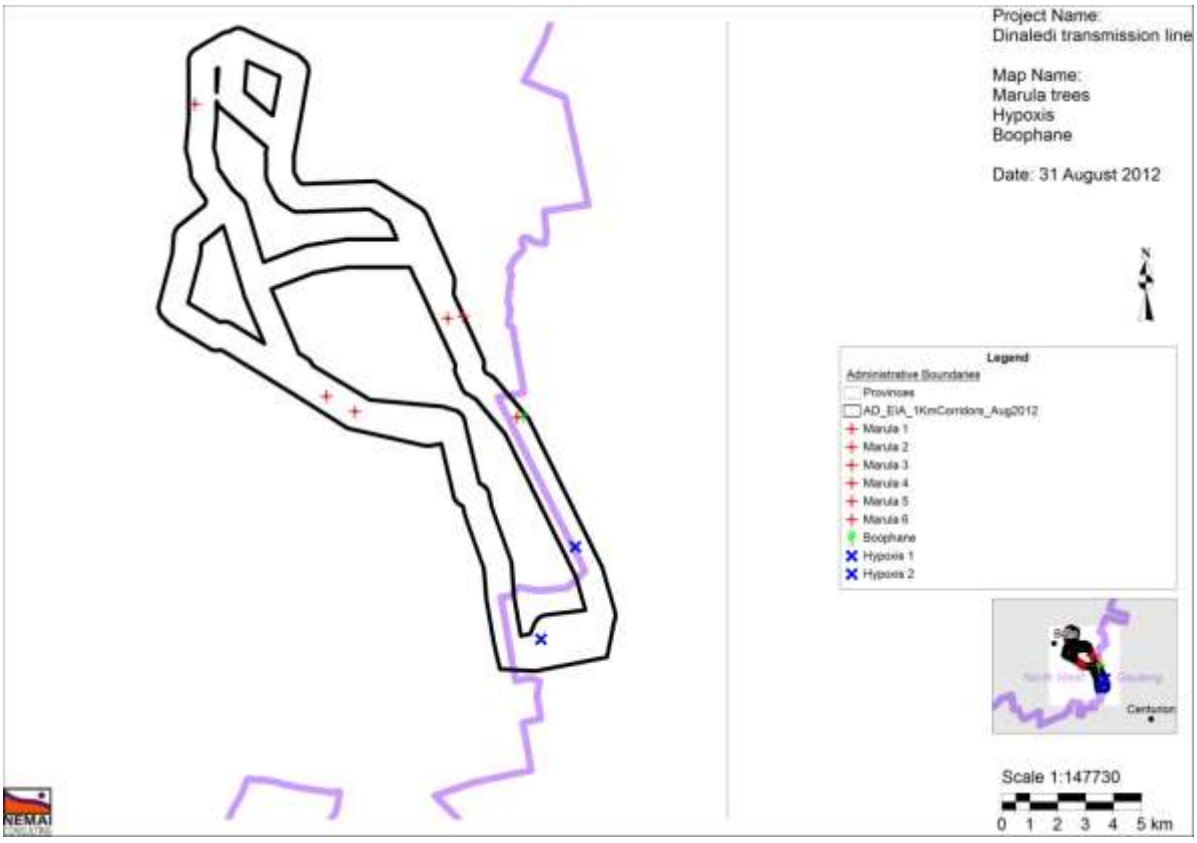

Figure 27. Proposed transmission line routes in relation to species of conservation importance

All three alternatives would traverse through the sensitive areas such as ridges. According to the Gauteng ridge policy, the transmission lines fall within Class 2 and the policy requirements states that *Low impact development activities, such as tourism facilities, which comprise of an ecological footprint of 5% or less of the property, may be permitted. (The ecological footprint includes all areas directly impacted on by a development activity, including all paved surfaces, landscaping, and property access and service provision).* Vultures (Cape and White-backed) are known to occur in the Eastern route and to a lesser extent, on the ridges of Western route.

Once the precise route has been demarcated, that specific area should be re-surveyed to make sure that plant and animal species are adequately recorded, and any species with high conservation value must be re-located or protected as far as possible. Development or any change in land use usually contributes to habitat loss in many biodiversity important areas, such as MPNE. Much of the impact can be minimised through careful planning and avoidance of sensitivitive areas and hence the route that has least biodiversity impacts is chosen. A portion of Wonderboom Municipal Nature reserve falls within the Eastern route, and also the red- data plant species- *Hypoxis hemerocallidea* and *Boophane disticha,* were recorded along this route and therefore this route is not considered an an option due to the number of species of conservation importance recorded. The marula trees recorded on the Western route were mostly found along the main road or near the exisiting powerlines and could be relocated to an area with similar habitat to ensure their survival.

14. ENVIRONMENTAL IMPACT ASSESSMENT

14.1 Methodology

Potential environmental impacts are analyzed with regard to their nature, extent, magnitude, duration, probability and significance. The following definitions and scoring system apply:

Nature (/Status)
The project could have a positive, negative or neutral impact on the environment.

Extent
- Local – extend to the site and its immediate surroundings.
- Regional – impact on the region but within the province.
- National – impact on an interprovincial scale.
- International – impact outside of South Africa.

Magnitude
Degree to which impact may cause irreplaceable loss of resources.
- Low – natural and social functions and processes are not affected or minimally affected.

- Medium – affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

Duration

- Short term – 0-5 years.
- Medium term – 5-11 years.
- Long term – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Probability

- Almost certain – the event is expected to occur in most circumstances.
- Likely – the event will probably occur in most circumstances.
- Moderate – the event should occur at some time.
- Unlikely – the event could occur at some time.
- Rare/Remote – the event may occur only in exceptional circumstances.

Significance

Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-
0 – Impact will not affect the environment. No mitigation necessary.
1 – No impact after mitigation.
2 – Residual impact after mitigation.
3 – Impact cannot be mitigated.

Table 16. Recommended mitigation measures with significance rating before and after mitigation for the transmission lines.

FLORA PRE – CONSTRUCTION PHASE Eastern Route Alternative and Eastern Route Alternative Deviation					
Impact	Nature	Description	Mitigation		
Direct	Positive	Search and Rescue	A qualified and / or appropriately experienced Botanist or an experienced person who knows specific vegetation types well should mark any species of conservation importance (*Hypoxis hemerocallidea, Sclerocarya birrea* and *Boophane disticha*) and other medicinal plants when the route is pegged. All medicinal, protected or red data listed species should be removed prior to the clearing of vegetation. The footprint area should be resurveyed by a plant ecologist and should be relocated to an area with similar habitat to ensure species survival. Workers must be educated to recognize markers on plants. Sensitive environmental features must be identified, mapped and demarcated as no-go zones, where possible.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	1
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA PRE – CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Site preparation	During site preparation topsoil must be removed and stored separately from organic material and spoil material for use in the rehabilitation phase. It should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater. Records of all environmental incidents must be maintained and a copy of these records must be made available to authorities on request throughout the project execution.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA PRE – CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Establishment of Site Camps	A suitable position for the construction camp to be selected, in consultation with the Environmental Control Officer (ECO). The positioning of the site camps must not be near any sensitive areas such as ridges, and rather be positioned in areas that are already disturbed, such as near human settlements wherever possible.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Long-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA PRE – CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Environmental Awareness Creation	Establish procedures to effectively verify and address complaints and claims received. Complaints or liaisons with landowners with regard to environmental matters must be recorded, reported to the correct person and a record of the response is to be entered in the complaints register. Establish lines of communications with landowners. Provide relevant contact details to landowners for queries / raising of issues or complaints. Landowners will be kept up to date with projected construction durations on their properties.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Long-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FAUNA PRE – CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Search and Rescue	A qualified and / or appropriately experienced Zoologist or an experienced person who knows the animals in the region well will identify any possible Red Data fauna on site and the necessary permits to relocate fauna will be obtained if avoidance is not possible. Training of construction workers to recognize threatened animal species will reduce the probability of fauna being harmed unnecessarily.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FAUNA PRE – CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Site preparation	During site preparation special care must be taken during the clearing of the works area to minimize damage or disturbance of roosting and nesting sites. Barricading measures to be utilised should not restrict the movement of the fauna in the area. As a pre-requisite to construction, it is strongly recommended that a rigorous monitoring programme is implemented to detail avian densities in the impact zone, better quantify flight paths and routes on site and in the immediate surrounding area. Careful installation of bird flappers on the conductors,at the Saartjies Nek will be required in order to mitigate collision risks at this vulnerable flight path area. Bird species, such as Bustards and cranes, which have slow, heavy flight pattern, are prone to collisions.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Removal and management of topsoil	Removal of vegetation during stripping and construction will be minimized to reduce the erosion potential. Topsoil will only be removed off areas proposed for installation of transmission lines. All soils should be stored and managed correctly for rehabilitation. Minimize topsoil disturbance as far as possible. Dumping or storage of topsoil must not be done on established vegetation, but should remain within the servitude footprint. Determine the average depth of the topsoil prior to excavations Remove topsoil from areas to be affected by construction activities. Prevent mixing of topsoil with subsoil. Topsoil to be adequately protected from contamination from construction activities and material. Protect stored topsoil from compaction. Wind and water erosion-control measures to be implemented to prevent loss of topsoil. Where relevant, following the construction phase the topsoil should be placed as the final soil layer prior to seeding.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	2

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Habitat lost during clearing for the access road.	Careful planning of access roads in order to prevent excessive removal of trees and prevent soil erosion. No collection of firewood may be allowed. Topsoil will only be removed off areas proposed for access roads. All soils should be stored and managed correctly for rehabilitation. Rehabilitate all temporarily access roads by replacing topsoil and scarring compacted earth to allow seedlings to take root. When possible make use of existing roads rather than creating new access routes. Areas such as Saartjies Nek should be marked with suitable anti collision marking devices (bird flappers) in order to make them more visible to birds in flight.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	2

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Habitat fragmentation	Remove vegetation only on areas ear-marked for powerlines construction. Careful planning of access roads in order to prevent excessive removal of trees and prevent soil erosion. Rehabilitate all temporary access roads.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Vegetation and habitat disturbance due to the accidental introduction of alien species.	Promote awareness of all personnel. After construction programme continued monitoring and control of alien weeds and invaders through hand removal; slashing (annuals) or chemical control (perennials).		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Vegetation and soil disturbance around construction sites due to general construction activities	Minimize topsoil disturbance as far as possible. Level and landscape disturbed topsoil areas to facilitate plant succession. Erosion control measures, such as stone packing, brush packing and reseeding, should be included on disturbed areas.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Soil contamination, vegetation loss and vegetation disturbance due to fuel and chemical spills.	Employ on-site personnel responsible for preventing and controlling potential soil pollution through fuel and oil leaks and spills. Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks. Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Containers containing potential contaminating substances must be kept on drip-trays or tarpaulins in case of spills. Drip-trays must be placed under vehicles and equipment when not in use.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Loss of aesthetic value and sense of place of ridges	Ensure that development designs compliment the natural surroundings in order to preserve a sense of place.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	2

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Vegetation and habitat disturbance due to pollution and littering during construction phase.	Employ personnel on site responsible for preventing and controlling of litter. Promote housekeeping with daily clean-ups on site. Before construction commences, construction workers should be educated with regards to littering, *ad hoc* veld fires, and dumping. Fires must be limited to designated areas and monitored closely.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Vegetation disturbance in and around construction camps.	Fencing of construction camps. No equipment or personnel will be allowed outside of the fenced construction servitude. Level and landscape disturbed topsoil areas to facilitate plant succession and to match surrounding topography. Erect construction camps on previously disturbed areas, preferably near residential areas. Erect construction camps on level surfaces only.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Vegetation disturbance due to increased dust during construction phase.	Wetting down of work areas can be used to reduce dust levels but not to a degree that causes runoff and contamination. Cultivate awareness among personnel to limit excessive and unnecessary dust. Maintain speed control measures on access roads through construction of speed bumps and speed limit signs.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Damage to plant life outside of the proposed transmission line routes area	Any plant accidentally removed outside the proposed routes should be replaced or rehabilitated at the expense of the contractor. Measures must be taken to penalize construction workers who damage plants intentionally or remove plants accidentally without reporting the incident.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE Eastern Route Alternative and Eastern Route Alternative Deviation					
Impact	Nature	Description	Mitigation		
Direct	Positive	Destruction of species of conservation importance and their natural habitats	The removal of any plant material from site, including flowers or bulbs is strictly prohibited unless unavoidable and essential for the purposes of construction. Relocation of plants of conservation importance (such as *Sclerocarya birrea* and *Boophane disticha*) should be implemented by a qualified specialist, following issue of relevant permits. The contractor for vegetation clearing must demonstrate competence and knowledge to be able to identify different species, declared weeds and alien species correctly. Leave as much of the natural vegetation intact as possible in order to maintain ecological corridors for the movement of species and make an effort to increase the natural areas around sensitive features such as ridges and rivers. Minimise the width of the servitude, particularly in sensitive areas.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	2

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Excavate foundations	Prevent disturbance to existing structures and services. Where necessary, safely barricade all excavations. Inspect open excavations daily. Divert runoff away from excavations. Restore all disturbed land to original gradient and/or slope.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Management of waste	No littering on construction site. Clean and tidy construction site. Maintain records of all waste generated and disposed at waste disposal facilities on a waste register. Valid disposal certificates for all waste disposed of are required to be available for inspection. Provision of adequate containers that are easily accessible and maintained for waste. Hazardous waste must be removed by a registered service provider and records of safe-disposal certificates must be maintained. Waste bins and toilets must be removed and cleaned weekly.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FAUNA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Habitat destruction and fragmentation	Avoid indiscriminate damage of natural habitats. Removal of vegetation should be limited to designated areas only. .		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FAUNA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Disturbance to animals	Animals residing within the designated area shall not be unnecessarily disturbed. Before construction starts, construction workers must be educated with regards to littering and poaching. Species of conservation importance such as Cape vultures (listed as vulnerable) are known to occur on the study area (Farm Welgegund 491 JQ) and extra care should be taken not to disturb the roosting and nesting sites of these bird species.this species is known to nest on cliffs and feeds on grasslands. The Contractor and his/her employees shall not bring any domestic animals onto site. Photographs of sensitive animals must be displayed in the construction camp to heighten awareness of the creatures. Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding snakes. Carry out the construction before or after the breeding season (i.e. from March–July) in order to reduce disturbance to breeding birds.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FAUNA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Removal of vegetation	Leave as much of the natural vegetation intact as possible in order to maintain ecological corridors for the movement of species. Make an effort to increase the natural areas around sensitive features such as ridges and rivers. In areas where there are nesting sites for birds, vegetation should not be disturbed, particularly near rivers. These areas should be clearly marked as no-go areas. All soils should be stored and managed correctly for rehabilitation to maintain natural habitats for animals. Construction activities should be limited to daylight hours, in order to minimize impacts on nocturnal fauna		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Long-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	2

FAUNA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Transportation of materials	Construction trucks should travel at a maximum speed of 40Km/h on access roads and 10Km/h on site in order to avoid unnecessary killings of animals found on site and to minimise dust generation. Loose material such as sand and gravel must be covered with tarpaulins during transport.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FAUNA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Bird streamers causing electrical faults.	Perch management through the use of perch deterrents (bird guards) can be used and fitted at least 1m directly above and on both sides of the phase conductor. Open perch areas should be allowed to remain after construction.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FAUNA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Allow for safe animal passage through and specifically out of the construction site.	Construction areas must be fenced using palisades for the migration of small faunal species out of the construction zone. This excludes areas where animal activity could be hazardous, such as around excavations, where such areas should be appropriately blocked off. Site camps should be placed in areas that do not impact on animal movement corridors.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FAUNA CONSTRUCTION PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	To protect and maintain habitats of sensitive species.	Important sensitive habitats such as rivers and ridges need to be preserved in order to protect species that utilize these areas as their preferred habitats. A buffer-zone around sensitive areas must be demarcated with hazard tape or orange mesh netting to prevent accidental disturbance.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	2

FLORA OPERATIONAL PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	The construction of the proposed transmission line may affect biodiversity through the encroachment of exotic vegetation following soil disturbance, in addition the maintenance of the area would disturb naturalized species within the area.	Encroachment of alien vegetation should be monitored regularly and controlled; the area must be kept clear of all invader plants as per the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983). Rehabilitation measures must be employed until such a time as indigenous species are established. If herbicides are used then correct licenses and permits must be acquired prior to use.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FAUNA OPERATIONAL PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Maintenance of powerlines	Use the existing road and look out for animals on the road. Speed limits must be maintained with the use of signs and speed bumps.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FAUNA OPERATIONAL PHASE All Alternatives					
Impact	Nature	Description	Mitigation		
Direct	Positive	Collisions of birds with overhead lines and alteration of flight paths	People responsible for maintaining the area should monitor for collisions and report any incidents. Fitting bird flappers on the lines within the flight paths (especially in Saartjies Nek, west of the proposed Western route) and the major migratory routes pertaining to the project area to coincide with sensitive areas such as river valleys and prominent ridge systems. Species such as Cape vultures should be monitored for collisions.		
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	2

15. CONCLUSION

The proposed transmission line will be approximately 40km in length and will be constructed in the Madibeng Local Municipality (North West) and the City of Tshwane Local Municipality (Gauteng). During field surveys, it was observed that the majority of the survey area (with the exception of Magaliesberg Protected Natural Environment (MPNE)) had been transformed through agriculture, formal settlements and other forms of infrastructure development, such as powerlines, roads and Telkom lines. The three alternative routes incorporate habitat units that would support a variety of both floral and faunal species biodiversity, particularly in the MPNE and riparian habitats.

Powerlines are linear in nature and that means that they pass through a variety of habitat types, topographies and climatic zones. This means that a variety of vegetation types, and therefore habitat integrity, will be affected by the proposed development. Magaliesberg Pretoria Mountain Bushveld, Marikana Bushveld and Witwatersberg Pretoria Mountain Bushveld are listed as terrestrial threatened ecosystems occurring on site. Witwatersberg Pretoria Mountain Bushveld and Magaliesberg Pretoria Mountain Bushveld are listed as **Critically Endangered** (CR) Threatened Terrestrial Ecosystems and as such any further negative impacts on this ecosystem should be avoided.

The proposed transmission lines will traverse through the Magaliesberg mountain range, which is a very unique mountain range of great ecological, geological and cultural importance and value. In order to preserve this uniqueness of the mountain, there must impacts that could cause the habitat destruction and fragmentation must be minimised and mitigated as much as possible.

Two Red Data plant species, *Hypoxis hemerocallidea* (Star-flower or African potato) and *Boophane disticha* (Sore-eye flower) were observed in abundance on the study site. These species are listed as Declining and will have to be relocated to another area of the same habitat during construction. The exotic plant species *Melia azedarach* (Syringa trees), *Lantana camara* (Common lantana) and *Solanum mauritianum* (Bugweed) were common at the site. Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of the invader species be removed and eradicated.

According to National Forests Act 1998 (Act No 84 of 1998), a permit is required from DAFF as *No person may (a) cut, disturb, damage, destroy or remove any protected tree; or (b) collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister."* Only one protected tree was recorded, i.e. *Sclerocarya birrea* subsp *caffra.* This must be incorporated in preconstruction planning to avoid damage to the tree.

Mammals are sensitive to disturbances and habitat destruction and degradation and as such many more species would occur on or near the MPNE than near the residential areas. Thirteen mammals were recorded in the study area from a combination of observations during site-visits and anecdotal evidence provided by local landowners. No sensitive or endangered mammals were visually recorded during the site visits. During the construction of the pipeline it is anticipated that there would be a loss of ecologically sensitive and important habitat units; ecosystem function and faunal habitat. These effects should be temporary as any mammals residing on site would move probably to another area nearby and could move back after the pipeline construction has been completed and rehabilitated.

In terms of avifauna, the study area falls within the Magaliesberg and Witwatersberg Important Bird Area (IBA(ZA018)). IBAs form a network of sites, at a biogeographic scale, which are critical for the long-term viability of naturally occurring bird populations. MPNE provides a suitable habitat for Red data bird species that are known to occur in the area. Cape Vultures and eagles are known to occur on the MPNE. It is however recommended that for areas where the transmission line will run in close proximity to sensitive habitats, the disturbance factors must be limited as much as possible to avoid displacement of sensitive species. Route alternatives would be preferred that are located in close proximity to the existing main transmission system infrastructure as studies have shown that migratory birds become familiar with the powerline patterns within an area and therefore learn to avoid them (van Rooyen, 2009).

The Eastern route is regarded as the route alternative that would pose the greatest threat to the overall biodiversity of the area during construction of the proposed transmission line as it traverses through the sensitive areas such as MPNE, and the number of Orange Listed plant species recorded on this route were higher than the other route alternatives. The preferred route in terms of flora and fauna sensitivity would be the Western Route-Western deviation, as most parts of the route are along the main road and existing powerline and are

considered less sensitive than the alternative routes in terms of biodiversity. Resident birds in an area become accustomed to a power line that crosses their flight paths, and learn to avoid it during their everyday activities and hence adding a new power line adjacent to an exisiting line would probably have less impact than putting it in totally new area, where the resident birds are not tey accustomed to overhead lines.The use of existing degraded habitat is preferable and habitat units known to be highly productive in supporting breeding, foraging and roosting sites, such as wetlands and ridges should be avoided.

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