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EMKHIWENI SUBSTATION AND 400KV LINE FROM EMKHIWENI SUBSTATION TO SILIMELA

DEA REFERENCE NO: 14/12/16/3/3/2/1063

Terrestrial Ecological Impact Assessment Report

August 2019

Final

Prepared for: Eskom Holdings SOC Limited

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Title and Approval Page

Project Name:	Emkhiweni Substation and 400KV Line from Emkhiweni Substation to Silimela
Report Title:	Terrestrial Ecological Impact Assessment Report
DEA Reference No:	14/12/16/3/3/2/1063
Report Status	Final

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Executive Summary

Introduction and Background

Nemai Consulting was appointed by Eskom in 2009 to undertake the Environmental Impact Assessment (EIA) as part of the 2006 EIA Regulations for the following projects:

1. Construction of the Rockdale B Substation (now referred to as Emkhiweni Substation), with 2x500MVA 400/132kV transformers; and
2. Construction of the Rockdale B to Wolwekraal 400kV line (now referred to as the Emkhiweni Substation to Silimela 400kV line).

The projects were authorised in May 2011 (Emkhiweni Substation) and July 2011 (Emkhiweni-Silimela 400kV line). Eskom has decided to proceed with the construction of Emkhiweni-Silimela 400kV line (which is approximately 80kms) however the previous Record of Decision (RoD) has lapsed. Therefore, Nemai Consulting are undertaking a new application for Environmental Authorisation (EA) as part of the 2014 EIA Regulations, as amended (07 April 2017). Eskom was not able to proceed with construction within the RoD timeframes as a result of the lack of funding for the project. The proposed project is associated with the transmission network and its associated substations in the Mpumalanga and Limpopo Provinces. The proposed activity entails the construction of a 400kV powerline from the Middelburg area in the south to the Marble Hall/Wolwekraal area in the north. Emkhiweni substation will be constructed in Middleburg area whereas the Silimela substation will be near Marble hall.

A Terrestrial Ecological Assessment was undertaken as part of the EIA Process in order to assess the impacts that the proposed development will have on the receiving environment. The objective of this study was to identify sensitive species and their habitats within the proposed development routes. The current ecological status and conservation priority of vegetation on the sites were assessed. Potential faunal habitats were also investigated in the study area and all mammals, reptiles and amphibians known to occur within the servitude or seen were recorded. Red Data species (both fauna and flora) that are known to occur on site were investigated.

Study Area

The proposed activity entails the construction of a 400kV powerline from the Middelburg area in the south to the Marble Hall/Wolwekraal area in the north. The proposed line originates at the Wolwekraal Substation, which is situated approximately 13km to the southeast of Marble Hall (Limpopo Province) on the Farm Loskop Noord 12 JS and runs south-eastwards. The line terminates at the proposed Emkhiweni Substation within Mpumalanga Province. The proposed development falls within the jurisdiction of the Steve Tshwete Local Municipality

(LM), Elias Motsoaledi LM and Ephraim Mogale LM. The width of the powerline servitude upon completion would be 55m in total.

Regional Vegetation

The Emkhiweni Substation and Emkhiweni-Silimela 400kV powerline falls within the Grassland and Savanna biomes. The Grassland biome has a high biodiversity, ranked only below the Fynbos biome in terms of biodiversity in South Africa. This Biome is found mainly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal Province and the Eastern Cape. Grasslands are dominated by a single layer of grasses. Trees are absent, except in a few localised habitats and geophytes are often abundant. The Savanna Biome is the largest Biome in South Africa and occupies over one third of the whole area. It is characterized by a grassy ground layer and distinct upper layer of woody plants. The study area is classified as falling within the following vegetation types: Central Sandy Bushveld (Savanna biome), Loskop Mountain Bushveld (Savanna biome), Loskop Thornveld (Savanna biome) and Rand Highveld Grassland (Grassland biome).

Terrestrial Threatened Ecosystems

The southern sections of the project area fall within the Rand Highveld Grassland terrestrial threatened ecosystem (listed as Vulnerable).

Limpopo Conservation Plan

Critical Biodiversity Areas (CBAs) are areas that are important for conserving biodiversity while Ecological Support Areas (ESAs) are areas that are important to ensure the long-term persistence of species or functioning of other important ecosystems. Degradation of CBAs or ESAs could potentially result in the loss of important biodiversity features and/or their supporting ecosystems. The map of CBAs includes five categories: Critical Biodiversity Area 1, Critical Biodiversity Area 2, Ecological Support Area 1, Ecological Support Area 2, No Natural Remaining (NNR), Other Natural Area (ONA) and Protected Area (PA). The project area falls within CBA 1, CBA 2, ESA 1, ESA 2, NNR and ONA. No protected area is traversed by the powerline servitude.

Methodology

Survey methodology included a comprehensive desktop review, utilising available provincial ecological data, relevant literature, GIS databases, topographical maps and aerial photography. This was then supplemented through a ground-truthing phase (walk-down survey), where pertinent areas associated with the powerline servitude were visited during field surveys undertaken from 11 to 15 February 2019. The survey focused on flora (vegetation) and fauna (mammals, reptiles and amphibians). Several Orange Listed floral and Red Data faunal species pertaining to the powerline servitude were identified during the desktop review. Habitat suitability was assessed through the ground-truthing phase of the surveys.

Results and Discussion – Flora

During the field survey, no threatened plant species were observed within the project area; however, only two species of conservation concern (Orange Listed Plants) were found, namely *Hypoxis hemerocallidea* (Star flower/African potato) and *Boophane disticha* (Century plant), both listed as *Declining*. It is recommended that prior to construction, these plant species must be searched and rescued and then, following construction activities, they can be re-established just within the powerline servitude and substation footprint.

In terms of the National Forests Act (Act No. 84 of 1998), certain tree species can be identified and declared as protected. Protected trees occurring in the study area are *Boscia albitrunca* (Shepherd's tree), *Combretum imberbe* (Leadwood) and *Sclerocarya birrea* subsp*. caffra* (Marula)*.* According to section 51(1) of the National Forests Act (Act No. 84 of 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, except under a license granted by the Minister of Department of Agriculture, Forestry and Fisheries (DAFF). There is only one plant species which falls within "*protected plants*" in terms of Limpopo Environmental Management Act (LEMA) (Act No. 7 of 2003) Schedule 12, namely *Spirostachys africana* (Tamboti). The following plant species are listed as "protected plants" in terms of Schedule 11 (Section 69 (1a)) of Mpumalanga Nature Conservation Act (No. 10 of 1998); all *Crinum* spp, all species of family Proteaceae, all *Gladioli* species and Whole Orchidaceae family (*Habenaria* species). Provincially protected plant species such as namely *Boophone disticha, Crinum graminicola, Hypoxis hemerocallidea, Gladiolus vinosomaculatus*, *Protea welwitschii* and *Habenaria epipactidea* and *Protea caffra* were recorded within the study area. Based on where these plant species are located, a permit from either the Limpopo Department of Economic Development, Environment and Tourism (LEDET) and/or Mpumalanga Tourism and Parks Agency (MTPA) is required before construction commences in order to cut, disturb, destroy or remove these trees noted within the project area.

The major concerns on site are alien invasives, weeds and potential invasives. Newly cleared soils will have to be re-vegetated and stabilised as soon as construction has been completed and there should be an on-going monitoring programme to control and/or eradicate newly emerging invasives. The rehabilitation of disturbed areas should receive high priority and must be included in the Environmental Management Program (EMPr) and recommendations regarding the specific plant species used during rehabilitation should be site specific and based on the surrounding vegetation composition.

Results and Discussion – Fauna

Historically, the study area could have provided habitat for a diverse population of larger mammal species, but the agricultural activities within the study area have transformed the majority of the habitats and due to these anthropogenic disturbances, it is likely that only the more common and smaller mammal species will be observed, which show more adaptation.

However, natural vegetation still exists and these areas are suitable for survival of the mammal species recorded within the study area. The agricultural fields were largely devoid of mammal species; however, meerkat dens were present on the edges of agricultural fields. Domestic animals such as cattle, sheep, donkeys and horses were noted in abundance witin the study area. Significantly, the bushveld, riparian vegetation and natural grasslands between agricultural fields are utilised as a movement and linkage corridor within the study area. These areas also provide ideal foraging and breeding habitat for a number of mammal species. Grassland habitats are utilised by a range of faunal species, particularly if there is some form of topographical change within the grassland. Mammal species such as Common Impala, Black Impala, Kudu, Nyala, Blesbok, Black-backed Jackal, Giraffe and Zebra were seen within the study area. Only one Red Data mammal species was visually seen on site, namely Sable Antelope, whereas information gathered from the land owners indicated that a mammal species such as Serval has been seen within the study area. Mammal species such as Waterbuck, Sable Antelope, Giraffe and Nyala are provincially protected under Schedule 2, protected game (Section 4 (1b) of Mpumalanga Nature Conservation Act (No. 10 of 1998) and Schedule 3 of LEMA (Act No. 7 of 2003).

A separate Avifauna Study has been undertaken to assess the impact of the proposed powerline development on avifauna. Therefore, this study will not assess the impact to avifauna as a result of the project.

The main potential impact of the project on reptile species is probable to be habitat loss or degradation. Nevertheless, in the long-term, effects on reptile species are probable to be comparatively low as the extent of habitat loss would be low. Habitat destruction should be limited to the absolute minimum throughout the survey area. In order to protect Southern African Python on site, should this species be encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. This remedial action requires the engagement of a herpetologist and/or ecologist to oversee the removal of any herpetofauna during the initial ground clearing phase of construction (*i.e.* initial ground-breaking by earthmoving equipment). However, if this species is found during the winter period, when it is in hibernation, then a permit from LEDET/MTPA would be required in order to catch and release it to a safer environment.

The state of the rivers (especially the Olifants River) within the project area offer suitable habitat for the Nile Crocodiles to occur on site. In order to mitigate the impacts of the project development within the habitats of this species, it is recommended that rivers and wetland systems must be spanned, and no towers should be placed within the buffer zones dictated by the surface water studies.

One of the frog species of conservation concern recorded within the study area was the Giant Bullfrog (*Pyxicephalus adspersus*). This species was recorded within human habitation, within temporary pans (due to heavy rains), which are potential breeding places for Giant Bullfrogs. This frog species is known to breed in seasonal shallow grassy pans, vleis and other rain filled depressions in open flat areas of grassland or savanna. According to Schedule 2 of the Mpumalanga Nature Conservation Act (No 10 of 1998), National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) *Threatened or Protected Species* and Schedule 3 of LEMA (Act No. 7 of 2003), this species is listed as *protected*. The conservation of the Giant Bullfrog and of amphibians in general will be met by the protected area network as well as the designation of priority habitats, *i.e.* pans or quaternary catchments, with associated restrictions on land use. Any impacts on a specimen of this species or that may negatively affect the survival of the species would require a Permit. A Permit is required from LEDET/MTPA in order catch, handle, collect, transport and/or relocate the species.

Environmental Impact Assessment

An impact significance rating was assessed and all impacts were found to be significantly reduced through the implementation of mitigation measures. Impacts were noted to be rated between “medium to low” prior to mitigation, and as “low” after mitigation.

Terrestrial Sensitivity

A map of the sensitivity and conservation value of the different parts of the powerline servitude and substations footprint was developed showing the distribution of areas in different sensitiviity classes. It is possible from this map to identify areas where there are possible conflicts between the alignment of the powerline and areas of high sensitivity.

Conclusion and Recommendations

It is recommended that a walk-down survey be undertaken by suitably qualified Environmental Control Officer (ECO) prior to the start of the construction activities only in the areas which were not accessible during the Terrestrial Ecological walk-down field surveys, in order to survey those specific areas (Loskop Suid 53 and Loskop Noord 12) in detail for any plant Species of Conservation Concern (SCC) and protected trees/plant species. The walk-down survey should preferably be undertaken during summer season in order to have a higher probability of detecting species of conservation concern. Any plant Species of Conservation Concern (SCC) or protected plant species that fall within the construction footprint must be search-and-rescued, and protected trees species should be conserved as far as possible. In order to conserve the faunal species community structures within the region, habitat destruction should be limited to an absolute minimum as intact habitat would result in higher faunal and floral species diversity. It is therefore critical that operations are limited to the required footprint only. During the field surveys, it was found that the impacts of the powerline on terrestrial ecosystems can be mitigated to a satisfactory level and as such, the development is deemed acceptable from the ecological perspective and as such should not be prevented from proceeding based on the ecological considerations. Once the proposed development has been constructed, rehabilitation process needs to take place and should ensure that alien plant emergence and erosion do not occur.

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1 INTRODUCTION AND BACKGROUND

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The projects were authorised in May 2011 (Emkhiweni Substation) and July 2011 (Emkhiweni-Silimela 400kV line). Eskom has decided to proceed with the construction of Emkhiweni-Silimela 400kV line (which is approximately 80kms) however the previous Record of Decision (RoD) has lapsed. Therefore, Nemai Consulting are undertaking a new application for Environmental Authorisation (EA) as part of the 2014 EIA Regulations, as amended (07 April 2017). Eskom was not able to proceed with construction within the RoD timeframes as a result of the lack of funding for the project. The proposed project is associated with the transmission network and its associated substations in the Mpumalanga and Limpopo Provinces. The proposed activity entails the construction of a 400kV powerline from the Middelburg area in the south to the Marble Hall/Wolwekraal area in the north. Emkhiweni substation will be constructed in Middleburg area whereas the Silimela substation will be near Marble hall.

A Terrestrial Ecological Assessment was undertaken as part of the EIA Process in order to assess the impacts that the proposed development will have on the receiving environment.

1.1 Objectives of the survey

In order to achieve the requirements of this study, the following objectives are to be noted:

- To apply relevant literature to determine the diversity and eco-status of the plants, mammals, reptiles and amphibians along the approved 55m servitude;
- To carry out field survey to gain an understanding of the diversity of taxa and eco-status of ecosystems which these species inhabit, as well as the presence of unique habitats that might require further investigation or protection;
- To assess the current conservation status of plant and animal species within the study area;
- To comment on ecological sensitive species/areas;
- To assess the possible impact of the proposed project on these taxa and/or habitats;
- To list the species on site and to recommend necessary actions in case of occurrence of endangered, vulnerable or rare species or any species of conservation importance; and

- To provide management recommendations to mitigate negative and enhance positive impacts within the study area.

1.2 Terms of Reference – Specific to Terrestrial Ecological Impact Assessment Study

Summary of Key Issues & Triggers identified during Scoping:

- Potential loss of significant flora and fauna species.
- Impacts to sensitive terrestrial ecological features.
- Management actions for controlling exotic vegetation.

Approach:

- Undertake baseline survey and describe affected environment within the project footprint from a biodiversity perspective;
- Take into consideration the provincial conservation goals and targets;
- Assess the current ecological status and the conservation priority within the project footprint and adjacent area (as deemed necessary). Provide a concise description of the importance of the affected area to biodiversity in terms of pattern and process, ecosystem goods and services, as appropriate;
- A complete potential biodiversity list must be provided;
- The conservation status of each species listed must be determined;
- Undertake sensitivity study to identify protected and conservation-worthy species. Prepare a terrestrial ecological sensitivity map with the use of GIS, based on the findings of the study;
- Recommend any conservation buffer zones;
- Assess impacts to fauna and flora, associated with the project. Consider cause-effect-impact pathways for assessing impacts to biodiversity related to the project;
- Identify potential fatal flaws associated with the project and its alternatives from a biodiversity perspective;
- Comply with specific requirements and guidelines of DEA and Province; and
- Consider the Provincial Biodiversity Conservation Plans and other relevant policies, strategies, plans and programmes.

1.3 Declaration

I, Avhafarei Phamphe, declare that I –

- act as an independent specialist consultant in the fields of Biodiversity (Fauna and Flora) for the Terrestrial Impact Assessment Report for the Emkhiweni Substation to Silimela Powerline Project;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- have and will not have any vested interest in the proposed activity proceeding;

- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006; and
- will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not.

Avhafarei Phamphe
Senior Biodiversity Specialist
Nemai Consulting (PTY) Ltd

2 RELEVANT LEGISLATION AND GUIDELINES

The following legislation are relevant to this project:

- The Constitution, 1996 (Act No. 108 of 1996) – Section 24;
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- National Forests Act, 1998 (Act No. 84 of 1998);
- National Environmental Management Act, 1998 (Act No. 107 of 1998);
- Mpumalanga Conservation Act, 1998 (Act No. 10 of 1998);
- Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003),
- National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Threatened or Protected Species regulations;
- Mpumalanga Minimum Requirements for Biodiversity Assessment (Mpumalanga Tourism and Parks Agency, 2008);
- Eskom Standard Vegetation Management and Maintenance within Eskom Land, Servitudes and Rights of Way (240-70172585);
- Limpopo Conservation Plan v.2. technical report (2013);
- Mpumalanga Tourism and Parks Agency requirements for assessing and mitigating Environmental Impacts of development applications;
- Mpumalanga Biodiversity Sector Plan, 2013;
- The National Environmental Management Act (NEMA) No. 107 of 1198): Environmental Impact Assessment Regulations, 2014 as amended. Specifically, the requirements of the specialist report as per the requirements of Appendix 6;
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) - Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014 and

- Limpopo Environmental Outlook Report, 2016.

3 STUDY AREA

The proposed activity entails the construction of a 400kV powerline from the Middelburg area in the south to the Marble Hall/Wolwekraal area in the north. Emkhiweni substation will be constructed in Middleburg area whereas the Silimela substation will be near Marble hall. The proposed line originates at the Wolwekraal Substation, which is situated approximately 13km to the southeast of Marble Hall (Limpopo Province) on the Farm Loskop Noord 12 JS and runs south-eastwards. The line terminates at the proposed Emkhiweni Substation within Mpumalanga Province (**Figures 1** and **2**). The proposed development falls within the jurisdiction of the Steve Tshwete Local Municipality (LM), Elias Motsoaledi LM and Ephraim Mogale LM. The width of the powerline servitude upon completion would be 55m in total. In addition to the Terrestrial Ecological Impact Assessment Study, a walk-down survey of the previously authorised powerline route was undertaken in order to ensure that the final pylon placement has a minimal impact. However, due to inaccessibility to some sections of the route, Loskop Suid 53 and Loskop Noord 12 farms were not surveyed.

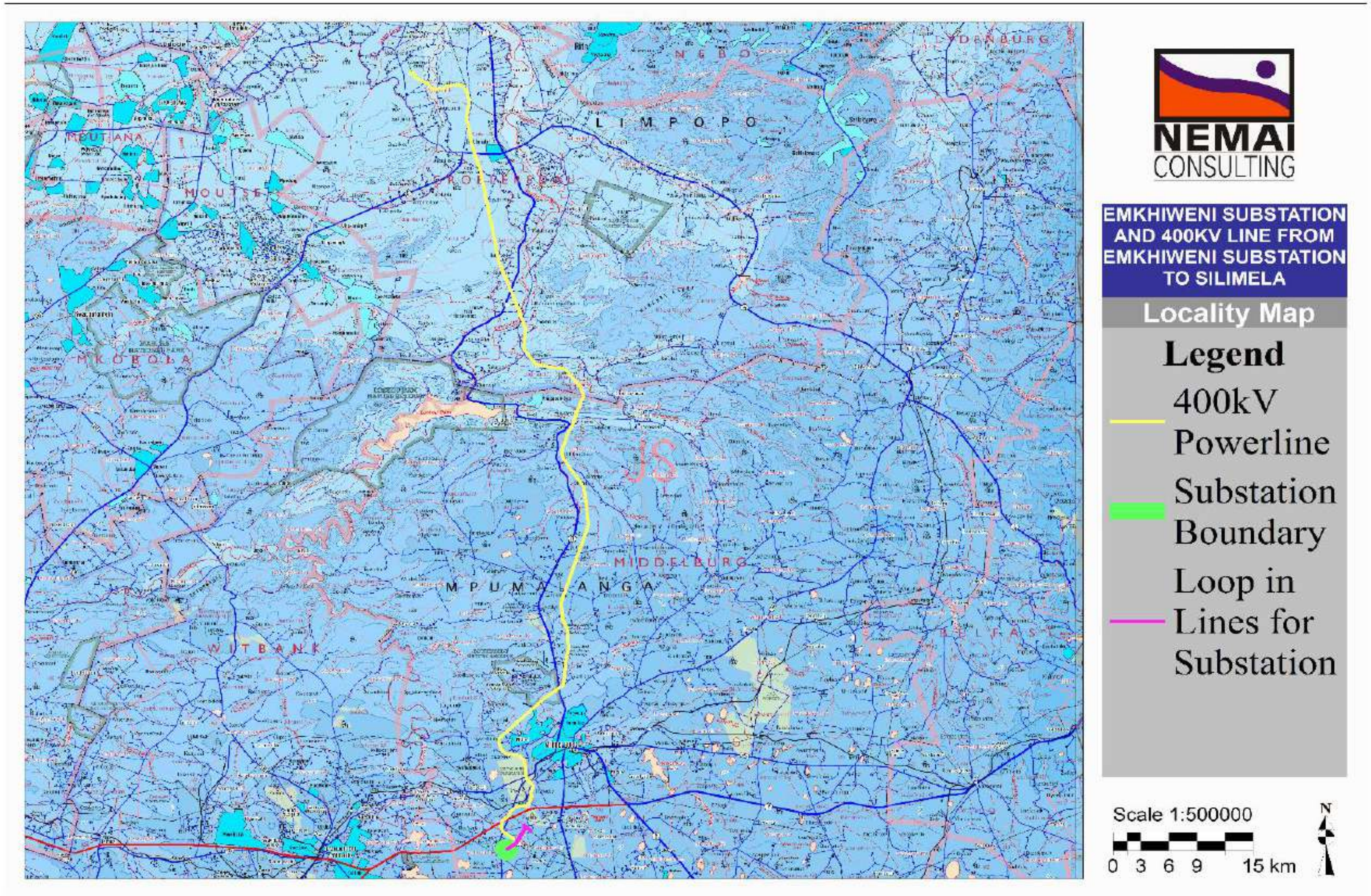

Figure 1. 1 in 250 000 Topographical map of the study area

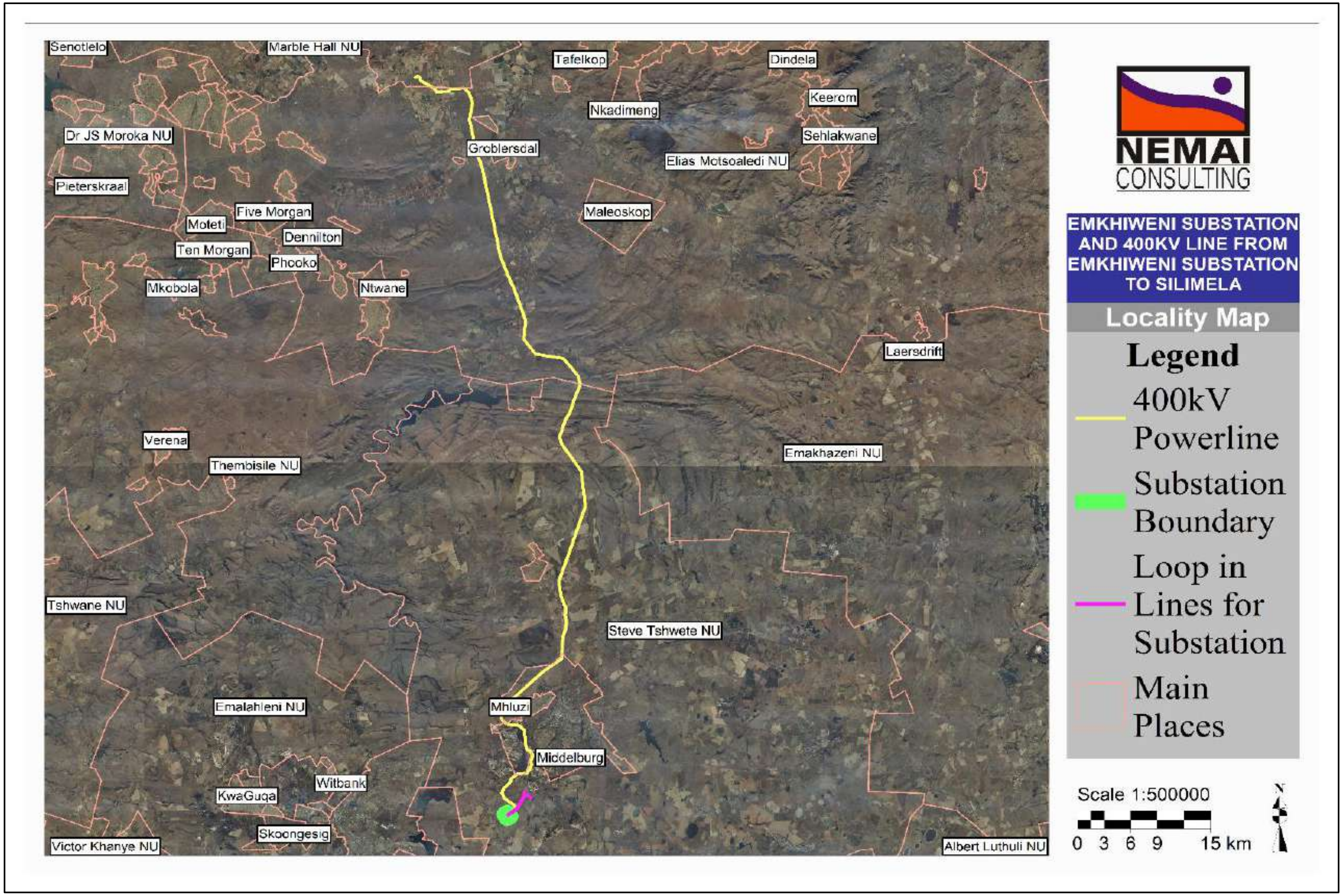

Figure 2. Locality map of the study area

4 LIMITATIONS AND GAPS

The constraints or limitations to the survey included:

- Given the magnitude of the project and the various extent of ervens and portions of farms in the area, some farms/areas (Loskop Suid 53 and Loskop Noord 12) were not easily accessible. However, detailed walk down surveys will be required on these properties which were not surveyed prior to construction by a suitably qualified ECO;
- Summer surveys were undertaken from 11-15 February 2019, which fall within an optimal time of the season to find sensitive plant and animal species of high conservation priority. Weather conditions during the surveys were favourable for recording both fauna and flora.
- Fauna species directly or indirectly observed during the site visits were augmented with those that are likely to occur in the area based on their distribution and habitat preferences; 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 on information gathered or databases consulted at the time of the investigation.

5 REGIONAL VEGETATION

The Emkhiweni Substation and Emkhiweni-Silimela 400kV powerline falls within the Grassland and Savanna biomes (SANBI, 2012) (**Figure 3**). The Grassland biome has a high biodiversity, ranked only below the Fynbos biome in terms of biodiversity in South Africa (Driver *et al*. 2004). This Biome is found mainly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal Province and the Eastern Cape Province. Grasslands are dominated by a single layer of grasses. Trees are absent, except in a few localised habitats and geophytes are often abundant (Low and Rebelo, 1996). The Savanna Biome is the largest Biome in South Africa and occupies over one third of the whole area. It is characterized by a grassy ground layer and distinct upper layer of woody plants (Low and Rebelo, 1996). SANBI (2012) classified the study area as falling within the following vegetation types: Central Sandy Bushveld (Savanna biome), Loskop Mountain Bushveld (Savanna biome), Loskop Thornveld (Savanna biome) and Rand Highveld Grassland (Grassland biome) (**Figure 4**).

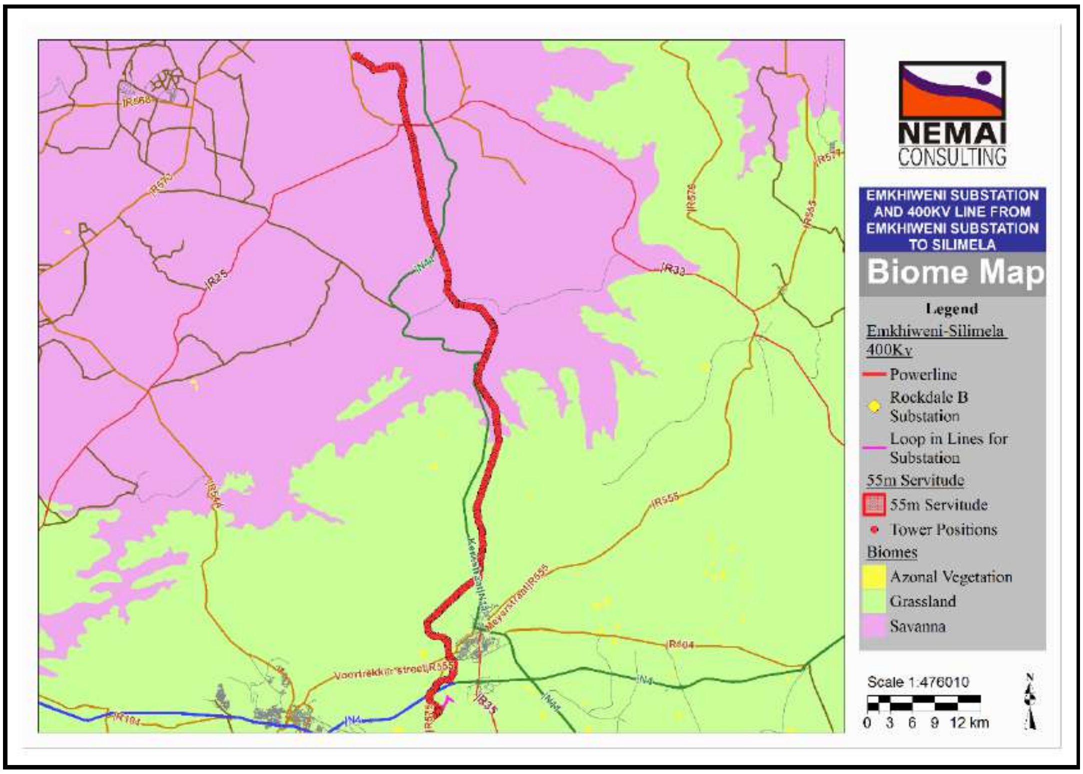

Figure 3. Biomes in relation to the project area

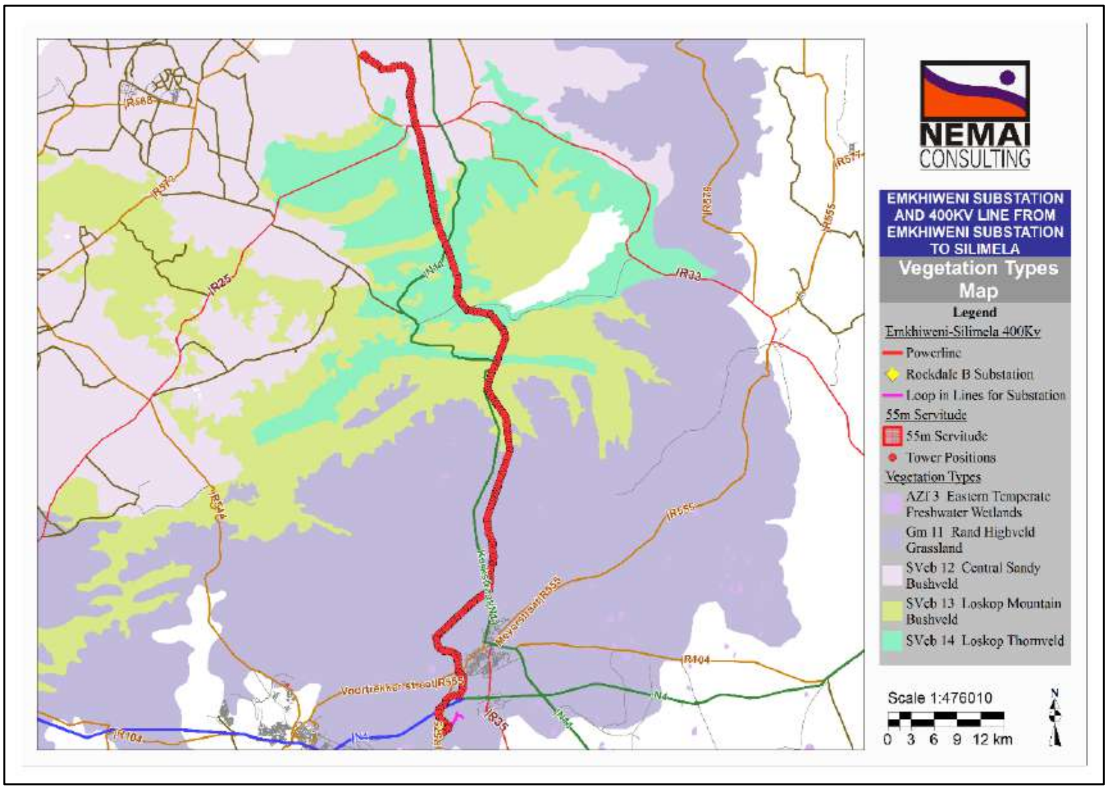

Figure 4. Vegetation types in relation to the project area

The description of the vegetation types follows below:

5.1 Central Sandy Bushveld

This vegetation unit can be found in the Limpopo, Gauteng, North West and Mpumalanga Provinces. The altitude of the vegetation unit ranges between 850 – 1 450 Metres above mean sea level (mamsl) (Mucina and Rutherford, 2006). The landscape features of this unit consist of low undulating areas, sometimes between mountains, sandy plains and catenas (Mucina and Rutherford, 2006). The southern and eastern parts of this area are underlain by granite of the Lebowa Granite Suite as well as some granophyre of the Rashoop Granophyre Suite, both of which are part of the Bushveld Complex. In the north are sedimentary rocks of the Waterberg Group (Mucina and Rutherford, 2006). This vegetation unit receives summer rainfall and has very dry winters. Frost in the unit is infrequent (Mucina and Rutherford, 2006).

The vegetation unit is considered *Vulnerable*, of a targeted 19%, less than three percent is statutorily conserved. An additional two percent is conserved in a grouping of private game reserves and the Wallmansthal South African National Defence Force (SANDF) property (Mucina and Rutherford, 2006). Approximately 24% of the vegetation unit has been transformed, this includes nineteen percent from cultivation and four percent for urban and other built up uses (Mucina and Rutherford, 2006). There are several alien plants scattered at a low density throughout the unit. These aliens include; *Cereus jamacaru, Eucalyptus spp., Lantana camara, Melia azedarach, Opuntia ficus-indica* and *Sesbania punicea* (Mucina and Rutherford, 2006).

5.2 Loskop Mountain Bushveld

This vegetation unit is distributed within the Mpumalanga, Gauteng and Limpopo Provinces (Mucina and Rutherford, 2006). The typical landscape features of this vegetation unit are low mountains and ridges (Mucina and Rutherford, 2006). Rhyolite of the Selons River Formation (Rooiberg Group, Transvaal Supergroup) and sandstone with conglomerate and minor shale from the Wilge River Formation (Mokolian Waterberg Group) form part of the geology of the vegetation unit (Mucina and Rutherford, 2006). The unit falls within a summer rainfall area with very dry winters. Frost in this vegetation unit is infrequent (Mucina and Rutherford, 2006).

The conservation status of this vegetation unit has been determined to be *Least Threatened*. A target to conserve 24% of the unit was not achieved. Fifteen percent of the unit is conserved by the State, predominately in the Loskop Dam and Mabusa Nature Reserves. An additional 20% is conserved in other reserves. Less than three percent of the unit has been transformed. The main causes of transformation are cultivation and for urban and built up uses (Mucina and Rutherford, 2006). Erosion in the unit is very low to low (Mucina and Rutherford, 2006).

5.3 Loskop Thornveld

This thornveld is distributed primarily in Mpumalanga Province and marginally in Limpopo Province. The unit is distributed mainly over the valleys and plains of part of the upper Olifants River Catchment. The altitude of this unit ranges between 950 – 1 300 mamsl (Mucina and Rutherford, 2006). The geology of the unit includes the Rustenburg Layered Suite, Bushveld Igneous Complex and the Transvaal Supergroup (Mucina and Rutherford, 2006). The Loskop Thornveld vegetation unit falls within a summer rainfall area that has very dry winters. Frost in this vegetation unit is infrequent (Mucina and Rutherford, 2006).

The vegetation unit is considered *Vulnerable*. The conservation target of this unit is 19%, however eleven percent is conserved in the Loskop Dam Nature Reserve (Mucina and Rutherford, 2006). The most common cause of transformation in this unit is for crops such as maize, citrus, cotton, grapes and wheat (Mucina and Rutherford, 2006). There are alien species within this vegetation unit and these include *Cereus jamacaru, Opuntia ficus-indica, Melia azedarach, Lantana camara* and *Solanum seaforthianum* (Mucina and Rutherford, 2006).

5.4 Rand Highveld Grassland

This vegetation unit is widely distributed and occurs in the Mpumalanga, Gauteng, the North West and Free State Provinces. The altitude occupied by the vegetation unit ranges between 1 300 – 1 635 (mamsl) but may reach as much as 1 760m in places (Mucina and Rutherford, 2006). The quality of the soils of this unit varies. The geology includes quartzite ridges of the Witwatersrand Supergroup and the Pretoria Group and the Selons River Formation of the Rooiberg Group (Mucina and Rutherford, 2006).

The landscape of this vegetation unit is highly variable. It consists of extensive sloping plains and a series of ridges that are slightly elevated over the undulating surrounding plains (Mucina and Rutherford, 2006). This vegetation unit is species rich. Wiry sour grassland alternates with low, sour shrubland on rocky outcrops and steeper slopes (Mucina and Rutherford, 2006). The unit receives summer rainfall and the winters are very dry. Frost does occur in this unit, the number of days per year with frost is higher in the west (30 – 40 days) than in the east (10 – 35 days) (Mucina and Rutherford, 2006).

The vegetation unit is considered *Endangered*, of a targeted 24%, only one percent is conserved. Small patches of the unit are conserved in the statutory reserves of Kwaggavoetpad, Van Riebeeck Park, Bronkhorstspruit and Boskop Dam Nature Reserve, as well as in private conservation areas such as Doornkop, Zemvelo, Rhenosterpoort and Mpopomeni. Almost half of this unit has been transformed, predominantly by plantations, urbanisation or dam building (Mucina and Rutherford, 2006). Approximately seven percent of the vegetation unit has scattered aliens, the main alien species is *Acacia mearnsii* (Mucina and Rutherford, 2006). Approximately seven percent of the unit has been subjected to moderate to high erosion levels (Mucina and Rutherford, 2006).

6 TERRESTRIAL THREATENED ECOSYSTEMS

The South African National Biodiversity Institute (SANBI), in conjunction with the Department of Environmental Affairs (DEA), 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 (SANBI, 2009). 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; and
- Priority areas for meeting explicit biodiversity targets as defined in a systematic conservation plan.

In terms of section 52(1) (a), of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA), a national list of ecosystems that are threatened and in need of protection was gazetted on 9 December 2011 (Government Notice 1002) (Driver *et al.* 2004). The list classified all threatened or protected ecosystems in South Africa in terms of four categories; Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Protected. The purpose of categorising these ecosystems is to prioritise conservation areas in order to reduce the rates 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 South Africa, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% of the land area. It is therefore vital that Threatened Terrestrial Ecosystems inform proactive and reactive conservation and planning tools, such as Biodiversity Sector Plans, municipal Strategic Environmental Assessments (SEAs) and Environmental Management Frameworks (EMFs), EIAs and other environmental applications (Mucina and Rutherford, 2006).

The Emkhiweni Substation and Emkhiweni-Silimela 400kV powerline falls within the Rand Highveld Grassland terrestrial threatened ecosystem (listed as *Vulnerable*) (SANBI, 2009) (**Figure 5**).

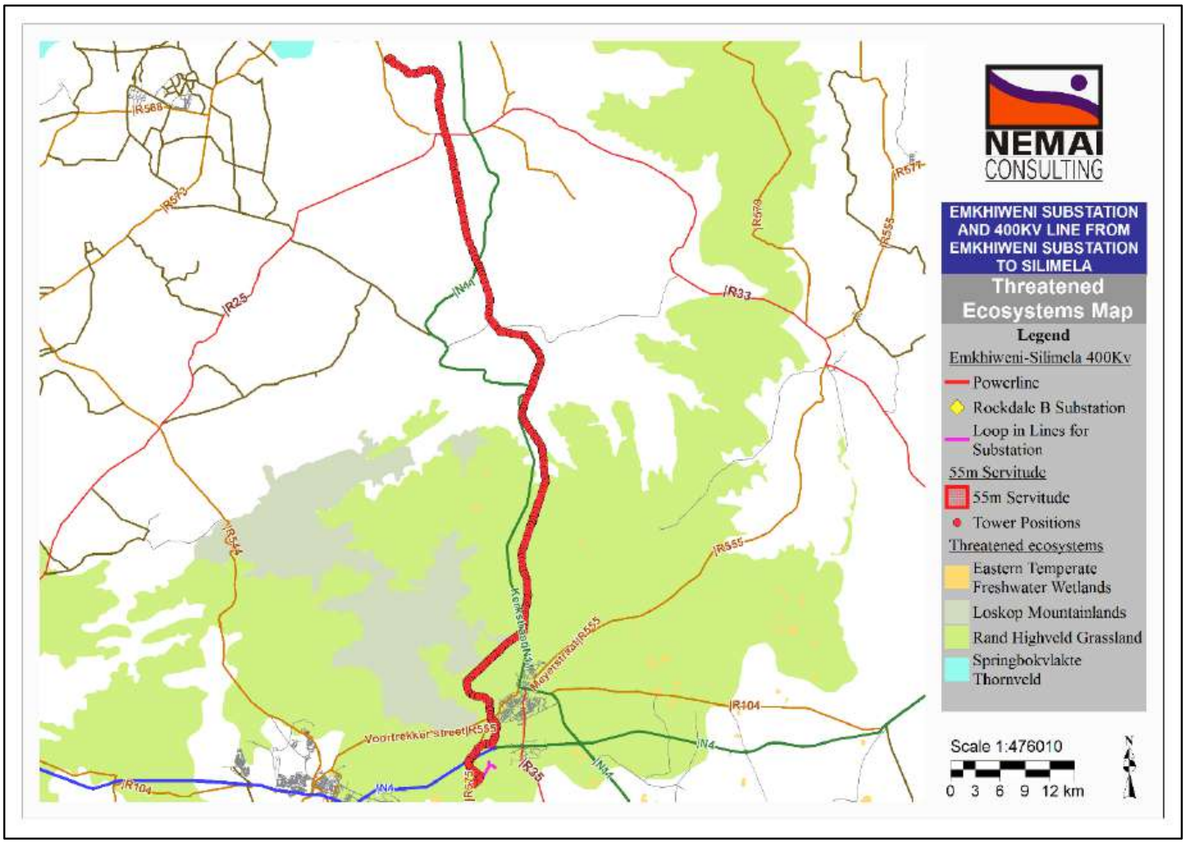

Figure 5. Terrestrial threatened ecosystems in relation to the project area

7 LIMPOPO CONSERVATION PLAN

Critical Biodiversity Areas (CBAs) within the bioregion are the portfolio of sites that are required to meet the region's biodiversity targets, and need to be maintained in the appropriate condition for their category (Desmet *et al*, 2013). An objective of the CBA map is to identify a network of areas, which if managed according to the land use guidelines would meet the pattern targets for all important biodiversity features, while at the same time ensuring the areas necessary for supporting necessary ecological processes remain functional.

The systematic conservation planning process resulted in 40% of the Limpopo Province being identified as CBAs (CBA1 22% and CBA2 18%). Ecological Support Areas (ESAs) cover a further 22% of the province, of which 16% are intact natural areas (ESA 1) and 7% are degraded or areas with no natural remaining which are nevertheless required as they potentially retain some value for supporting ecological processes (ESA 2) (Desmet *et al*, 2013).

A map indicating the Limpopo Conservation Plan categories in relation to the project footprint is shown in **Figure 6**. The study area does not traverse any protected areas but crossed through all the other categories. The general description of CBA map categories and associated land management objectives are listed in **Table 1**. Infrastructure developments such as powerlines are listed as Incompatible Land-Uses in CBA 1, CBA 2 and ESA 1 categories.

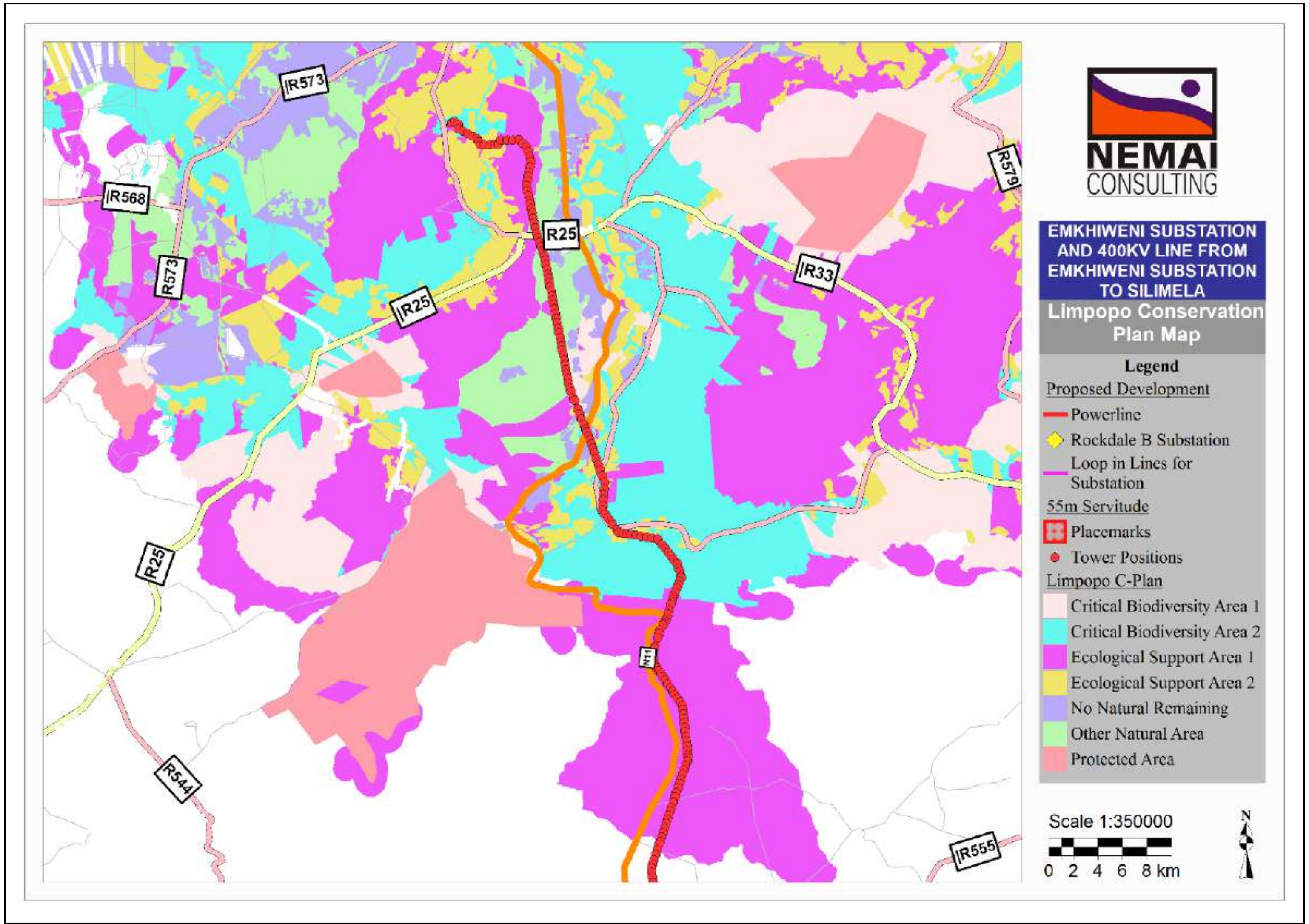

Figure 6. Limpopo Conservation Plan in relation to the project area

Table 1. General description of CBA Map categories and associated land management objectives

CBA Map Category	Description	Land Management Objective	Land Management Recommendations	Compatible Land-Use	Incompatible Land-Use
Protected Areas	Formal Protected Areas and Protected Areas pending declaration under NEMPAA.	Maintain in a natural state with limited or no biodiversity loss. Rehabilitate degraded areas to a natural or near natural state, and manage for no further degradation. Development subject to Protected Area objectives and zoning in a NEMPAA compliant and approved management plan.	Maintain or obtain formal conservation protection.	Conservation and associated activities (e.g. ecotourism operations), and required support infrastructure.	All other land-uses.
Critical Biodiversity Areas (1)	Irreplaceable Sites. Areas required to meet biodiversity pattern and/or ecological processes targets. No alternative sites are available to meet targets.	Maintain in a natural state with limited or no biodiversity loss. Rehabilitate degraded areas to a natural or near natural state, and manage for no further degradation.	Obtain formal conservation protection where possible. Implement appropriate zoning to avoid net loss of intact habitat or intensification of land use.	Conservation and associated activities. Extensive game farming and eco--- tourism operations with strict control on environmental impacts and carrying capacities, where the overall there is a net biodiversity gain. Extensive Livestock Production with strict control on environmental impacts and carrying capacities. Required support infrastructure for the above activities. Urban Open Space Systems	Urban land-uses including Residential (including golf estates, rural residential, resorts), Business, Mining & Industrial; Infrastructure (roads, power lines, pipelines). Intensive Animal Production (all types including dairy farming associated with confinement, imported foodstuffs, and improved/irrigated pastures). Arable Agriculture (forestry, dry land & irrigated cropping). Small holdings
Critical Biodiversity Area (2)	Best Design Selected Sites. Areas selected to meet biodiversity pattern and/or ecological process targets.	Maintain in a natural state with limited or no biodiversity loss. Maintain current agricultural activities. Ensure that land use is not intensified and that activities	Avoid conversion of agricultural land to more intensive land uses, which may have a negative impact on	Current agricultural practices including arable agriculture, intensive and extensive animal production, as well as game and ecotourism operations, so long as	Urban land-uses including Residential (including golf estates, rural residential, resorts), Business,

CBA Map Category	Description	Land Management Objective	Land Management Recommendations	Compatible Land-Use	Incompatible Land-Use
	Alternative sites may be available to meet targets.	are managed to minimize impact on threatened species.	threatened species or ecological processes.	these are managed in a way to ensure populations of threatened species are maintained and the ecological processes which support them are not impacted. Any activities compatible with CBA1.	Mining & Industrial; Infrastructure (roads, power lines, pipelines). More intensive agricultural production than currently undertaken on site. Note: Certain elements of these activities could be allowed subject to detailed impact assessment to ensure that developments were designed to CBA2. Alternative areas may need to be identified to ensure the CBA network still meets the required targets.
Ecological Support Areas (1)	Natural, near natural and degraded areas supporting CBAs by maintaining ecological processes.	Maintain ecosystem functionality and connectivity allowing for limited loss of biodiversity pattern.	Implement appropriate zoning and land management guidelines to avoid impacting ecological processes. Avoid intensification of land use. Avoid fragmentation of natural landscape.	Conservation and associated activities. Extensive game farming and eco-tourism operations. Extensive Livestock Production. Urban Open Space Systems. Low density rural residential, smallholdings or resorts where development design and overall development densities allow maintenance of ecological functioning.	Urban land-uses including Residential (including golf estates), Business, Mining & Industrial; Infrastructure (roads, power lines, pipelines). Intensive Animal Production (all types including dairy farming associated with confinement, imported foodstuffs, and improved/irrigated pastures). Arable Agriculture (forestry, dry land & irrigated

<table>
<tr><th>CBA Map Category</th><th>Description</th><th>Land Management Objective</th><th>Land Management Recommendations</th><th>Compatible Land-Use</th><th>Incompatible Land-Use</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>cropping). Note: Certain elements of these activities could be allowed subject to detailed impact assessment to ensure that developments were designed to maintain overall ecological functioning of ESAs.</td></tr>
<tr><td>Ecological Support Areas (2)</td><td>Areas with no natural habitat that is important for supporting ecological processes.</td><td>Avoid additional/ new impacts on ecological processes.</td><td>Maintain current land-use. Avoid intensification of land use, which may result in additional impact on ecological processes.</td><td>Existing activities (e.g. arable agriculture) should be maintained, but where possible a transition to less intensive land uses or ecological restoration should be favoured.</td><td>Any land use or activity that results in additional impacts on ecological functioning mostly associated with the intensification of land use in these areas (e.g. Change of floodplain from arable agriculture to an urban land use or from recreational fields and parks to urban).</td></tr>
<tr><td>Other Natural Areas</td><td>Natural and intact but not required to meet targets, or identified as CBA or ESA</td><td colspan="4" rowspan="2">No management objectives, land management recommendations or land-use guidelines are prescribed. These areas are nevertheless subject to all applicable town and regional planning guidelines and policy. Where possible existing Not Natural areas should be favoured for development before "Other natural areas" as before "Other natural areas" may later be required either due to the identification of previously unknown important biodiversity features on these sites, or alternatively where the loss of CBA has resulted in the need to identify alternative sites.</td></tr>
<tr><td>No natural habitat remaining</td><td>Areas with no significant direct biodiversity value. Not Natural or degraded natural areas that are not required as ESA, including intensive agriculture, urban, industry; and human infrastructure.</td></tr>
</table>

8 MPUMALANGA BIODIVERSITY SECTOR PLAN – TERRESTRIAL CRITICAL BIODIVERSITY AREAS

A regional conservation plan was produced jointly by the Mpumalanga Tourism and Parks Agency (MTPA) and Mpumalanga Department of Agriculture and Land Administration (MDALA). This plan indicated several areas requiring some level of conservation within the strategic premise to either systematically include these areas into conservation areas or to protect these areas from irresponsible development. The Mpumalanga Biodiversity Sector Plan has divided the distribution of the Province's biodiversity into the following 9 categories in **Table 2** below (MTPA, 2013). A map indicating the Mpumalanga Biodiversity Sector Plan categories in relation to the project footprint is shown in **Figure 7** below. The study area does not traverse any protected areas but crossed through all the other categories.

Table 2. MBCP Categories (MTPA, 2013)

Category		Description
1	Protected areas	These are protected areas that were used to meet biodiversity targets in MBSP 2013.
2	Critical Biodiversity Area: Irreplaceable	This category comprises areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence and of species and the functioning of ecosystems. Such biodiversity or landscape facets is usually at risk of being lost due to the remaining distribution being below target. For example, only known sites for certain threatened species, or areas of high connectivity value which have high risk of having connectivity disrupted (i.e. critical corridor linkages in the landscape).
3	Critical Biodiversity Area: Optimal	The CBA Optimal Areas, previously referred to as Important & Necessary in MBCPv1, are the best localities out of a larger selection of available PUs as they are optimally located to meet both the various biodiversity targets and the criteria defined by either the Marxan design or cost layers. These areas have an irreplaceability (or frequency selection score) of less than 80%. In Marxan, this is categorised as the "Best" solution and is essentially the most efficient and thus optimal solution to meet all biodiversity conservation targets while avoiding high cost areas as much as possible.
4	Ecological Support Area: Landscape-scale corridors	These corridors represent the ideal or best route option to support existing biodiversity and allow them to adapt to the impacts of climate change. The functionality of these corridors to support biodiversity connectivity needs to be maintained.
5	Ecological Support Area: Local-scale corridors	These are fine scale connectivity pathways that contribute to connectivity between climate change focal areas. They represent alternative pathways for movement, and thus lessen the effect of critical linkages and provide networks that are more robust to disturbance. The ecological functionality of these corridors to support biodiversity connectivity needs to be maintained.
6	Ecological Support Area: Species Specific	These are areas required for the persistence of specific species. Although these areas are frequently transformed, a change in current land use, to anything other than rehabilitated land, would most likely result in a loss of that feature from the area identified. Only one area, an important over-

Category		Description
		wintering site for Blue Crane shared with Gauteng, and which comprises a matrix of natural and cultivated lands, was identified by expert opinion.
7	Ecological Support Area: Protected Area buffers	These are areas around our Protected Areas where changes in land-use may affect the ecological functioning or tourism potential of the PAs. The purpose of buffer zones is to mediate the impacts of undesirable land-uses that have a negative effect on the environment. This zone also offers tourism opportunities. Changes in land use usually have either direct impacts, such as cultivating virgin land, or both direct and indirect impacts, such as light and noise pollution in addition to a change in land cover. The nature of the impacts needs to be assessed and appropriate land-uses supported. The buffer distances applied, include: • National Parks: National biodiversity and tourism asset. A 10 km buffer applied as indicated in Listing Notice 3. Undesirable land-uses must be avoided. • Protected Areas (Nature Reserves): Nature reserves have both biodiversity and tourism value, and any undesirable changes in land-use should be avoided. A 5 km buffer distance has been applied around nature reserves as indicated in Listing Notice 3. • Protected Environments: Usually production landscapes with biodiversity friendly management. Management plans in place for improvement of biodiversity. A 1 km buffer is applied around Protected Environments.
8	Other Natural Areas (ONA)	Natural areas which are not identified to meet biodiversity pattern or process targets, provided that CBAs or ESAs are not lost. ONA will most likely provide a range of ecosystem services from their ecological infrastructure in varying efficiency and effectiveness. Although these areas are not essential for ensuring the persistence of biodiversity or landscape targets, they are still important repositories of species and play an important role in society as ecological infrastructure. They are however, not prioritized for immediate conservation action.
9	Heavily Modified	Includes areas currently transformed where biodiversity and ecological function has been lost to the point that it is not worth considering for conservation at all.
10	Moderately Modified – Old Lands:	Includes areas which were modified within the last 80 years but were at some point abandoned, including old mines and old cultivated lands, collectively termed “old Lands”. They are areas where biodiversity and function have been seriously compromised in the past, but may still play an important role in the provisioning of ecosystem services.

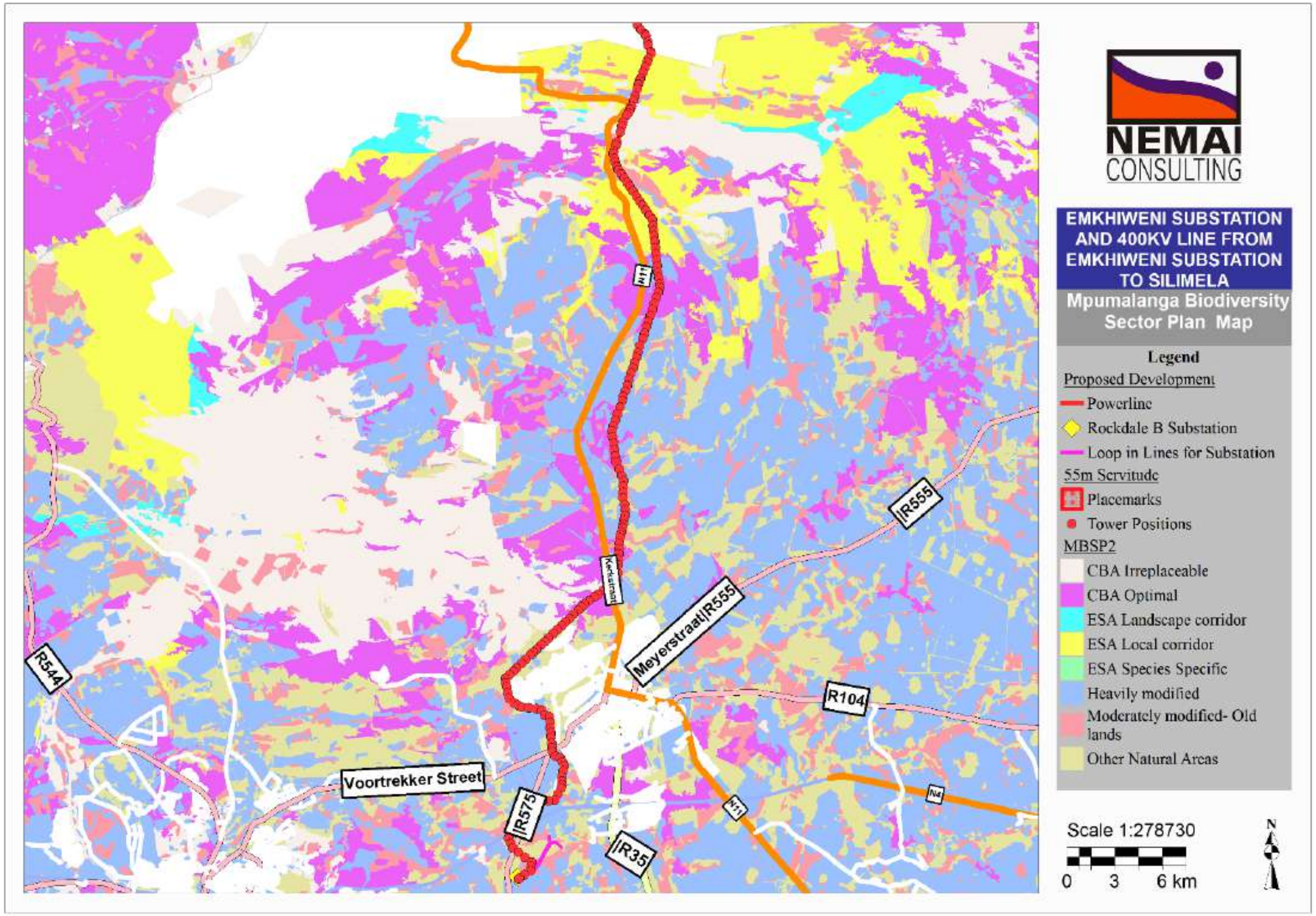

Figure 7. Mpumalanga Terrestrial Critical Biodiversity Area in relation to the project area

9 METHODOLOGY

9.1 Flora

The flora assessment consisted of two complementary approaches:

- A desktop analysis, which included a literature review (previous specialist studies), local knowledge, topographical maps, and Google Earth imagery; and
- Site visits were conducted from 11 to 15 February 2019.

Satellite imagery of the area (Google Earth) was studied in order to acquire a three-dimensional impression of the topography and land use and also to identify potential "hot-spots" or specialized habitats such as natural habitats, wetlands and rivers on or near the study area.

The Pretoria Computerised Information System (PRECIS) list of Red Data plants recorded in the 2529CD, 2529CB, 2529AD and 2529AB quarter degree grid squares were consulted to verify the record of occurrence of the plant species seen in the vicinity of the study area. The site sampled is also only a very small portion of the whole grid and so habitats suitable for certain species in the PRECIS list may not be present at the areas sampled. The vegetation map published in SANBI (2012) 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 plants was conducted before the site visits.

The habitats on the study area 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 grasses, herbs (forbs), shrubs and trees. The habitats suitable for Red Data listed species known to occur in the quarter degree grid square were examined intensively for the presence of such species. Attention was also paid to the occurrence of medicinal, alien and declared weed species. Field guides such as van Wyk *et al.* (1997), Pooley (1998), van Oudshoorn (1999) and Manning (2009) were utilised during the field work.

Exotic and invasive plant species were categorised according to the framework laid out by The Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA). 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 ornamental plants, as sources of timber, or other benefits such as medicinal uses (Henderson, 2001). These plants need to be managed and prevented from spreading.

Invasive species are controlled by NEM:BA – Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014. The AIS Regulations list four (4) different categories of invasive species that must be managed, controlled or eradicated from areas where they may cause harm to the environment, or that are prohibited to be brought into South Africa.

Invasive plant species are divided into four categories, namely:

- Category 1a: Invasive species which must be combatted and eradicated. Any form of trade or planting is strictly prohibited.
- Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form or trade or planting is strictly prohibited.
- Category 2: Invasive species, or species deemed to be potentially invasive, in which a permit is required to carry out a restricted activity. Category 2 species include commercially important species such as pine, wattle and gum trees.
- Category 3: Invasive species which may remain in prescribed areas or provinces. Further planting, propagation or trade, is however prohibited.

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 3** describes the classification of grasses.

Table 3. 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 triandra, 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*

9.2 Mammals

A mammal site visit was conducted in February 2019, and during these visits, the observed and presence of mammals associated with the recognized habitat types of the study area were recorded during the day. Animal Demography Unit virtual museum was consulted before the site visits for a list of species that could potentially be found within the study area and these species were thoroughly investigated within their suitable habitats. No night surveys were undertaken. Adjoining properties were also scanned for important faunal habitats. During the site visits, mammals were identified by spoor, burrow and visual sightings through random transect walks. Locals were also interviewed to provide species lists on their properties.

9.3 Reptiles

The reptile assessment was conducted during the day. During the field visits, the observed and derived presence of reptiles associated with the recognised habitat types of the study sites were recorded. This was done with due regard to the known distributions of Southern African reptiles. Reptiles were identified by sightings during random transect walks. Possible burrows or other reptile retreats were inspected for any inhabitants. Locals were also interviewed to provide species lists on their properties.

9.4 Amphibians

According to Carruthers (2001), amphibians are extremely sensitive to habitat transformation and degradation. The identification technique which was used for this study was frog's call. According to Carruthers (2001), a frog's call is a reliable means of identifying species. Frog calls were compared with pre-recorded calls from du Preez and Carruthers (2009)'s CD and identified from this comparison. According to Waddle (2006), physical searching should take place during both day and night, while acoustic surveying took place primarily at night between the hours of 18:00 and 21:00. Samplings were conducted on the moist to semi-aquatic areas. During this surveys; fieldwork was augmented with species lists compiled from personal records; data from the South African Frog Atlas Project (SAFAP) (1999-2003) and published data. Suitable habitats such as ephemeral wetlands where amphibian species of conservation such as Bullfrogs occur were also investigated.

10 RESULTS AND DISCUSSION

10.1 Flora

10.1.1 Desktop study results

The study area is located within the following quarter degree squares in terms of the 1:20 000 grid of South Africa 2529CD, 2529CB, 2529AD and 2529AB. SANBI uses 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 the list of species which could potentially occur within an area. **Table 4** indicates the plants that are known to occur on or around the project area recorded in 2529CD, 2529CB, 2529AD and 2529AB quarter degree squares. The definitions of the conservation status are provided in **Table 5.**

Table 4. Red Data Plant species which could potentially occur in the study area (SANBI data)

QDS	Family	RDL floral species	Growth form	Status
2529AB	Asphodelaceae	*Haworthia koelmaniorum* var. *koelmaniorum*	Succulent	VU
	Hyacinthaceae	*Eucomis vandermerwei*	Geophyte	VU
	Fabaceae	*Argyrolobium megarrhizum*	Dwarf shrub, shrub	NT
	Iridaceae	*Gladiolus pardalinus*	Geophyte, herb	Rare
	Fabaceae	*Acacia erioloba*	Shrub, tree	Declining
	Amaryllidaceae	*Crinum macowanii*	Geophyte	Declining
2529AD	Fabaceae	*Argyrolobium megarrhizum*	Dwarf shrub, shrub	NT
	Amaryllidaceae	*Boophane disticha*	Geophyte, succulent	Declining
	Hyacinthaceae	*Bowiea volubilis* subsp. *volubilis*	Climber, Geophyte, succulent	VU
	Asteraceae	*Callilepis leptophylla*	Herb	Declining
	Combretaceae	*Combretum petrophilum*	Shrub, tree	Rare
	Amaryllidaceae	*Crinum bulbispermum*	Geophyte	Declining
	Hyacinthaceae	*Drimia altissima*	Geophyte, succulent	Declining
	Celastraceae	*Elaeodendron transvaalense*	Shrub, tree	NT
	Zamiaceae	*Encephalartos lanatus*	Shrub, tree	VU
	Orchidaceae	*Eulophia speciosa*	Geophyte, herb, succulent	Declining
	Iridaceae	*Gladiolus pardalinus*	Geophyte, herb	Rare
	Iridaceae	*Gladiolus pole-evansii*	Geophyte, herb	Rare
	Aquifoliaceae	*Ilex mitis* var. *mitis*	Shrub, tree	Declining
2529CB	Fabaceae	*Argyrolobium megarrhizum*	Dwarf shrub, shrub	NT
	Zamiaceae	*Encephalartos lanatus*	Shrub, tree	VU
	Hyacinthaceae	*Eucomis vandermerwei*	Geophyte	VU
	Mesembryanthemaceae	*Frithia humilis*	Succulent	EN
	Aquifoliaceae	*Ilex mitis var. mitis*	Shrub, tree	Declining
	Rubiaceae	*Pavetta zeyheri* subsp. *middelburgensis*	Dwarf shrub	Rare
2529CD	Amaryllidaceae	*Crinum bulbispermum*	Geophyte	Declining
	Amaryllidaceae	*Crinum macowanii*	Geophyte	Declining
	Apocynaceae	*Pachycarpus suaveolens*	Herb, succulent	VU
	Aquifoliaceae	*Ilex mitis var. mitis*	Shrub, tree	Declining
	Asteraceae	*Callilepis leptophylla Harv.*	Herb	Declining
	Zamiaceae	*Encephalartos lanatus*	Shrub, tree	VU

QDS	Family	RDL floral species	Growth form	Status
	Hypoxidaceae	*Hypoxis hemerocallidea.*	Geophyte	Declining
	Rubiaceae	*Pavetta zeyheri subsp. middelburgensis*	Dwarf shrub	Rare

Note: EN=Endangered; VU=Vulnerable; NT=Near Threatened

Table 5. Definitions of Red Data status (Raimondo *et al*. 1999)

Symbol	Status	Description
EN	Endangered	A taxon is Endangered when the best available evidence indicates that it meets any of the five International Union for Conservation of Nature (IUCN) criteria for Endangered, and is therefore facing a very high risk of extinction in the wild.
VU	Vulnerable	A taxon is Vulnerable when the best available evidence indicates that it meets any of the five IUCN criteria for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.
NT	Near Threatened	A taxon is Near Threatened when available evidence indicates that it is close to meeting any of the five IUCN criteria for Vulnerable and it is therefore likely to qualify for a threatened category in the near future.
	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.
N/A	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 does not qualify for a category of threat according to the five IUCN.

10.1.2 Plant species recorded in the study area

The plant species recorded during the site visits confirmed the study area's location within both the Grassland and Savanna Biomes of South Africa. The project area traverses through agricultural areas such as soya bean farm (**Figure 8**), maize fields (**Figure 9**), rivers (**Figure 10**), rocky outcrops (**Figure 11**) and human settlements (**Figure 12**). All of the species recorded in the study area are listed in **Table 6** and the plant species of conservation concern recorded are indicated in **bold**.

Figure 8. Soya bean within the Emkhiweni substation, powerline servitude and loop in lines

Figure 9. Maize fields within powerline servitude

Figure 10. Rivers within powerline servitude and loop in lines

Figure 11. Rocky outcrops within powerline servitude and loop in lines

Figure 12. Human settlements within powerline servitude

Table 6. Plant species recorded within the study area

Scientific Name	Common Name	Ecological status	Form	55m Servitude	Silimela Substation	Emkhiweni Substation	Loop in Lines for Substation
Acacia dealbata	Silver wattle	Invader 2	Medicinal	Medicinal		✓	✓
Vachellia (Acacia) xanthophloea	Fever tree	Medicinal	Medicinal	Medicinal			
Acacia karroo (*Vachellia karroo*)	Sweet thorn		Tree	✓	✓		
Acacia mearnsii	Black Wattle	Invader 2	Tree	✓			✓
Acacia melanoxylon	Australian blackwood	Invader 2	Shrub	✓			
Acanthospermum australe	Creeping starbur		Herb	✓		✓	✓
Aloe cf. bergeriana	Kleinaalwyn		Succulent	✓			
Aloe greatheadii var. *davyana*	Spotted aloe	Medicinal	Succulent	✓			
Aloe marlothii	Mountain aloe	Medicinal	Succulent	✓			
Aloe mutabilis (=Aloe arborescens)	Candelabra aloe	Medicinal	Succulent	✓			
Alternanthera pungens	Khakhiweed	Weed	Herb	✓			
Argemone ochroleuca	White-Flowered Poppy	Category 1b	Herb	✓			
Aristida congesta subsp. *congesta*	Buffalo Grass		Grass	✓			
Aristida junciformis	Ngongoni three-awn		Grass	✓			
Arundo donax	Spanish Reed	Category 1b	Reed	✓			
Asparagus laricinus	Bergkatbos		Herb	✓			
Boophane disticha	**Century plant**	**Declining**	**Herb**	✓			✓
Berkheya setifera	Buffalo-tongue		Herb	✓			
Berkheya rigida	Disseldoring		Herb	✓			
Bidens formosa	Cosmos	Weed	Herb	✓			
Bidens pilosa	Common Black-jack	Weed	Herb	✓		✓	✓
Bothriochloa radicans	Stinking Grass		Grass	✓			
Bulbine narcissifolia	Strap-leaved Bulbine	Medicinal	Herb	✓			

Scientific Name	Common Name	Ecological status	Form	55m Servitude	Silimela Substation	Emkhiweni Substation	Loop in Lines for Substation
Burkea africana	Wild seringa		Tree	✓	✓		
Canna indica	Indian shot	Category 1b	Herb	✓			
Campuloclinium macrocephalum	Pompom weed	Category 1b	Herb	✓		✓	✓
Celtis africana	White stinkwood		Tree	✓			
Cenchrus ciliaris	Foxtail buffalo grass		Grass	✓			
Cereus jamacaru	Queen of the night	Category 1b	Succulent	✓			
Cirsium vulgare	Scotch Thistle	Category 1b	Herb	✓			
Chenopodium album	Common lambsquarters	Weed	Herb	✓			
Chloris virgata	Feather-top chloris	Increaser 2	Grass	✓	✓	✓	✓
Commelina africana	Yellow commelina	Medicinal	Herb	✓			
Combretum apiculatum subsp. *apiculatum*	Red bush willow		Tree	✓	✓		
Combretum erythrophyllum	River bushwillow		Tree	✓			
Combretum imberbe	**Leadwood**	**Protected tree**	**Tree**	✓			
Combretum molle	Velvet bush-willow		Tree	✓			
Combretum hereroense	Russet bushwillow		Tree	✓			
Combretum zeyheri	Large-fruited bushwillow		Tree	✓	✓		
Cleome maculata	Spotted Cleome		Herb	✓			
Cortaderia selloana	Common Pampas grass	Category 1b	Grass				
Crassula capitella	Campfire crassula		Succulent	✓			
Crinum graminicola	Grass Crinum		Herb	✓			
Cymbopogon excavatus	Broad-Leaved Turpentine Grass	Increaser 1	Grass	✓			
Cyperus esculentus	Yellow nutsedge		Sedge	✓			
Cyperus rotundus subsp.*rotundus*	Purple Nutsedge	Weed	Sedge	✓			

Scientific Name	Common Name	Ecological status	Form	55m Servitude	Silimela Substation	Emkhiweni Substation	Loop in Lines for Substation
Erigeron (*Conyza*) *bonariensis*		Weed	Herb	✓		✓	✓
Cynodon dactylon	Couch Grass	Increaser 2	Grass	✓	✓	✓	✓
Datura stramonium	Jimson weed	Category 1b	Herb	✓		✓	✓
Dichrostachys cinerea	Sicklebush		Shrub	✓	✓		✓
Digitaria eriantha	Common Finger Grass	Decreaser	Grass	✓	✓	✓	✓
Digitaria monodactyla	One-finger-grass		Grass	✓			
Diheteropogon amplectens			Grass	✓			
Diplorhynchus condylocarpon	Hornpod Tree		Tree	✓			
Diospyros lyciodes	Blue bush		Tree	✓			
Dombeya rotundifolia	Wild pear		Tree	✓			
Dovyalis caffra	Kei apple		Shrub	✓			
Ehretia alba	Puzzle bush		Shrub	✓			
Ehretia rigida subsp. *nervifolia*			Shrub	✓			
Elephantorrhiza elephantina	Elephant's root		Shrub	✓			
Englerophytum magalismontanum	Transvaal milkplum		Shrub	✓			
Eucalyptus camaldulensis	River Red Gum	Invader 2	Tree	✓			
Euclea crispa	Blue guarri		Shrub	✓			
Euphorbia clavarioides var. *truncata*	Lion's Spoor		Herb	✓			
Euphorbia schinzii	Klipmelkbossie		Succulent				
Eragrostis curvula	Weeping love grass		Grass	✓			
Eragrostis gummiflua	Gum Grass		Grass	✓			
Eragrostis plana	Fan Love Grass		Grass	✓			
Eragrostis pallens	Broom love grass		Grass	✓			
Eragrostis superba	Saw-tooth love grass		Grass	✓			

Scientific Name	Common Name	Ecological status	Form	55m Servitude	Silimela Substation	Emkhiweni Substation	Loop in Lines for Substation
Eragrostis trichophora	Atherstone's Grass		Grass	✓			
Faurea saligna	Willow beechwood		Tree	✓			
Ficus sp			Tree	✓			
Flueggea virosa	White berry-bush		Tree	✓			
Gerbera piloselloides	Small Yellow gerbera	Medicinal	Herb	✓			
Gladiolus vinosomaculatus	Sword lily		Herb	✓		✓	✓
Gladiolus permeabilis subsp. *edulis*	Patrysuintjie		Herb	✓			
Gomphocarpus physocarpus	Balloon milkweed	Medicinal	Shrub	✓			
Glycine max	Soya bean		Herb	✓			
Grewia flava	Brandy bush		Shrub	✓			
Gymnosporia buxifolia	Common spike-thorn		Shrub	✓			
Habenaria epipactidea	**Bog Orchid**	**Protected (Mpumalanga Nature Conservation Act)**	**Herb**	✓			
Haplocarpha scaposa	False gerbera	Medicinal	Herb	✓			
Helichrysum aureonitens	Golden everlasting	Medicinal	Herb	✓	✓		✓
Heteropyxis natalensis	Lavender Tree		Tree				
Heteropogon contortus	Spear Grass		Grass	✓			
Hibiscus trionum	Flower-of-an-hour		Herb	✓			✓
Hyparrhenia hirta	Common Thatching Grass	Increaser 1	Grass	✓			✓
Hyperthelia dissoluta	Yellow thatching grass		Grass				
Hypochaeris radicata	Hairy wild lettuce	Weed	Herb	✓		✓	✓
Hypoxis hemerocallidea	**Yellow star**	**Medicinal**	**Herb**	✓		✓	✓

Scientific Name	Common Name	Ecological status	Form	55m Servitude	Silimela Substation	Emkhiweni Substation	Loop in Lines for Substation
Hypoxis rigidula	Silver-leaved Star Flower	Medicinal	Herb	✓			✓
Imperata cylindrica	Cotton-wool Grass		Grass	✓			
Indigofera comosa			Herb	✓			
Indigofera cf. oxytropis			Herb	✓			
Ipomoea oblongata (=*Turbina oblongata*)	Ubhoqo		Herb	✓			
Ipomoea purpurea	Morning glory		Herb	✓			
Ipomea ommaneyi	Cattle sweet potato		Herb	✓		✓	✓
Justicia sp			Herb	✓			
Kalanchoe paniculata	Hasie-oor		Herb	✓			
Kalanchoe rotundifolia	Common Kalanchoe	Medicinal	Herb	✓			
Kalanchoe cf. thyrsiflora	Bird's brandy		Herb	✓			
Lantana camara	Tick-berry	Category 1b	Shrub	✓			
Lannea discolor	Live-long, tree grape	Medicinal	Tree	✓	✓		
Leonotis leonurus	Lion's ear		Shrub	✓			
Ledebouria ovatifolia subsp. *ovatifolia*	Flat-leaved African hyacinth	Medicinal	Herb	✓			
Ledebouria cf. ovalifolia			Herb	✓			
Lippia javanica	Lemon Bush	Medicinal	Herb	✓		✓	
Lopholaena coriifolia	Leather-leaved Fluff-bush		Tree	✓			
Melia azedarach	Persian Lilac/Syringa	Category 1b	Tree	✓			
Melinis repens	Natal Red Top	Increaser 2	Grass	✓	✓	✓	✓
Mundulea sericea	Cork Bush		Shrub	✓			
Nidorella anomala			Herb	✓			
Oenothera cf. stricta	Sweet sundrop	Invader 3	Herb	✓			

Scientific Name	Common Name	Ecological status	Form	55m Servitude	Silimela Substation	Emkhiweni Substation	Loop in Lines for Substation
Opuntia ficus-indica	Sweet prickly pear	Category 1b	Succulent	✓			
Ornithogalum cf. tenuifolium	Bush onion		Herb	✓			
Oxygonum cf. dregeanum			Herb	✓			
Ozoroa paniculosa var. paniculosa			Tree	✓			
Pappea capensis	Jacket plum		Shrub	✓			
Parinari capensis	Dwarf Mobola-plum		Shrub	✓			
Paspalum dilatatum	Dallas grass		Grass	✓	✓		
Pearsonia sessilifolia	Silwerertjietee		Herb	✓			
Peltophorum africanum	Weeping Wattle		Tree	✓			
Pennisetum macrourum	African feather grass		Grass	✓			
Persicaria lapathifolia	Pale persicaria	Weed	Herb	✓			
Plantago major	Broadleaved Ribwort	Weed/Medicinal	Herb	✓		✓	✓
Phragmites australis	Common reed	Decreaser	Reed	✓			
Pogonarthria squarrosa	Herringbone Grass	Increaser 2	Grass	✓		✓	✓
Populus X canescens	Grey poplar	Invader 2	Shrub	✓			
Pseudognaphalium luteoalbum	Jersey Cudweed		Herb	✓		✓	✓
Pterocarpus rotundifolius	Round-leaved bloodwood		Tree	✓	✓		
Protea caffra subsp. caffra	**Common Sugarbush**	**Protected (Mpumalanga Nature Conservation Act)**	**Tree**	✓		✓	✓
Protea welwitschii	**Cluster-head Sugarbush**	**Protected (Mpumalanga Nature Conservation Act)**	**Tree**	✓			✓

Scientific Name	Common Name	Ecological status	Form	55m Servitude	Silimela Substation	Emkhiweni Substation	Loop in Lines for Substation
Pygmaeothamnus zeyheri	Sand Apple		Shrub	✓			
Prunus persica	Peach tree	Exotic	Tree	✓			
Ricinus communis	Caster-oil plant	Category 1b	Shrub	✓			
Richardia brasiliensis	White-eye (Australia)	Weed	Herb	✓			
Salix babylonica	Weeping willow	Invader 2	Tree	✓			
Satyrium cf. cristatum			Herb	✓			
Sclerocarya birrea* subsp. *caffra	**Marula**	**Protected tree**	**Tree**	✓			
Schoenoplectus corymbosus			Sedge	✓			
Schizocarphus nervosus (= Scilla nervosa)	White scilla		Herb	✓			
Schmidtia pappophoroides	Sand Quick Grass		Grass	✓			
Searsia lancea	Karee		Tree	✓			
Searsia pyroides	Common wild currant		Tree	✓			
Senna italica	Port Royal senna		Herb	✓			
Seriphium plumosum (stoebe vulgaris)	Slangbos		Shrub	✓		✓	✓
Setaria sphacelata var. *sphacelata*	Common Bristle Grass		Grass				
Solanum sisymbrifolium	Wild Tomato	Category 1b	Herb	✓			
Solanum mauritianum	Bugweed	Category 1b	Shrub	✓			
Sorghum bicolor	Sorghum		Herb	✓			
Sporobolus africanus	Ratstail Dropseed	Increaser 3	Grass	✓		✓	✓
Spirostachys africana	**Tamboti**	**LEMA Protected/ Protected (Mpumalanga Nature**	Tree	✓			

Scientific Name	Common Name	Ecological status	Form	55m Servitude	Silimela Substation	Emkhiweni Substation	Loop in Lines for Substation
		Conservation Act)					
Strychnos spinosa	Spiny monkey orange		shrub	✓			
Strychnos pungens	Spine-leaved monkey orange		Shrub	✓			
Tagetes minuta	Tall Khaki Weed	Weed	Herb	✓		✓	✓
Tapinanthus sp.			Herb	✓			
Terminalia sericea	Silver terminalia		Tree	✓			
Themeda triandra	Red grass		Grass	✓			✓
Trachyandra sp.			Herb	✓			
Tragus racemosus	Burweed		Grass	✓			
Tristachya biseriata			Grass	✓			
Typha capensis	Bulrush		Aquatic Herb	✓			
Vangueria infausta	African medlar		Tree	✓			
Pachystigma (Vangueria) pygmaeum	Dwarf Crowned-medla		Shrub	✓			
Verbena bonariensis	Tall Verbena	Weed	Herb	✓			✓
Xanthium strumarium	Rough cocklebur	Category 1b	Shrub	✓			
Xanthium spinosum	Spiny cocklebur	Category 1b	Herb	✓			
Xerophyta retinervis	Black-stick lily		Herb	✓			
Zaluzianaskya sp.			Herb	✓			
Zea mays	Corn or maize		Herb	✓			
Ziziphus mucronata	Buffalo thorn		Shrub	✓			

10.1.3 Threatened Species and Species of Conservation Concern and Medicinal Plants recorded within the study area

According to NEM:BA, there is a dire need to conserve biodiversity in each province and as such, all natural and/or indigenous resources must be utilised sustainably. Within the study area, there are a number of plants that are used to provide medicinal products (**Table 6**). In some cases there is merit in protecting or translocating them before the proposed development commences. 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), their economic value means that they are considered to be in need of protection.

According to the South African Red Data list categories done by SANBI (**Figure 13**), **threatened species** are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered, Endangered or Vulnerable is a threatened species whereas **Species of conservation concern** are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD).

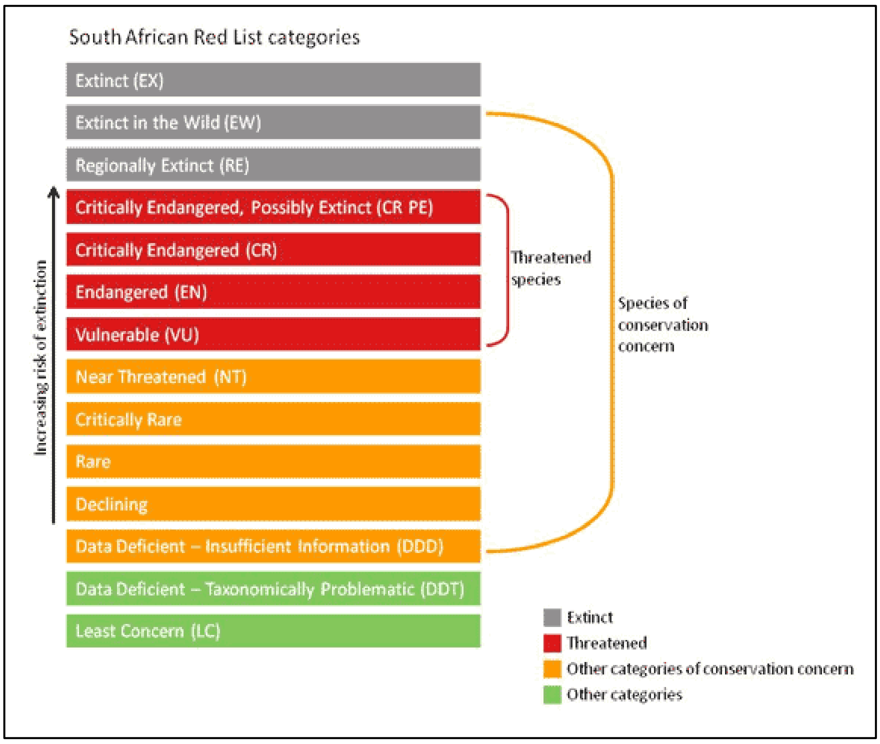

Figure 13. South African Red Data list categories (SANBI)

During the field survey, no threatened plant species were observed within the study area, however only two (2) species of conservation concerns were noted, namely *Hypoxis hemerocallidea* (Star flower/African potato) and *Boophane disticha* (Century plant). Raimondo *et al.* (2009) has listed these species as *Declining.* These plant species were recorded within the study area.

Hypoxis hemerocallidea (Star flower/African potato) (**Figure 14**) occurs in open grassland and woodland and is widespread in South Africa in the eastern summer rainfall provinces (Eastern Cape, Free State, KwaZulu-Natal, Mpumalanga, Gauteng and Limpopo Provinces). It is used to treat headaches, dizziness, mental disorders, cancers, inflammation and HIV (Pooley, 1998). The distribution of *Hypoxis hemerocallidea* plant species within the study area is shown in **Figure 15**.

Figure 14. *Hypoxis hemerocallidea* recorded within the study area

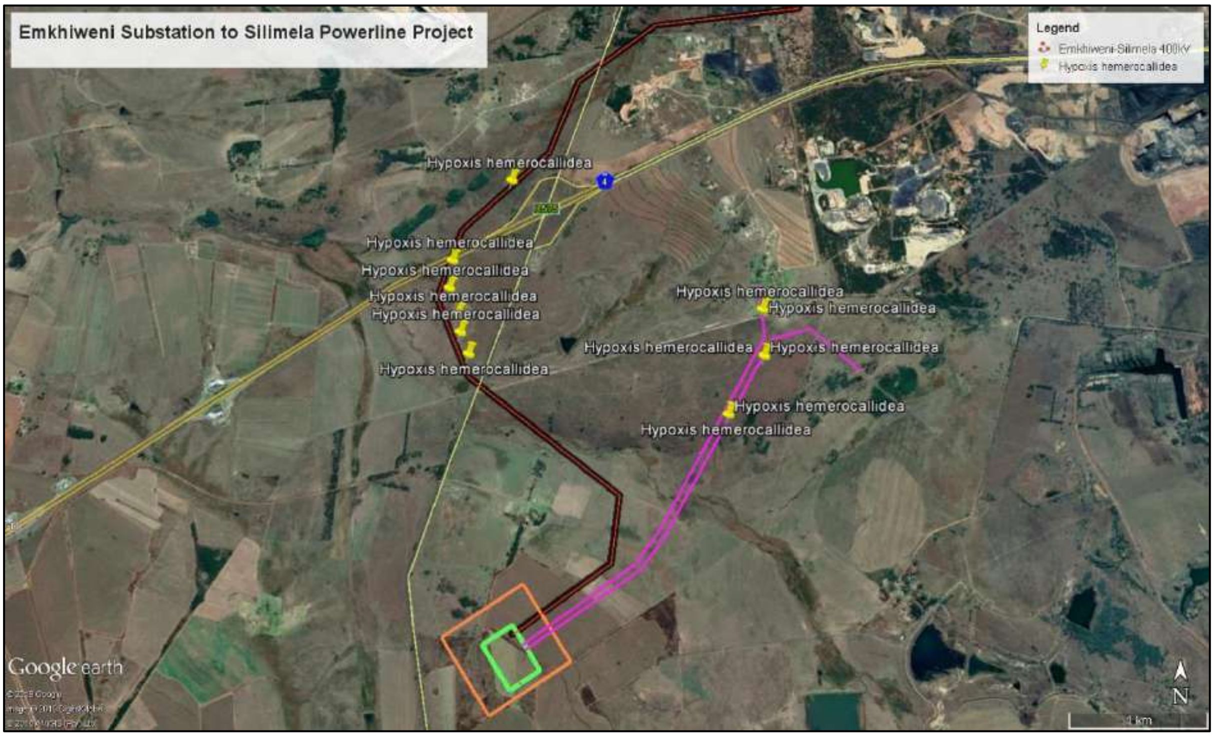

Figure 15. The distribution of *Hypoxis hemerocallidea* plant species within the study area

According to Williams *et al.* (2016), *Boophane disticha* (**Figure 16**) is found in the Northern Cape, Eastern Cape, KwaZulu-Natal, Free State, Gauteng, Limpopo, Mpumalanga, and North West Provinces, and north up to Uganda, in Albany Thicket, Fynbos, Grassland, Indian Ocean Coastal Belt, Nama Karoo, Savanna and Succulent Karoo habitats, in dry grassland and rocky areas. The distribution of this species within the study area is indicated in **Figure 17**.

Figure 16. *Boophane disticha* recorded within the study area

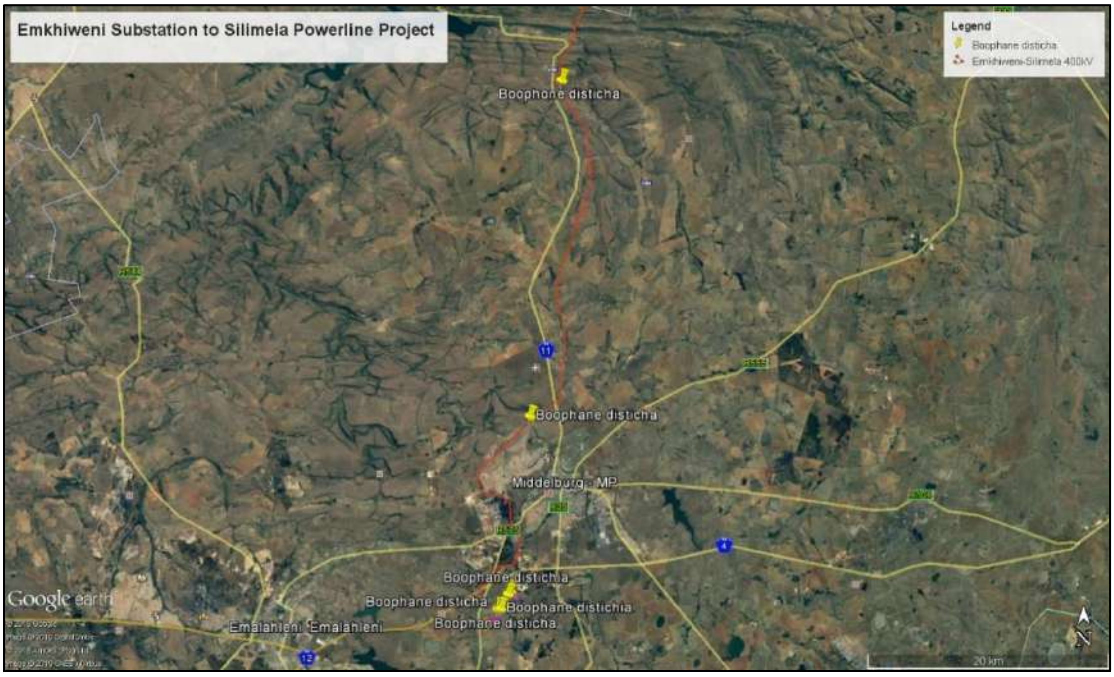

Figure 17. The distribution of *Boophane disticha* plant species within the study area

It is recommended that a walk-down survey be undertaken by suitably qualified Environmental Control Officer (ECO) prior to the start of the construction activities in the areas which were not accessible during the Terrestrial Ecological walk-down field surveys, in order to survey those specific areas (Loskop Suid 53 and Loskop Noord 12) in detail for any plant Species of Conservation Concern (SCC) and protected trees/plant species. The walk-down survey should preferably be undertaken during summer season in order to have a higher probability of detecting species of conservation concern. Any plant SCC or protected plant species that fall within the construction footprint must be search-and-rescued, and protected trees species should be conserved as far as possible.

10.1.4 Protected plant species

In terms of the National Forests Act (Act No. 84 of 1998), certain tree species can be identified and declared as protected. Protected trees occurring in the study area are *Boscia albitrunca* (Shepherd's tree), *Combretum imberbe* (Leadwood) and *Sclerocarya birrea* subsp. *caffra* (Marula). According to section 51(1) of the National Forests Act (Act No. 84 of 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, except under a license granted by the Minister of Department of Agriculture, Forestry and Fisheries (DAFF). There is only one plant species which falls within "*protected plants*" in terms of Limpopo Environmental Management Act (LEMA) (Act No. 7 of 2003) Schedule 12, namely *Spirostachys africana* (Tamboti). The following plant species are listed as "protected plants" in terms of Schedule 11 (Section 69 (1a)) of Mpumalanga Nature Conservation Act (No. 10 of 1998); all *Crinum* spp, all species of family Proteaceae, all *Gladioli* species and Whole Orchidaceae family (*Habenaria* species). Provincially protected plant species such as namely *Boophone disticha, Crinum graminicola, Hypoxis hemerocallidea, Gladiolus vinosomaculatus*, *Protea welwitschii*, and *Habenaria epipactidea* and *Protea caffra* were recorded within the study area.

A Permit from the Limpopo Department of Economic Development, Environment and Tourism (LEDET) and Mpumalanga Tourism and Parks Agency (MTPA) is required before construction commences in order to cut, disturb, destroy or remove these trees noted within the project area. The distribution of these protected plant species within the study area are indicated in **Figures 18-26** below.

Figure 18. Distribution of *Boscia albitrunca* (Shepherd's tree) recorded within the study area

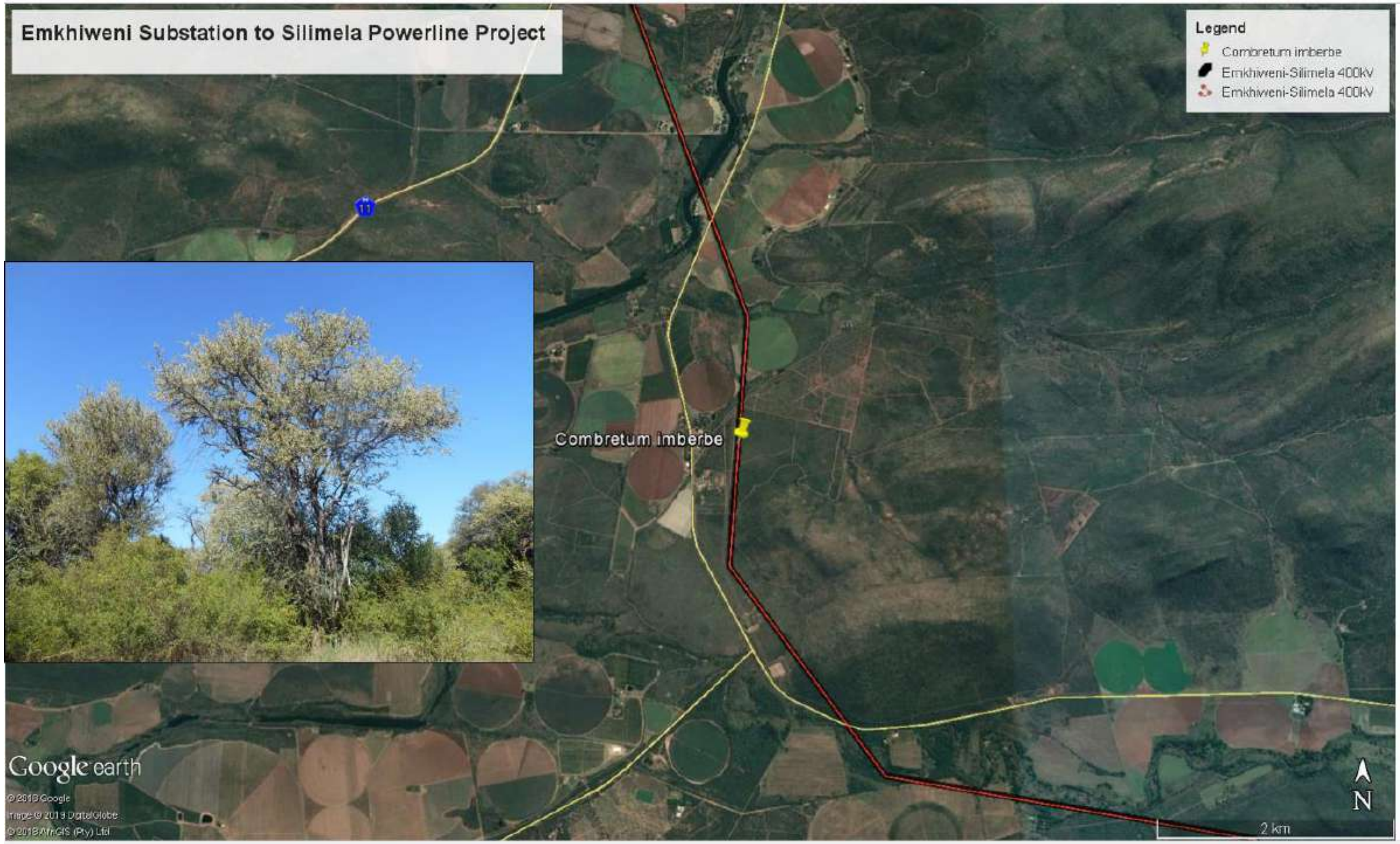

Figure 19. Distribution of *Combretum imberbe* recorded within the study area

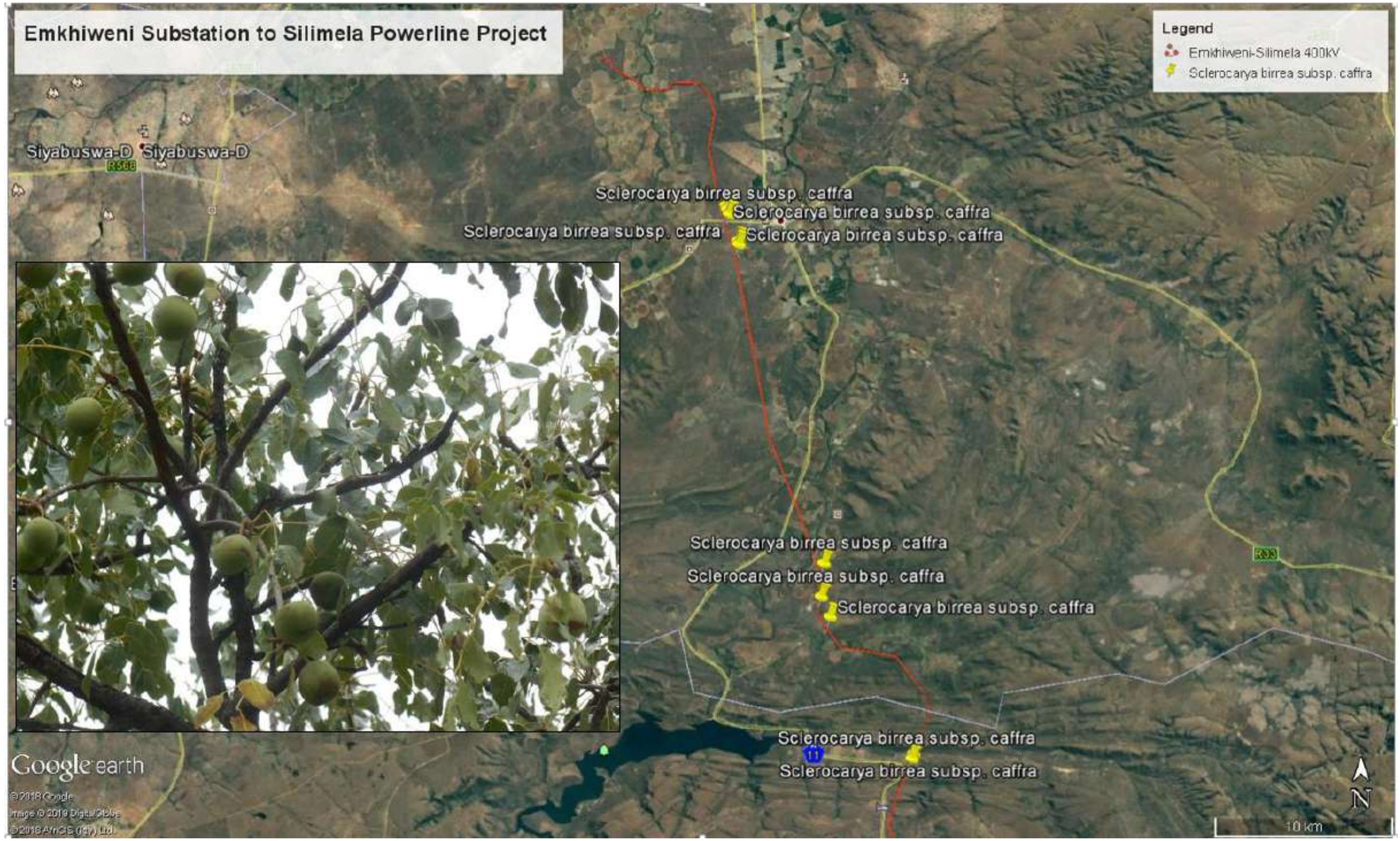

Figure 20. Distribution of *Sclerocarya birrea subsp. caffra* recorded within the study area

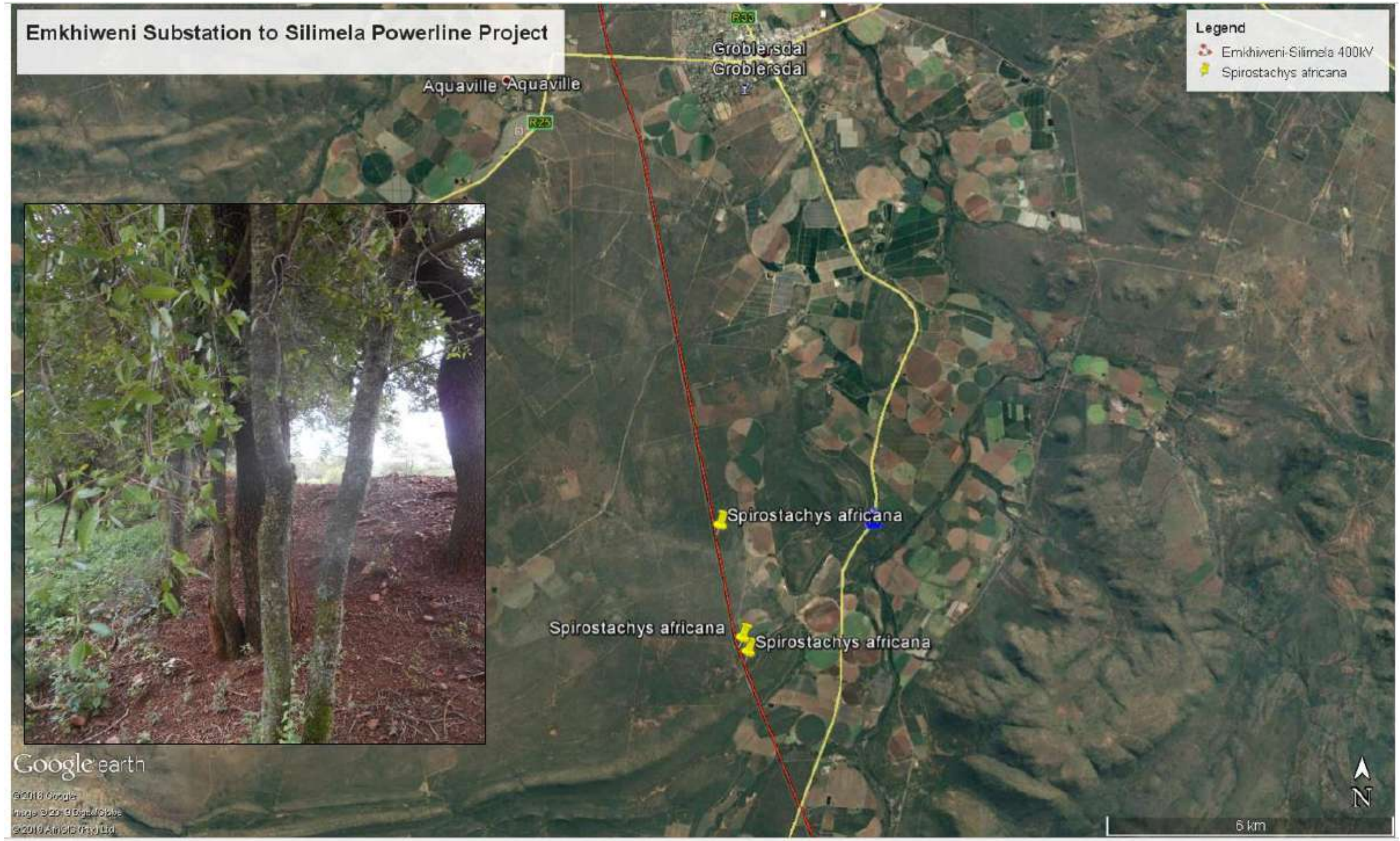

Figure 21. Distribution of *Spirostachys africana* recorded within the study area

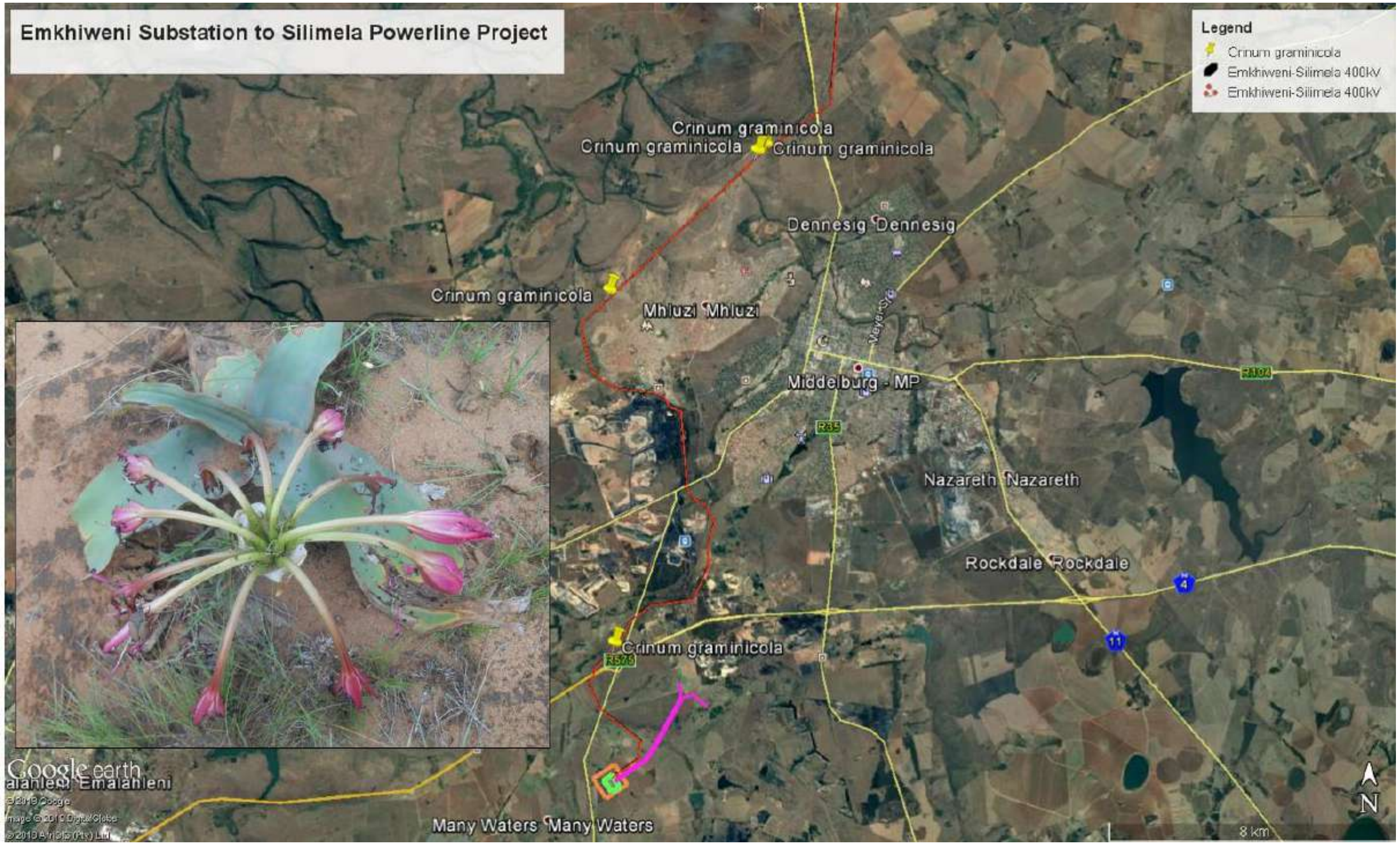

Figure 22. Distribution of *Crinum graminicola* recorded within the study area

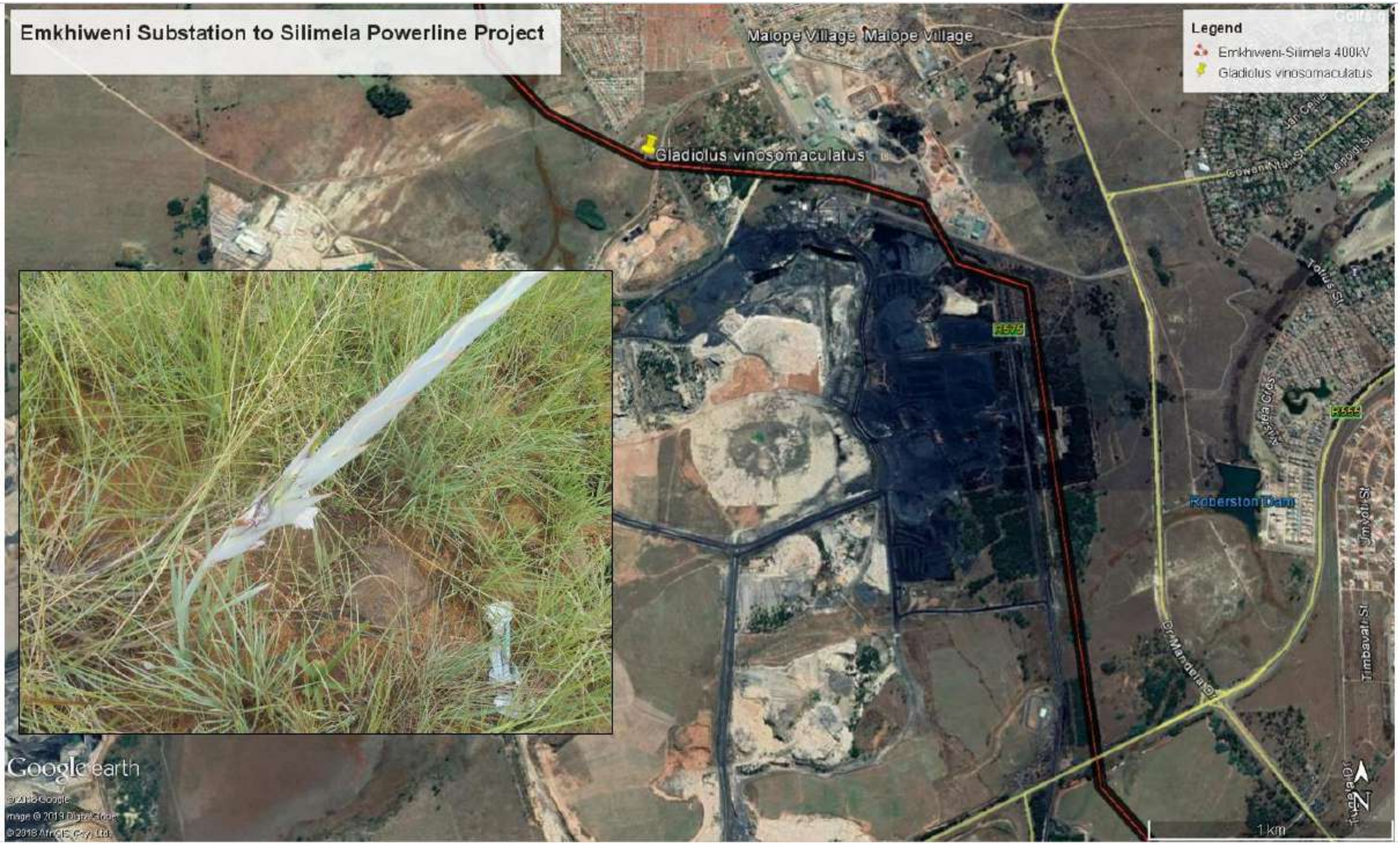

Figure 23. Distribution of *Gladiolus vinosomaculatus* recorded within the study area

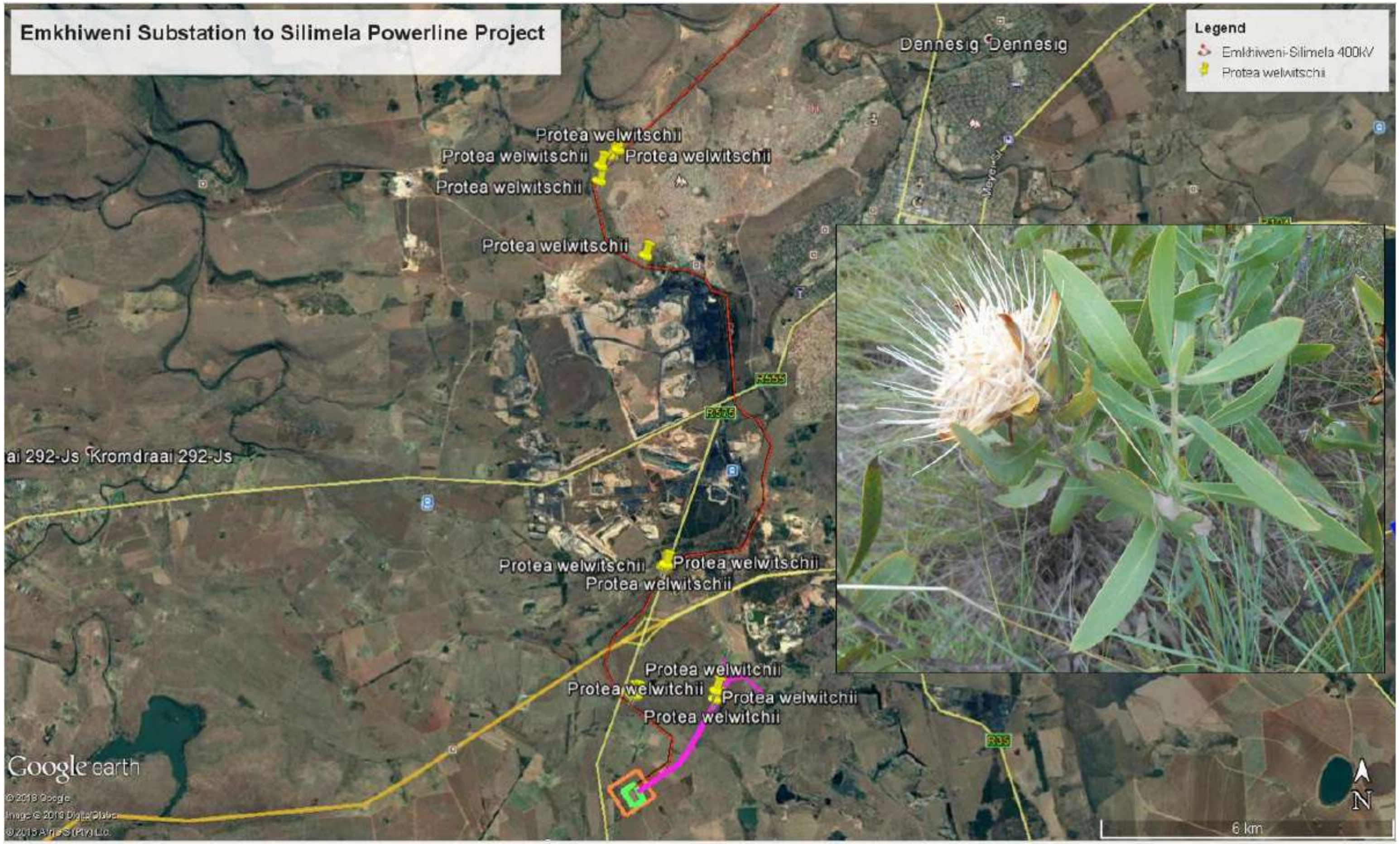

Figure 24. Distribution of *Protea welwitschii* recorded within the study area

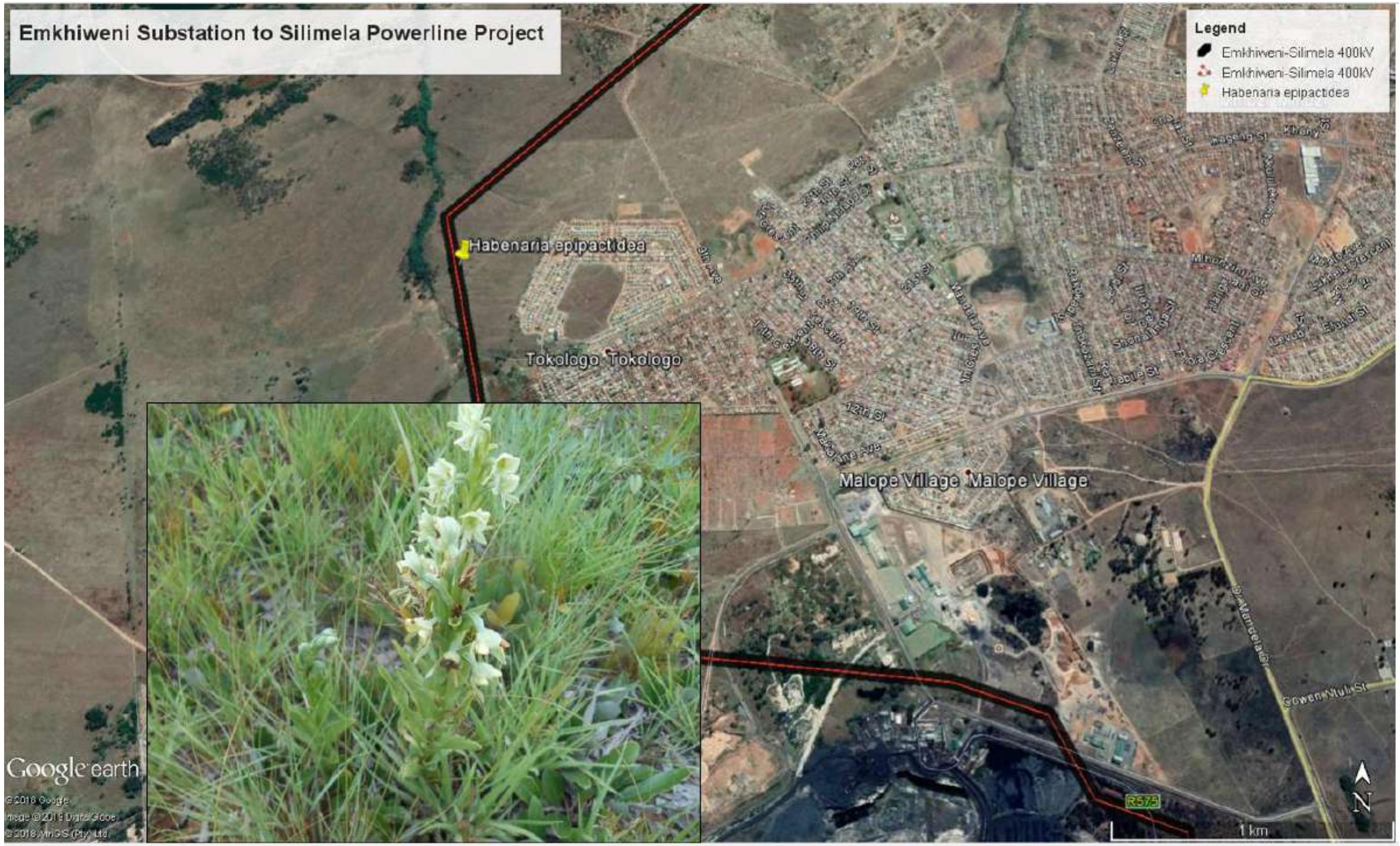

Figure 25. Distribution of *Habenaria epipactidea* recorded within the study area

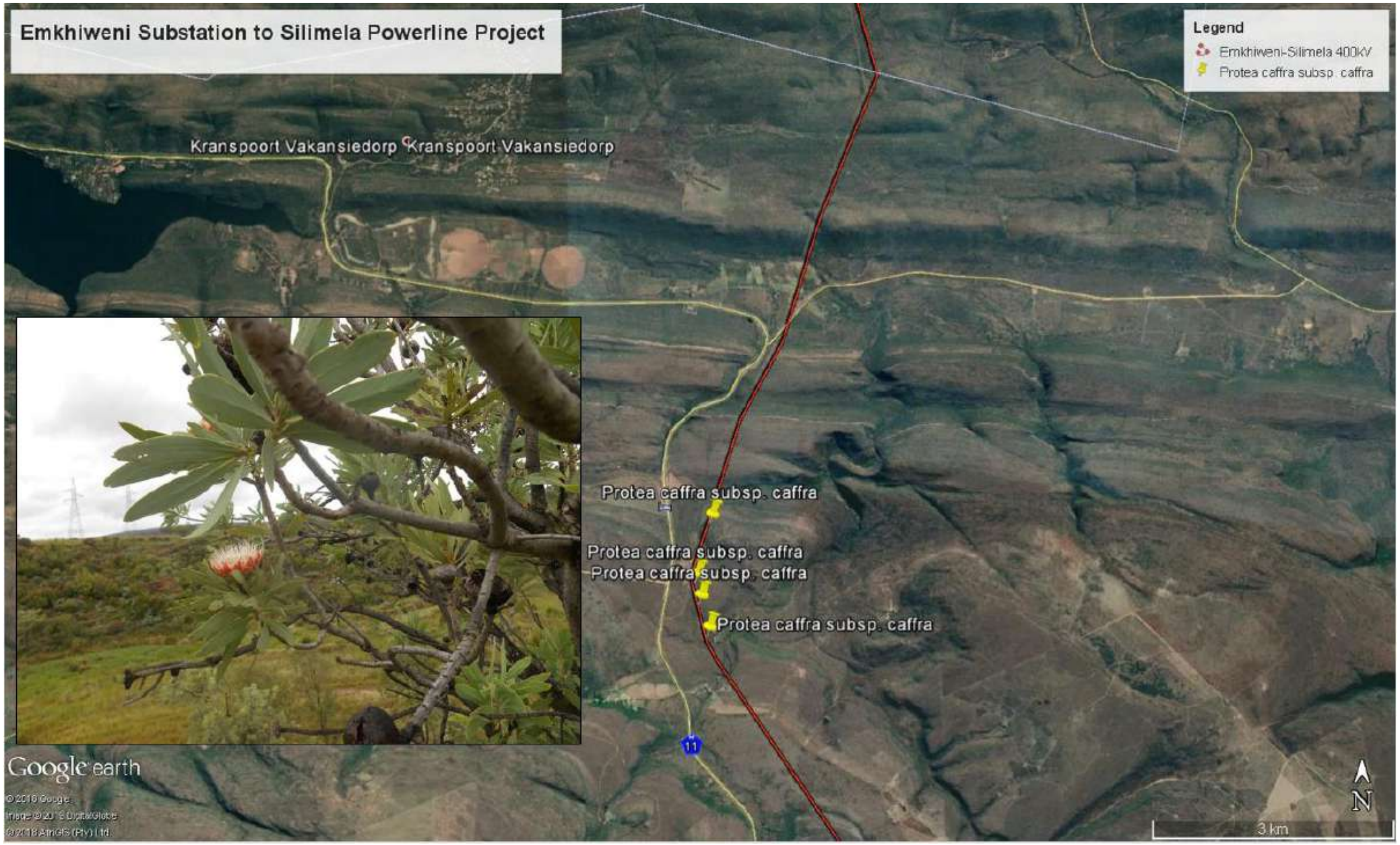

Figure 26. Distribution of *Protea caffra* recorded within the study area

10.1.5 Alien invasive species recorded in the study area

Alien invader plants are species that are of exotic, non-native or of foreign origin that typically invade undeveloped or disturbed areas. Invaders are a threat to our ecosystem because by nature they grow fast, reproduce quickly and have high dispersal ability (Henderson, 2001). This means that invader plants and seeds spread rapidly and compete for the growing space of our own indigenous plants. If these invader plants out-compete indigenous plants there is a shift in the species composition of the area and the changing our plant communities causes a decline in species richness and biodiversity (Henderson, 2001). Many factors allow alien invasive plants to succeed, particularly the absence of their natural enemies. This makes it difficult to control invasive plants without bringing in natural enemies and eliminating the high competition they have over the indigenous vegetation (Bromilow, 2010). Alien invasive plant species within both the servitude were observed to occur in clumps, scattered distributions or as single individuals on site. Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of invader species (Especially Category 1) must be removed and eradicated (Henderson, 2001). Riparian vegetation, human settlements, overgrazed areas, roads and foot paths and all associated with alien invasive plant species and species which were dominated within the study area were *Campuloclinium macrocephalum* (**Figure 27**), *Datura stramonium* (**Figure 28**), *Opuntia ficus-indica* (**Figure 29**) and *Xanthium strumarium* (**Figure 30**) (All Category 1b).

Figure 27. *Campuloclinium macrocephalum* recorded within the study area

Figure 28. *Datura stramonium* recorded within the study area

Figure 29. *Opuntia ficus-indica* recorded within the study area

Figure 30. *Solanum sisymbrifolium* recorded within both the study area

The Environmental Management Programme (EMPr) must ensure that the Applicant/Contractor implements suitable methods during the construction phase to limit the introduction and spread of alien invasive plant species.

10.1.6 Habitat available for species of conservation importance

Data sourced from SANBI indicates there are plant species on the Red Data List that are known to occur in or surrounding the project area. These species and their probability of occurrence are indicated in **Table 7**. The probability of occurrence is based on the suitable habit where the species is likely to occur.

Table 7. Red Listed plant species which are known to occur in the general vicinity of the project area, which could potentially be found within the study area

RDL floral species	Status	Suitable habitat	Probability of Occurrence
Boophane disticha	Declining	Occurs in dry grassland and rocky areas	**FOUND**
Crinum macowanii	Declining	Occurs in in mountain grasslands, stony slopes, hard dry shale, gravelly soil and sandy flats	High
Crinum bulbispermum	Declining	Occurs in grasslands and Savanna, on the banks of freshwater rivers, streams, dams, seasonal pans, permanent to seasonal swampy grasslands and in damp depressions, in deep soils	High
Pachycarpus suaveolens	VU	Short or annually burnt grasslands	Medium
Ilex mitis var. *mitis*	Declining	Along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to inland mountain slopes.	High
Haworthia koelmaniorum var. *koelmaniorum*	VU	Bushveld, on sandstone outcrops and ridges.	Medium
Callilepis leptophylla	Declining	Grassland or open woodland, often on rocky outcrops or rocky hill slopes.	High
Elaeodendron transvaalense	NT	Savanna or bushveld, from open woodland to thickets, often on termite mounds.	Medium
Acacia erioloba	Declining	Savanna, semi-desert and desert areas with deep, sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrop	Medium
Combretum petrophilum	Rare	Rocky outcrops in mountain bushveld.	Medium
Argyrolobium megarrhizum	NT	Mixed bushveld.	Medium
Bowiea volubilis subsp. *volubilis*	VU	In Gauteng, Mpumalanga and North West Province it is often found in open woodland or on steep rocky hills usually in well-shaded situations. Tolerates wet and dry conditions, growing predominantly in summer rainfall areas with an annual rainfall of 200-800 mm	Low
Drimia altissima	Declining	Open veld and scrubby woodland in a variety of soil types	Medium
Eucomis vandermerwei	VU	Short, sour montane grassland on sandy, low-pH soils derived from quartzitic rocky outcrops. In rock crevices or under overhanging rocks, confined to outcrops on slopes and plateaus of higher peaks, predominantly on north-facing slopes, 2200-2500 m.	Medium

RDL floral species	Status	Suitable habitat	Probability of Occurrence
Hypoxis hemerocallidea.	Declining	It occurs in open grassland and woodland and is widespread in South Africa in the eastern summer rainfall provinces (Eastern Cape, Free State, KwaZulu-Natal, Mpumalanga, Gauteng and Limpopo).	**FOUND**
Gladiolus pardalinus	Rare	Bushveld, among dolerite outcrops on low hills and plains, altitude 1 200-1 500 m	Medium
Gladiolus pole-evansii	Rare	Granite basement rock.	Medium
Frithia humilis	EN	It is found predominantly in shallow, sandy gravel on large, flat, rock plates of the coarse sandstone sediments of the Irrigasie Formation of the Ecca Group of the Karoo Sequence	Medium
Encephalartos lanatus	VU	Sheltered, wooded ravines in sandstone ridges, 1200-1500 m	Medium
Eulophia speciosa	Declining	Occupies various habitats including sand dunes, bushveld, thornveld and montane grasslands.	Medium
Pavetta zeyheri subsp. *middelburgensis*	Rare	Outcrops of rocks and boulders or rocky sheets.	High

10.2 Fauna

The evaluation of faunal presence is based on the presence / absence of mammals, reptiles and amphibians in the study area. The surveys determined 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 survey assessments of the study area, which were carried out utilising vehicles and also on foot. 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 nomenclature is referred to using Stuart and Stuart (1998), Skinner and Chimimba (2005), Friedman and Daly (2004), Child *et al*. (2017); reptile names by Branch (1988), Branch (2001) and Bates *et al.* (2014) and Amphibian names by Minter *et al.* (2004).

10.2.1 Mammals

10.2.1.1 Desktop survey results

The potential Red Data mammal species that could be found within the study area are those which have been recorded in the grid cells (ADU, 2018) (**Table 8**). The Red List category follows the Child *et al*. (2016). Mammal species such as African Bush Elephant, Tsessebe, Leopard and Brown Hyena are mostly restricted to protected or conservation areas and as mentioned earlier, the study area does not traverse any protected area.

Table 8. Mammal species recorded which could occur within the study area

Family	Scientific name	Common name	Red list category
Bovidae	*Ourebia ourebi*	Oribi	Endangered
Bovidae	*Damaliscus lunatus*	(Southern African) Tsessebe	Vulnerable
Erinaceidae	*Atelerix frontalis*	Southern African Hedgehog	Near Threatened
Felidae	*Panthera pardus*	Leopard	Vulnerable
Felidae	*Felis nigripes*	Black-footed Cat	Vulnerable
Hyaenidae	*Hyaena brunnea*	Brown Hyena	Near Threatened
Mustelidae	*Aonyx capensis*	African Clawless Otter	Near Threatened
Soricidae	*Crocidura maquassiensis*	Makwassie Musk Shrew	Vulnerable

10.2.1.2 Mammals recorded within the study area

Historically, the study area could have provided habitat for a diverse population of larger mammal species, but the agricultural activities within the study area have transformed the majority of the habitats and due to these anthropogenic disturbances, it is likely that only the more common and smaller mammal species will be observed, which show more adaptation. However, natural vegetation still exist and these areas are suitable for survival of the mammals species recorded within the study area. The agricultural fields were largely devoid of mammal species; however meerkat dens were present on the edges of agricultural fields. Domestic animals such as cattle, sheep, donkeys and horses were noted in abundance within the study area. Significantly the bushveld, riparian vegetation and natural grasslands between agricultural fields are utilised as a movement and linkage corridor within the study area. These areas also provide ideal foraging and breeding habitat for a number of mammal species. Grassland habitats are utilised by a range of faunal species, particularly if there is some form of topographical change within the grassland. Mammal species such as Common Impala (**Figure 31**), Black Impala (**Figure 32**), Kudu (**Figure 33**), Nyala (**Figure 34**), Blesbok (**Figure 35**), Black-backed Jackal (**Figure 36**), Giraffe (**Figure 37**) and Zebra (**Figure 38**) were seen within the study area. **Table 9** lists mammal species recorded during the surveys. The species lists provided by the local land owners are indicated in **BOLD** and includes only two Red Data mammal species. Mammal species such as Waterbuck, Sable Antelope, Giraffe and Nyala are provincially protected under Schedule 2, protected game (Section 4 (1b) of Mpumalanga Nature Conservation Act (No. 10 of 1998) and Schedule 3 of LEMA (Act No. 7 of 2003).

Figure 31. Common Impala recorded within the servitude

Figure 32. Black Impala recorded within the servitude

Figure 33. Kudu recorded within the servitude

Figure 34. Nyala recorded within the servitude

Figure 35. Blesbok recorded within the servitude

Figure 36. Black-backed Jackal recorded within the servitude

Figure 37. Giraffe recorded within the servitude

Figure 38. Zebra recorded within the servitude

Figure 39. Sable Antelope recorded within the servitude

Table 9. Mammals recorded within the study area

Scientific name	English name	Conservation Status
Sylvicapra grimmia	Grey/Common Duiker	Least concern
Canis mesomelas	Black-backed Jackal	Least concern
Cryptomys hottentotus	African Mole Rat	Least concern
Gerbilliscus brantsii	Highveld Gerbil	Least concern
Rhabdomys pumilio	Four-striped Grass Mouse	Least concern
Cynictis penicillata	Yellow mongoose	Least concern
Suricata suricatta	Meerkat	Least concern
Hystrix africaeaustralis	Cape Porcupine	Least concern
Rattus	House rat	Least concern
Xerus inauris	Cape Ground Squirrel	Least concern
Orycteropus afer	Aardvark	Least concern
Damaliscus pygargus phillipsi	Blesbok	Least concern
Hippotragus niger	Sable	Vulnerable
Tragelaphus strepsiceros	Greater Kudu	Least concern
Tragelaphus angasii	Nyala	Least concern
Phacochoerus africanus	Common Warthog	Least concern
Taurotragus oryx	Common Eland	Least concern
Kobus ellipsiprymnus	Waterbuck	Least concern
Aepyceros melampus	Impala	Least concern
Equus burchellii	Burchell's Zebra	Least concern
Lepus saxatilis	Scrub hare	Least concern
Papio hamadryas	Chacma baboon	Least concern
Cercopithecus pygerythrus	Vervet monkey	Least concern
Giraffa camelopardalis giraffe	South African Giraffe	Least Concern
Raphicerus campestris	**Steenbok**	**Least concern**
Leptailurus serval	**Serval**	**Near Threatened**
Redunca fulvorufula	**Mountain Reedbuck**	**Least Concern**

10.2.1.3 Habitat available for mammal species of conservation importance

Data sourced from Animal Demographic Unit (ADU, 2019) indicates that there are Red Data mammal species which are known to occur in the general vicinity of the study area. **Table 10** below indicates the suitable habitat together with the probability of occurrence for each species that could potentially occur in the study area. The probability of occurrence is based on the presence of suitable habit where the species is likely to occur.

Table 10. Red Data Listed mammal species which could potentially occur within the project area, their suitable habitats and also the probability of occurrence (Friedmann & Daly (2004), Skinner & Chimimba (2005) and Child et al. (2017)).

Common name	Red list category	Suitable habitat	Probability of occurrence
Oribi	Endangered	Inhabits floodplains, grasslands, open plains and montane grasslands, and marginally in light bushland.	Medium
(Southern African) Tsessebe	Vulnerable (2016)	Tsessebe occurred in the bushveld and lowveld, often at the ecotone between grassland and woodland	Medium
Southern African Hedgehog	Near Threatened (2016)	The distribution mainly falls within savannah and grassland vegetation types, within which it is found in a wide variety of semi-arid and sub-temperate habitats, including scrub brush, western Karoo, grassland and suburban gardens	Medium
Leopard	Vulnerable (2016)	The Leopard has a wide habitat tolerance, including woodland, grassland savannah and mountain habitats but also occur widely in coastal scrub, shrubland and semidesert. Densely wooded and rocky areas are preferred as choice habitat types.	Medium
Black-footed Cat	Vulnerable (2016)	The species prefers hollowed out abandoned termite mounds when available (especially for the kittens), but will use dens dug by other animals such as Springhares, Cape Ground Squirrels (*Xerus inauris*) and Aardvark (*Orycteropus afer*). It is a specialist of open, short grass areas with an abundance of small rodents and groundroosting birds. It inhabits dry, open savannah, grasslands and Karoo semi-desert with sparse shrub and tree cover and a mean annual rainfall of between 100 and 500 mm at altitudes up to 2,000 m asl.	Medium
Brown Hyena	Near Threatened (2015)	The Brown Hyaena is widespread across southern Africa and is found in the desert areas with annual rainfall less than 100 m, semi-desert, open scrub and open woodland savannah with a maximum rainfall up to about 700 mm. It shows an ability to survive close to urban areas. It requires some type of cover in which to lie up during the day. For this it favours rocky, mountainous areas with bush cover in the bushveld areas of South Africa.	Low

Common name	Red list category	Suitable habitat	Probability of occurrence
African Clawless Otter	Near Threatened (2016)	Cape Clawless Otters are predominantly aquatic and seldom found far from permanent water. Fresh water is an essential habitat requirement, not only for drinking but also for rinsing their fur.	High
Makwassie Musk Shrew	Vulnerable (2016)	Little is known about the habitats and ecology of this species. The type specimen was collected in a house and the Motlateng specimen from a grassy mountainside beneath a rock at 1,580 m asl. Other specimens have also been found on rocky or montane grassland, such as recently in the Soutpansberg Mountains. Thus, it may tolerate a wide range of habitats, including urban and rural landscapes	Low

10.2.2 Reptiles

10.2.2.1 Desktop survey results

The grassland biome houses 22% of South Africa's endemic reptiles (O' Connor and Bredenkamp, 1997). In general, the habitat types affected by the project area are suitable for relatively high species diversity. The reptiles mainly consists of widespread, common Bushveld species with slight variation due to the presence of sandy substrate, stony to rocky terrain, water bodies, bush and trees. According to South African Reptile Conservation Assessment (ADU, 2019), only one reptile species of conservation importance is known to occur in the vicinity of the study area, namely Nile Crocodile (*Crocodylus niloticus*). Bates *et al.* (2014) listed this species as Vulnerable.

10.2.2.2 Reptiles recorded within the study area

Areas such as rocky outcrops, bushveld, grasslands and riparian vegetation within the project area are of high importance to reptiles. Reptiles are exceptionally hard to detect during field surveys. Riverine habitats are traditionally rich in reptile diversity and concentrations due to the habitat supporting a high number of prey species, such as frogs, birds and small mammals (Branch, 2001). The majority of reptile species are sensitive to severe habitat alteration and fragmentation. Species are also very often "expelled" into riparian zones due to transformation of lands for anthropogenic disturbances such as human settlements and agricultural purposes. Termite mounds were present within the project area (**Figure 40**) and the old termite mounds offer important refuges especially during veld fires as well as cold winter months for numerous frog, lizard, snake and smaller mammal species (Jacobsen, 2005). Large number of species of mammal, birds, reptiles and amphibians feed on the emerging alates (winged termites). No termite mounds were destroyed during the brief field survey. All overturned rock material was carefully replaced in its original position. **Table 11** indicates reptile species observed within the project area. The list of species provided by the local land owners are indicated in **BOLD**. The main potential impact of the powerline development on reptile species is probable to be habitat loss or degradation. Nevertheless, in the long-term, effects on reptile species are probable to be comparatively low as the extent of habitat loss would be low and the majority of the powerline servitude would still be available for use by most reptile species. Habitat destruction should be limited to the absolute minimum throughout the survey area. Species such as Montane Speckled Skink were recorded in abundance within the study area.

Figure 40. Termite mound recorded within the project area

Table 11. Reptiles recorded within the study area

Genus	Species	Subspecies	Common name
Agama	*aculeata*	*distanti*	Distant's Ground Agama
Trachylepis	*punctatissima*		Montane Speckled Skink
Acanthocercus	*atricollis*		Southern Tree Agama
Lamprophis	*capensis*		Brown House Snake
Lygodactylus	*capensis*	*capensis*	Common Dwarf Gecko
Varanus	*niloticus*		Nile/Water Monitor
Gerrhosaurus	*flavigularis*		Yellow-throated Plated Lizard
Agama	*atra*		Southern Rock Agama
Bitis	***arietans***		**Puff Adder**
Python	***natalensis***		**Southern African Python**
Dendroaspis	***polylepis***		**Black Mamba**
Hemachatus	***haemachatus***		**Rinkhals**
Naja	***mossambica***		**Mozambique Spitting Cobra**
Thelotornis	***capensis***		**Vine Snake**
Dasypeltis	***scabra***		**Rhombic Egg-eater**
Dispholidus	***typus***	***typus***	**Boomslang**
Thelotornis	***capensis***		**Vine Snake**
Pseudaspis	***cana***		**Mole snake**
Naja	***annulifera***		**Snouted Cobra**
Telescopus	***semivariegatus***		**Eastern Tiger Snake**
Psammophylax	***tritaeniatus***		**Striped grass snake**
Stigmochelis	***pardalis***		**Leopard Tortoise**

Figure 41. *Trachylepis punctatissima* recorded within the study area

10.2.2.3 Protected Species

These are indigenous species of high conservation value or national importance that require protection. Reptile species such as Southern African Python (*Python natalensis*) are known to occur in abundance, especially in the northern parts of the project area. This species is found in moist, rocky, well-wooded valleys, plantations or bush country, but seldom if ever stray far from permanent water (Broadley, 1990). This species is listed as a *Protected Species* in terms of the Schedule 3 of LEMA (Act No. 7 of 2003) and NEM:BA Threatened or Protected Species regulations. In order to protect Southern African Python on site, should this species be encountered or exposed during the construction phase, it should be removed and relocated to natural areas in the vicinity. This remedial action requires the engagement of a herpetologist and or ecologist to oversee the removal of any herpetofauna during the initial ground clearing phase of construction (i.e. initial ground-breaking by earthmoving equipment). However, if this species if found during winter period, when it is in hibernation, then a permit from the LEDET/ MTPA would be required in order to catch and release it to a safer environment.

10.2.2.4 Habitat requirements for Red Data reptile species

The data sourced from SARCA (ADU, 2019) indicates that Nile Crocodile is the only species of conservation concern known to occur within the project area. According to Branch (2001), Nile Crocodiles can be found in larger rivers, lakes, estuaries, mangrove swamps. They are considered important indicators of ecosystem health and predators within a variety of aquatic habitats and listed as *Vulnerable* (Branch, 1988). They are considered as keystone species in aquatic environments. They are threatened due to over-exploitation, uncontrolled hunting, disease, pollution and habitat degradation. Crocodile Specialist Group (1996) listed this species on the Convention on International Trade in Endangered Species (CITES) Appendix I. The state of the rivers within the project area offer suitable habitat for this species to occur within the servitude (Bates *et al.* 2014). In order to mitigate the impacts of the project development within the habitats of this species, it is recommended that rivers and wetland systems must be spanned and no towers should be placed within the buffer zones dictated by the surface water studies.

10.2.3 Amphibians

Amphibians are an essential part of South Africa’s exceptional biodiversity and are such worthy of both research and conservation effort. This is furthermore made relevant by international concern over globally declining amphibian populations, a phenomenon currently undergoing intensive investigation but is still poorly understood (Wyman, 1990 and Wake, 1991). This decline seems to have worsened over the past years and amphibians are now more threatened than either mammals or birds, though comparisons with other taxa are confounded by a shortage of reliable data. Amphibians are an important component of South Africa’s exceptional biodiversity (Siegfried, 1989) and are worthy of both research and conservation effort.

10.2.3.1 Desktop survey results

Frogs and tadpoles are good species indicator on water quality, because they have permeable, exposed skins that readily absorb toxic substances. Tadpoles are aquatic and greatly exposed to aquatic pollutants (Blaustein, 2003). The presence of amphibians is also generally regarded as an indication of intact ecological functionality and therefore construction activities within these habitat units should be undertaken in an ecologically-sensitive manner.

According to Frog Atlas of Southern Africa (ADU, 2019), the Giant Bullfrog (*Pyxicephalus adspersus*) is the only frog species of conservation concern (considered as Near Threatened by Du Preez and Carruthers (2009)) which could potentially be found within the study area. The Giant Bullfrog has been chosen as a flagship species for the grassland eco-region (Cook, 2007).

10.2.3.2 Field work results

The watercourses (**Figure 42**) within the study area hold water on a permanent and temporary basis and are probably important breeding habitat for most of the frog species which occur within the study site. Only Ten frog species were recorded within the study area (**Table 12**). One of the frog species of conservation concern recorded within the study area was the Giant Bullfrog (*Pyxicephalus adspersus*) (**Figure 43**). This species was recorded within human habitation, within temporary pans (due to heavy rains), which are potential breeding places for Giant Bullfrogs (**Figures 44**). The Giant Bullfrog (*Pyxicephelus adspersus*) is known to breed in seasonal shallow grassy pans, vleis and other rain filled depressions in open flat areas of grassland or savanna (Du Preez and Carruthers, 2009). Giant Bullfrogs are also known to travel vast distances and may utilise wetlands as migratory corridors (Du Preez, and Cook, 2004). Many of these breeding sites are temporary, which bullfrogs prefer in order to avoid predation from fish. Giant Bullfrogs prefer warm, stagnant water, which giant bullfrog tadpoles need for rapid development (Van Wyk, Kok. and Du Preez, 1992). According to Schedule 2 of the Mpumalanga Nature Conservation Act (No 10 of 1998), National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) *Threatened or Protected Species* and Schedule 3 of LEMA (Act No. 7 of 2003), this species is listed as *protected*. The conservation of the Giant Bullfrog and of amphibians in general will be met by the protected area network as well as the designation of priority habitats, *i.e.* pans or quaternary catchments, with associated restrictions on land use. Any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. A Permit is required from MTPA/LEDET in order catch, handle, collect, transport and/or relocate the species.

Figure 42. Watercourses within the study area

Table 12. Amphibian species recorded within the study area

Genus	Species	Common name	Conservation status
Amietophrynus	*gutturalis*	Guttural Toad	Least Concern
Cacosternum	*boettgeri*	Common Caco	Least Concern
Kassina	*senegalensis*	Bubbling Kassina	Least Concern
Amietia	*delalandii*	Delalande's River Frog	Least Concern
Phrynobatrachus	*natalensis*	Snoring Puddle Frog	Least Concern
Tomopterna	*cryptotis*	Tremolo Sand Frog	Least Concern
Xenopus	*laevis*	Common Platanna	Least Concern
Pyxicephalus	*adspersus*	Giant Bullfrog	Near Threatened
Sclerophrys	*capensis*	Raucous Toad	Least Concern
Schismaderma	*carens*	Red Toad	Least Concern

Figure 43. Giant Bullfrog (*Pyxicephalus adspersus)* recorded within the study area

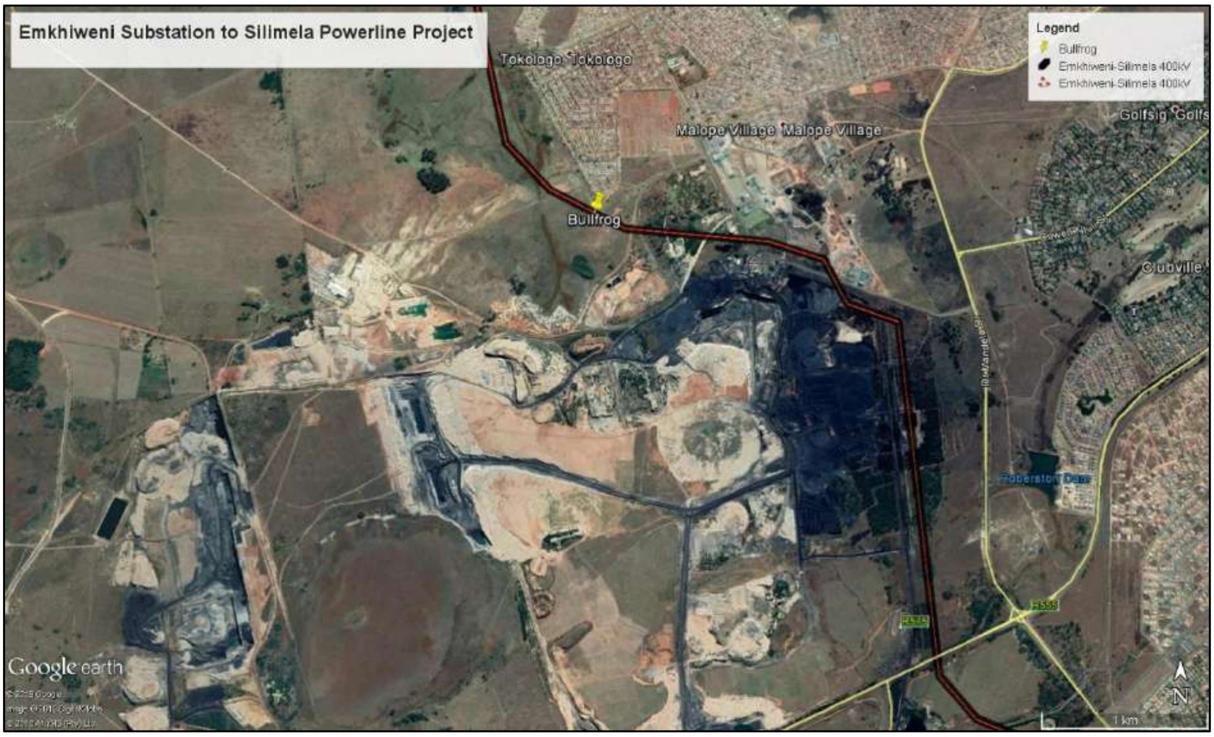

Figure 44. The distribution of Giant Bullfrog (*Pyxicephalus adspersus*) within the study area

11 TERRSTRIAL ECOLOGICAL SENSITIVITY ANALYSIS

The ecological function describes the intactness of the structure and function of the vegetation communities which in turn support faunal communities. It also refers to the degree of ecological connectivity between the identified vegetation communities and other systems within the landscape. Therefore, systems with a high degree of landscape connectivity among each other are perceived to be more sensitive.

High – Sensitive vegetation communities with either low inherent resistance or resilience towards disturbance factors or vegetation that are considered important for the maintenance of ecosystem integrity. Most of these vegetation communities represent late succession ecosystems with high connectivity with other important ecological systems.

Medium – Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree of connectivity with other ecological systems.

Low – Degraded and highly disturbed vegetation with little ecological function.

The sensitivity map (**Figure 45**) was based on the following criteria:

- CBA 1 and 2 (High);
- CBA Irreplaceable (High);
- Threatened ecosystem (High);
- CBA Optimal (High);
- Giant Bullfrog (High); and
- All identified plant species of conservation concern (Medium).

An ecological field assessment was carried out to determine the most sensitive areas within the study area. All the areas denoted as *high* must be taken into account when the final layout is designed. The natural and near natural areas on site contain plants and animal species of conservation concern and it is advisable that the infrastructure development should be placed in areas which are already disturbed.

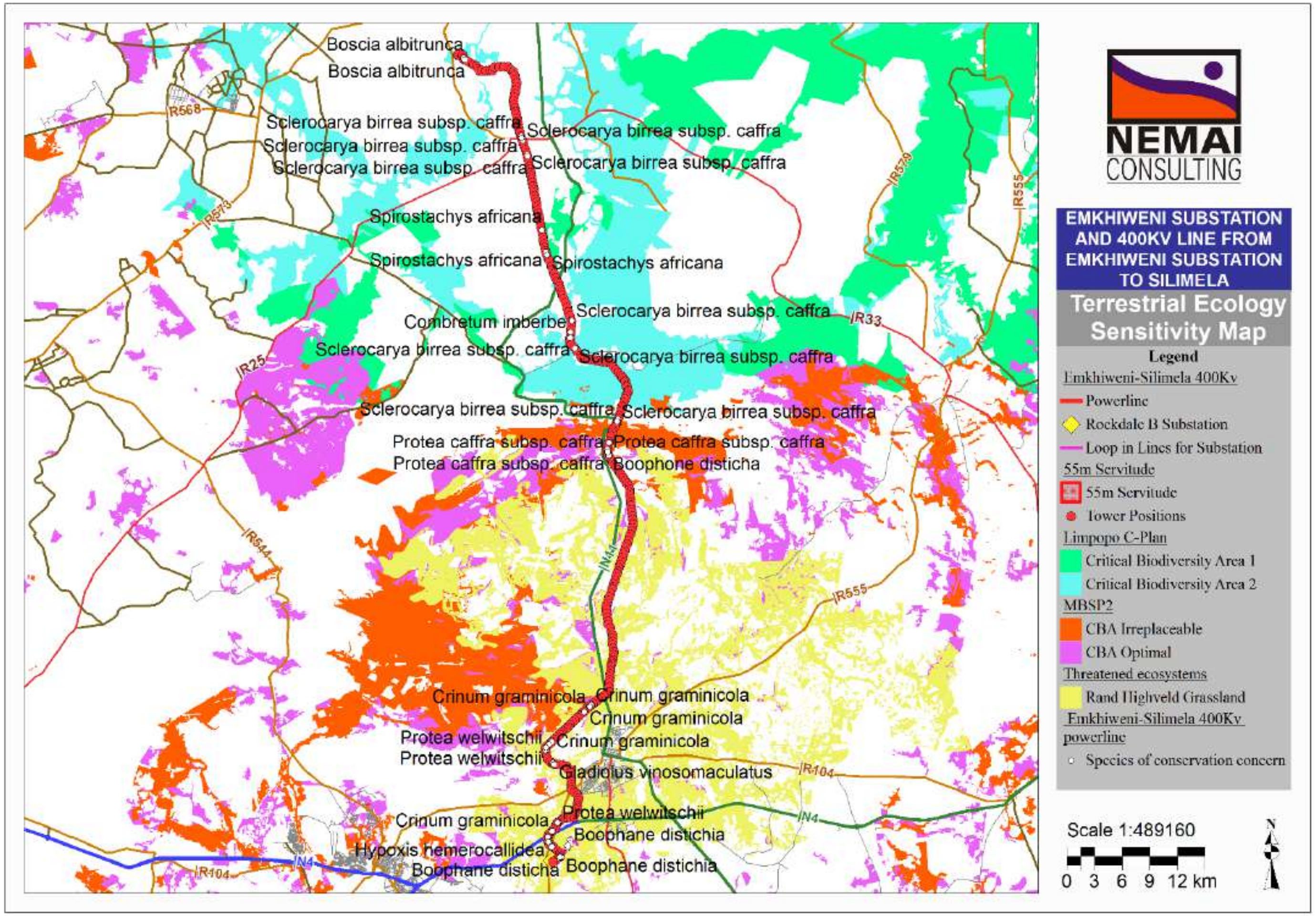

Figure 45. Terrestrial ecological sensitivity map of the study area

12 ENVIRONMENTAL IMPACT ASSESSMENT

12.1 Methodology

All impacts are analysed in the section to follow (**Table 13**) with regard to their nature, extent, magnitude, duration, probability and significance. The following definitions 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.

12.2 Assessment of Environmental Impacts and Suggested Mitigation Measures

Only the environmental issues identified during the appraisal of the receiving environment and potential impacts are assessed (**Table 13**). Mitigation measures are provided to prevent (first priority), reduce or remediate adverse environmental impacts.

The mitigation measures listed in **Table 13** should be supplemented by the Eskom's standard document which deals specifically with vegetation management in Eskom land including servitudes and rights of way.

Table 13. Proposed impacts and the recommended mitigation measures for the Emkhiweni Substation to Silimela Powerline Project

<table>
<tr><th colspan="7">FLORA
PRE-CONSTRUCTION PHASE</th></tr>
<tr><td colspan="3">Potential Impact</td><td colspan="4">Mitigation</td></tr>
<tr><td colspan="3">Loss of plant species of conservation concern and protected trees</td><td colspan="4">• It is recommended that prior to construction, Boophane disticha and Hypoxis hemerocallidea plant species recorded within the project area must be searched and rescued and then following construction activities, they can be re-established within the study area.
• Permits from DAFF and LEDET are required before construction commences in order to cut, disturb, destroy or remove the several protected trees noted within the project area.
• It is recommended that search, rescue and relocation be conducted taking into consideration flora and fauna species of conservation concern. For flora species, the following factors need to be considered (amongst others) as part of this plan:
○ Detailed plan of action (including timeframes, methodology and costs);
○ Site investigations;
○ Consultation with authorities and stakeholders;
○ Marking of species to be relocated;
○ Applying for permits (LEDET/MTPA);
○ Identification of suitable areas for relocation;
○ Aftercare; and
○ Monitoring (including targets and indicators to measure success).</td></tr>
<tr><td>Without Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Positive</td><td>Local</td><td>Medium</td><td>Medium-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Positive</td><td>Local</td><td>Low</td><td>Short-term</td><td>Likely</td><td>1</td></tr>
</table>

FAUNA PRE-CONSTRUCTION & CONSTRUCTION PHASE						
Potential Impact			Mitigation			
Loss of *Protected species* listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Threatened or Protected Species regulations			• In order to protect Southern African Python on or around the site, should this species be encountered or exposed during the construction phase, it should be removed and relocated to natural areas in the vicinity. This remedial action requires the engagement of a herpetologist and or ecologist to oversee the removal of any herpetofauna during the initial ground clearing phase of construction (i.e. initial ground-breaking by earthmoving equipment). However, if this species if found during winter period, when it is in hibernation, then a permit from LEDET/MTPA would be required in order to catch and release it to a safer environment. • The conservation of the Giant Bullfrog and of amphibians in general will be met by the protected area network as well as the designation of priority habitats, *i.e.* pans or quaternary catchments, with associated restrictions on land use. Any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit from MTPA for relocation if avoidance is not possible. A permit is required from MTPA in order catch, handle, collect, transport and/or relocate the species. • River and wetland systems must be spanned and no towers should be placed within the buffer zones dictated by the surface water studies.			
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Regional	High	Short-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Regional	Low	Short-term	Likely	1

FLORA PRE-CONSTRUCTION PHASE						
Potential Impact		Mitigation				
Loss of CBA and ESA habitats		• The most significant way to mitigate the loss of habitat is to limit the construction footprint within the natural habitat areas remaining. Disturbance of vegetation must be limited to the servitude area acquired for the project. • Where possible, sensitive habitats must not be cleared and encouraged to grow. • Disturbance of vegetation must be limited only to areas of construction. • Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site. • All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation. • Prevent contamination of natural areas by any pollution. • Although it is unavoidable that sections of the project infrastructure development will need to traverse areas of potential high sensitivity, the clearing of vegetation must be limited to the servitude area acquired for the project.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA PRE-CONSTRUCTION PHASE						
Potential Impact		Mitigation				
Loss of topsoil		• During site preparation, topsoil and subsoil are to be stripped separately from each other and must be stored separately from 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	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Destruction of indigenous flora during site establishment	• Indigenous plants naturally growing within the project area, but that would be otherwise destroyed during clearing for development purposes, should be incorporated into landscaped areas. • Vegetation clearing should be kept to a minimum, and this should only occur where it is absolutely necessary and the use of a brush-cutter is highly preferable to the use of earth-moving equipment. • Where possible, natural vegetation must not be cleared and encouraged to grow. • Ensure that all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm and this can be achieved through provision of appropriate awareness to all personnel. • Disturbance of vegetation must be limited only to areas of construction. • Prevent contamination of natural vegetation by any pollution. • Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site. • Any fauna (mammal and reptile) that becomes trapped in the trenches or in any construction or operational related activity may not be harmed and must be placed rescued and relocated by an experienced person. • Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent further spread. • No trapping or any other method of catching of any fauna may be performed on site • No storage of building materials or rubbles are allowed in the sensitive areas. • Areas showing dense natural vegetation can be avoided/ spanned in order to reduce vegetation loss. • Avoid translocating stockpiles of topsoil from one place to sensitive areas in order to avoid translocating soil seed banks of alien species. • Rehabilitate all disturbed areas as soon as the construction is completed within the study area					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FAUNA CONSTRUCTION PHASE						
Potential Impact		Mitigation				
Loss and displacement of animals on site		• Training of construction workers to recognise threatened animal species will reduce the probability of fauna being harmed unnecessarily. • The contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase. • All construction and maintenance vehicles must stick to properly demarcated and prepared roads. Off-road driving should be strictly prohibited. • A low speed limit should be enforced on site to reduce wildlife collisions. • No fires should be allowed at the site • No dogs or other domestic pets should be allowed at the site.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Low	Short-term	Likely	1

FLORA AND FAUNA CONSTRUCTION PHASE						
Potential Impact		Mitigation				
Loss of habitat and habitat fragmentation		• The most significant way to mitigate the loss of habitat is to limit the footprint within the natural habitat areas remaining. • No structures should be built outside the area demarcated for the development. • Although it is unavoidable that sections of the project infrastructure development will need to traverse areas of potential high sensitivity, the clearing of vegetation must be limited to the servitude area acquired for the project. • Where possible, the proposed linear infrastructure (powerline) should be aligned with existing linear infrastructure or routed through already transformed/degraded areas. • All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE						
Potential Impact		Mitigation				
Loss of vegetation due to fuel and chemical spills		• Appropriate measures should be implemented in order to prevent potential soil pollution through fuel, oil leaks and spills and then compliance monitored by an appropriate person. • 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. Drip-trays must be placed under vehicles and equipment when not in use.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE						
Potential Impact		Mitigation				
Management of alien invasive species		• Control of alien invasive species and noxious weeds for areas disturbed by the construction activities, in accordance with the requirements of the NEM:BA Alien and Invasive Species Regulations. Eradication method to be approved by the Project Manager. • To prevent unnecessary alien plant infestations, an alien plant monitoring and eradication programme needs to be in place, at least until the disturbed areas have recovered and properly stabilised. • Promote awareness of all personnel.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE						
Potential Impact		Mitigation				
Destruction of alien vegetation		• All alien seedlings and saplings must be removed as they become evident for the duration of construction phase. • Manual / mechanical removal is preferred to chemical control.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Increased soil erosion	• Topsoil should be stored in such a way that does not compromise its plant-support capacity. • Topsoil from the construction activities should be stored for post-construction rehabilitation work and should not be disturbed more than is absolutely necessary. • Protect topsoil in order to avoid erosion loss on steep slopes. • Protect topsoil from contamination by aggregate, cement, concrete, fuels, litter, oils, domestic and wastes. • An ecologically-sound storm water management plan must be implemented during construction and appropriate water diversion systems put in place.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Loss of CBA and ESA habitats	• The most significant way to mitigate the loss of habitat is to limit the construction footprint within the natural habitat areas remaining. Disturbance of vegetation must be limited to the servitude area acquired for the project. • Where possible, sensitive habitats must not be cleared and encouraged to grow. • Disturbance of vegetation must be limited only to areas of construction. • Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site. • All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation. • Prevent contamination of natural areas by any pollution. • Although it is unavoidable that sections of the project infrastructure development will need to traverse areas of potential high sensitivity, the clearing of vegetation must be limited to the servitude area acquired for the project.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA AND FAUNA CONSTRUCTION PHASE						
Potential Impact		Mitigation				
Damage to plant and animal life outside of the powerline servitude		• Any fauna (mammal, reptile and amphibian) that becomes trapped in the trenches or in any construction or operational related activity may not be harmed and must be placed rescued and relocated by an experienced person. • Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent their spread. • No unauthorised vehicles should be allowed to drive through the site during the construction activities. • No trapping or any other method of catching of any animal may be performed on site. • Illegal hunting is prohibited. • No dumping of any form is permitted. • No damage and/or removal/trapping/snaring of indigenous plant or animal species for cooking and other purposes will be allowed. • All areas to be affected by the project will be rehabilitated by indigenous vegetation. • Construction activities should be restricted to the development footprint area and then the compliance in terms of footprint can be monitored by Environmental Control Officer (ECO). • River systems must be spanned and no towers should be placed within the buffer zones dictated by the surface water studies. • Natural areas which could be deemed as no go should be clearly marked.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significanc e
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significanc e
	Negative	Local	Low	Short-term	Likely	1

FAUNA CONSTRUCTION PHASE						
Potential Impact		Mitigation				
Disturbance to animals		• Animals residing within the designated area shall not be unnecessarily disturbed. • During construction, refresher training should be conducted to construction workers with regards to littering and poaching. • The Contractor and his/her employees shall not bring any domestic animals onto site. • Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding snakes.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

FLORA CONSTRUCTION/POST CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Loss of habitat due to construction activities	• All areas to be affected by the project will be rehabilitated after construction and all waste generated by the construction activities will be stored in a temporary demarcated storage area, prior to disposal thereof at a licensed registered landfill site. • As much vegetation growth as possible should be promoted within the servitude in order to protect soils and to reduce the percentage of the surface area which is left as bare ground. In this regard special mention is made of the need to use indigenous vegetation species as the first choice during landscaping. In terms of the percentage of coverage required during rehab and also the grass mix to be used for rehab, the EMPr will be consulted for guidance. However, the plant material to be used for rehabilitation should be similar to what is found in the surrounding area.					
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Low	Short-term	Likely	1

FAUNA OPERATIONAL PHASE						
Potential Impact		Mitigation				
Disturbance of faunal species		• The disturbance of fauna should be minimized. • Animals residing within the designated area shall not be unnecessarily disturbed.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Positive	Local	Low	Short-term	Likely	1

FLORA OPERATIONAL PHASE						
Potential Impact		Mitigation				
Destruction of alien vegetation		• All alien seedlings and saplings must be removed as they become evident for the duration of operational phase. • Manual / mechanical removal is preferred to chemical control.				
Without Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Nature	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

12.3 Cumulative Impacts

Cumulative impacts can be identified by combining the potential environmental implications of the proposed project with the impacts of projects and activities that have occurred in the past, are currently occurring, or are proposed in the future within the project area. The following cumulative impacts are anticipated:

- Loss of sensitive habitats;
- Encroachment of alien vegetation and
- Loss of plant species of conservation concern and protected trees.

Cumulative Impacts						
Potential Impact:	Loss of sensitive habitats					
Proposed Mitigation:	• Indigenous plants naturally growing within the project area, but that would be otherwise destroyed during clearing for development purposes, should be incorporated into landscaped areas. • Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site. • No structures should be built outside the area demarcated for the development. • Although it is unavoidable that sections of the project infrastructure development will need to traverse areas of potential high sensitivity, the clearing of vegetation must be limited to the servitude area acquired for the project. • Appropriate measures should be implemented in order to prevent potential soil pollution through fuel and oil leaks and spills and then compliance monitored by an appropriate person. • All stockpiles, construction vehicles, equipment and machinery should only be situated within the servitude acquired for the project. • Where possible, linear infrastructure development should be aligned adjacent to the existing infrastructure or routed through already transformed/degraded areas.					
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Without Mitigation	-	Local	Medium	Long Term	Likely	2
With Mitigation	-	Local	Low	Long Term	Unlikely	1
Potential Impact:	Encroachment of alien vegetation					
Proposed Mitigation:	• Control of alien invasive species and noxious weeds for areas disturbed by the construction activities, in accordance with the requirements of the NEM:BA Alien and Invasive Species Regulations. Eradication method to be approved by the Project Manager. • To prevent unnecessary alien plant infestations, an alien plant monitoring and eradication programme needs to be in place, at least until the disturbed areas have recovered and properly stabilised. • Promote awareness of all personnel.					
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Without Mitigation	-	Local	Medium	Short	Moderate	2
With Mitigation	-	Local	Low	Short	Unlikely	1
Potential Impact:	Loss of plant species of conservation concern and protected trees.					
Proposed Mitigation:	• It is recommended that prior to construction, *Boophane disticha* and *Hypoxis hemerocallidea* plant species recorded within the study area must be searched and rescued and then following construction activities, they can be re-established within the servitude. • Permits from DAFF and LEDET are required before construction commences in order to cut, disturb, destroy or remove the several protected trees noted within the project area. • It is recommended that search, rescue and relocation be conducted taking into consideration flora and fauna species of conservation concern.					
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Without Mitigation	-	Local	Medium	Short	Likely	2
With Mitigation	-	Local	Low	Short	Unlikely	1

13 CONCLUSION AND RECOMMENDATIONS

The Emkhiweni Substation and Emkhiweni-Silimela 400kV powerline falls within the Grassland and Savanna biomes. The study area falls within the following vegetation types: Central Sandy Bushveld (Savanna biome), Loskop Mountain Bushveld (Savanna biome), Loskop Thornveld (Savanna biome) and Rand Highveld Grassland (Grassland biome). The project area falls within the *Vulnerable* Rand Highveld Grassland terrestrial threatened ecosystem.

During the field survey, no threatened plant species were observed within the project area; however, only two species of conservation concern (Orange Listed Plants) (listed as *Declining)* were found, namely *Hypoxis hemerocallidea* (Star flower/African potato) and *Boophane disticha* (Century plant).

In terms of the National Forests Act (Act No. 84 of 1998), certain tree species can be identified and declared as protected. Protected trees occurring in the study area are *Boscia albitrunca* (Shepherd's tree)*, Combretum imberbe* (Leadwood) and *Sclerocarya birrea* subsp*. caffra* (Marula)*.* According to section 51(1) of the National Forests Act (Act No. 84 of 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, except under a license granted by the Minister of DAFF. There is only one plant species which falls within "*protected plants*" in terms of LEMA (Act No. 7 of 2003) Schedule 12, namely *Spirostachys africana* (Tamboti). The following plant species are listed as "protected plants" in terms of Schedule 11 (Section 69 (1a)) of Mpumalanga Nature Conservation Act (No. 10 of 1998); all *Crinum* spp, all species of family Proteaceae, all *Gladioli* species and Whole Orchidaceae family (*Habenaria* species). Provincially protected plant species such as namely *Boophone disticha, Crinum graminicola, Hypoxis hemerocallidea, Gladiolus vinosomaculatus*, *Protea welwitschii* and *Habenaria epipactidea* and *Protea caffra* were recorded within the study area. A Permit from the LEDET and MTPA is required before construction commences in order to cut, disturb, destroy or remove these trees noted within the project area.

The major concerns on site are alien invasives, weeds and potential invasives. All areas affected by construction should be rehabilitated upon completion of the construction phase of the development to its pre-construction state where possible, in agreement with the ECO. Mitigation measures provided will ensure that any available ecological linkages between sensitive areas are not affected negatively. Mitigation measures included within this report are feasible and will be easy to achieve. Several of the mitigation measures included here have been implemented successfully on several different construction sites.

Historically, the study area could have provided habitat for a diverse population of larger mammal species, but the agricultural activities within the study area have transformed the majority of the habitats and due to these anthropogenic disturbances, it is likely that only the more common and smaller mammal species will be observed, which show more adaptation. However, natural vegetation still exist and these areas are suitable for survival of the mammals species recorded within the project area. The agricultural fields were largely devoid of mammal species; however Meerkat dens were present on the edges of agricultural fields. Domestic animals such as cattle, sheep, donkeys and horses were noted in abundance within the project area. Significantly the bushveld, riparian vegetation and natural grasslands between agricultural fields are utilised as a movement and linkage corridor within the study area. These areas also provide ideal foraging and breeding habitat for a number of mammal species. Grassland habitats are utilised by a range of faunal species, particularly if there is some form of topographical change within the grassland. Mammal species such as Common Impala, Black Impala, Kudu, Nyala, Blesbok, Black-backed Jackal, Giraffe and Zebra were seen within the project area. Only one Red Data mammal species was visually seen on site, namely Sable Antelope, whereas information gathered from the land owners indicated that a mammal species such as Serval has been seen within the study area. Mammal species such as Waterbuck, Sable antelope, Giraffe and Nyala are provincially protected under Schedule 2, protected game (Section 4 (1b) of Mpumalanga Nature Conservation Act (No. 10 of 1998) and Schedule 3 of LEMA (Act No. 7 of 2003).

The main potential impact of the project on reptile species is probable to be habitat loss or degradation. Nevertheless, in the long-term, effects on reptile species are probable to be comparatively low as the extent of habitat loss would be low. Habitat destruction should be limited to the absolute minimum throughout the survey area. In order to protect Southern African Python on site, should this species be encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. This remedial action requires the engagement of a herpetologist and or ecologist to oversee the removal of any herpetofauna during the initial ground clearing phase of construction (*i.e.* initial ground-breaking by earthmoving equipment). However, if this species if found during winter period, when it is in hibernation, then a Permit from LEDET/MTPA would be required in order to catch and release it to a safer environment.

The state of the rivers (especially the Olifants River) within the project area offer suitable habitat for the Nile Crocodiles to occur on site. In order to mitigate the impacts of the project development within the habitats of this species, it is recommended that rivers and wetland systems must be spanned and no towers should be placed within the buffer zones dictated by the surface water studies.

One of the frog species of conservation concern recorded within the project area was the Giant bullfrog (*Pyxicephalus adspersus*). This species was recorded within human habitation, within temporary pans (due to heavy rains), which are potential breeding places for giant bullfrogs. This frog species is known to breed in seasonal shallow grassy pans, vleis and other rain filled depressions in open flat areas of grassland or savanna. According to Schedule 2 of the Mpumalanga Nature Conservation Act (No 10 of 1998), NEM:BA *Threatened or Protected Species* and Schedule 3 of LEMA (Act No. 7 of 2003), this species is listed as *protected*. The conservation of the Giant Bullfrog and of amphibians in general will be met by the protected area network as well as the designation of priority habitats, *i.e.* pans or quaternary catchments, with associated restrictions on land use. Any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. A Permit is required from LEDET/MTPA in order catch, handle, collect, transport and/or relocate the species.

Biodiversity offsets are not deemed to be necessary, however, it is recommended that a walk-down survey be undertaken by a suitably qualified ECO prior to the start of the construction activities in the areas which were not accessible during the Terrestrial Ecological walk-down field surveys, in order to survey those specific areas (Loskop Suid 53 and Loskop Noord 12) in detail for any plant SCC and protected trees/plant species. The walk-down survey should preferably be undertaken during summer season in order to have a higher probability of detecting species of conservation concern. Any plant SCC or protected plant species that fall within the construction footprint must be search-and-rescued, and protected trees species should be conserved as far as possible. In order to conserve the faunal species community structures within the region, habitat destruction should be limited to an absolute minimum as intact habitat would result in higher faunal and floral species diversity. It is therefore critical that operations are limited to the required footprint only. During the field surveys, it was found that the impacts of the powerline on terrestrial ecosystems can be mitigated to a satisfactory level and as such, the development is deemed acceptable from the ecological perspective and as such should not be prevented from proceeding based on the ecological considerations. Once the proposed development has been constructed, rehabilitation process needs to take place and should ensure that alien plant emergence and erosion do not occur.

14 REFERENCES

ANIMAL DEMOGRAPHY UNIT (2019). **FrogMAP Virtual Museum**. Accessed at http://vmus.adu.org.za/?vm=FrogMAP on 2019-02-07

ANIMAL DEMOGRAPHY UNIT (2018). **MammalMAP Virtual Museum**. Accessed at http://vmus.adu.org.za/?vm=MammalMAP on 2019-02-07.

ANIMAL DEMOGRAPHY UNIT (2018). **ReptileMAP Virtual Museum**. Accessed at http://vmus.adu.org.za/?vm=ReptileMAP on 2019-02-07.

BATES, M.F., BRANCH, W.R., BAUER, A.M., BURGER, M., MARAIS, J., ALEXANDER, G.J., DE VILLIERS, M.S., (2014). **Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland**. South African National Biodiversity Institute, Pretoria.

BLAUSTEIN, A. R. (2003). **Amphibian Population Declines.** Encyclopedia.com. [Online] 2003. [Cited: 05 February 2019.] http://www.encyclopedia.com/doc/1G2-3409400018.html.

BRANCH, W.R. (1988). **South African Red Data Book - Reptiles and Amphibians**. South African National Scientific Programmes Report No. 151. CSIR, Pretoria.

BRANCH, B. (2001). **Snakes and Other Reptiles of Southern Africa**. Struik Publishers, South Africa.

BROADLEY, D.G., (1990), **FitzSimons' snakes of Southern Africa**, Jonathan Ball & Ad. Donker, Parklands.

BROMILOW, C. (2010). **Problem plants of South Africa**. Briza, Pretoria.

CARRUTHERS, V. (2001). **Frogs and frogging in southern Africa**. Struik Publishers, Cape Town.

CHILD, M.F, ROXBURGH, L, DO LINH SAN, E, RAIMONDO, D, DAVIES-MOSTERT HT. (2017). **Mammal Red List 2016: Introduction and Methodology**. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa

COOK, C.L. (2007). **Proposed Eikenhof cemetery situated on portions of the Farm Bronkhorstfontein 329-IQ**. Preliminary faunal survey/habitat assessment.

DESMET, P.G., HOLNESS, S., SKOWNO, A. & EGAN, V.T., (2013). Limpopo conservation plan, v.2: Technical report.

DU PREEZ, L.H. & COOK, C. (2004). **Genus *Pyxicephalus Tschudi*, 1838 (Family Ranidae).** In: **Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland** (L.R. Minter, M. Burger, J.A. Harrison, H.H. Braack, P.J. Bishop, & D. Kloepfer, eds) pp 298-303. SI/MAB Series #9, Smithsonian Institution, Washington DC, USA.

DU PREEZ, L.H. & CARRUTHERS, V.C. (2009). **Complete Guide to the Frogs of Southern Africa.** Random House Struik. 488pp.

DRIVER, A., MAZE, K., LOMBARD A.T., NEL, J., ROUGET, M., TURPIE, J.K., COWLING, R.M., DESMET, P., GOODMAN, P., HARRIS, J., JONAS, Z., REYERS, B., SINK, K. & STRAUSS, T. (2004). **South African National Spatial Biodiversity Assessment 2004**: Summary Report. South African National Biodiversity Institute, Pretoria.

FRIEDMANN, Y. & DALY, B, (EDITORS) (2004). **Red Data Book of the mammals of South Africa: a conservation assessment: CBSG southern Africa, Conservation Breeding Specialist Group (SSC/IUCN)**. Endangered Wildlife Trust, South Africa.

HENDERSON, L. (2001). **Alien weeds and invasive plants**. ARC, Pretoria.

JACOBSEN, N. (2005). **Remarkable Reptiles of South Africa**. Briza Publications. Pretoria. South Africa.

LOW, A.B & REBELO, A.G. (1996). **Vegetation of South Africa, Lesotho and Swaziland**. Department of Environmental Affairs and Tourism, Pretoria.

MANNING, J. (2009). **Field guide to the wild flowers of South Africa**. Struik, Cape Town.

MINTER, L.R., BURGER, M., HARRISON, J.A., BRAACK, H.H., BISHOP, P.J. AND KNOEPFER, D. (2004). **Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland**. SI/MAB Series No. 9, Washington, D.C.

MTPA (2013). **Mpumalanga Biodiversity Sector Plan Handbook**. Complied by Lötter, MC, Cadman, MJ and Lechmere-Oertel, RG. Mpumalanga Tourism and Parks Agency, Mbombela (Nelspruit).

MUCINA, L. & RUTHERFORD, M.C. (2006). **The vegetation of South Africa, Lesotho and Swaziland**. *Strelitzia* 19. South African Biodiversity Institute, Pretoria.

O'CONNOR, T.G. and G.J. BREDENKAMP. (1997). **Grassland**. In Cowling, R.M., D.M. Richardson, and S.M. Pierce, editors. (eds). **Vegetation of Southern Africa.** pp. 215–257.Cambridge University Press. London.

POOLEY, E.S. (1998). **A Field Guide to Wildflowers Kwazulu-Natal and the eastern region**. Natal Flora Publishers Trust: Durban, South Africa.

RAIMONDO, D., VON STADEN, L., FODEN, W., VICTOR, J.E., HELME, N.A., TURNER, R.C., KAMUNDI, D.A. & MANYAMA, P.A. (eds) (2009). **Red List of South African plants**. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria.

SIEGFRIED. W.R. (1989). **Preservation of species in Southern African nature reserves.** In: Biotic diversity in southern Africa. Concepts and conservation, (ed.) B.J. Huntley, pp. 186-201.

SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE (2009). **Draft Threatened Ecosystems in South Africa: Descriptions and Maps**. Department of Environmental Affairs and Tourism. Pretoria.

SKINNER, J.D. & CHIMIMBA, C. T. (2005). **The Mammals of the Southern African Subregion**. Cambridge University Press, Cambridge.

SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE (2012). **Vegetation Map of South Africa, Lesotho and Swaziland [vector geospatial dataset] 2012**. Available from the Biodiversity GIS website, downloaded on 08 February 2019.

STUART, C. & STUART, T. (1988). **Field Guide to the Mammals of Southern Africa**. Struik Publishers, Cape Town.

VAN OUDSHOORN, F. (1999). **Guide to grasses of southern Africa**. Briza Publications, Pretoria.

VAN WYK, B., VAN OUDTSHOORN, B. AND GERICKE, N. (1997). **Medicinal plants of South Africa**. Briza Publications, Pretoria.

VAN WYK, J.C.P., KOK, D.J. & DU PREEZ L.H. (1992). **Growth and behaviour of tadpoles and juveniles of the African Bullfrog, *Pyxicephalus adspersus*** Tschudi 1838. J Herp. Assoc. Afr. 40:56.

WADDLE, J. H. (2006). **Use of amphibians as ecosystem indicator species**. Doctor of philosophy dissertation, University of Florida.

WAKE, D.B. (1991). **Declining amphibian populations**. Science 253:860.

WILLIAMS, V.L., RAIMONDO, D., BRUETON, V.J., CROUCH, N.R., CUNNINGHAM, A.B., SCOTT-SHAW, C.R., LÖTTER, M. & NGWENYA, A.M. (2016). ***Boophone disticha*** (L.f.) Herb. National Assessment: Red List of South African Plants version 2017.1. Accessed on 2019/03/04.

WYMAN, R.I. (1990). **What's happening to the amphibians?** Conservation Biology 4:350-352.

Appendix 6B: Avifaunal Impact Assessment

EMKHIWENI SUBSTATION & 400KV LINE FROM EMKHIWENI SUBSTATION TO SILIMELA SUBSTATION

AVIFAUNAL SPECIALIST STUDY

February 2019

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EXECUTIVE SUMMARY

Nemai Consulting was appointed by Eskom in 2009 to undertake the EIA as part of the 2006 EIA Regulations for the following projects:

1. Construction of the Rockdale B Substation (now referred to as Emkhiweni Substation), with 2x500MVA 400/132kV transformers; and
2. Construction of the Rockdale B to Wolwekraal 400kV line (now referred to as the Emkhiweni Substation to Silimela 400kV line).

The projects were authorised in May 2011 (Emkhiweni Substation) and July 2011 (Emkhiweni-Silimela 400kV line). Eskom has decided to proceed with the construction of Emkhiweni-Silimela 400kV line (which is approximately 80kms long) however the previous Record of Decision (RoD) has lapsed. Therefore Nemai Consulting are undertaking a new application for Environmental Authorisation (EA) as part of the 2014 EIA Regulations, as amended (07 April 2017).

The proposed activity entails the construction of a 400kV power line from the Middelburg area in the south to the Marble Hall/Wolwekraal area in the north. The proposed line originates at the Silimela Substation, which is situated approximately 13km to the southeast of Marble Hall (Limpopo Province) on the Farm Loskop Noord No. 12 JS and runs south-eastwards. The line terminates at the proposed Emkhiweni Substation within Mpumalanga. The proposed development falls within the Steve Tshwete Local Municipality (LM), Elias Motsoaledi LM and Ephraim Mogale LM.

In January 2019 Nemai Consulting appointed WildSkies Ecological Services (Pty) Ltd to conduct the avifaunal impact assessment study for this project. We conducted a brief site visit in January 2019 to examine the study area.

A project of this nature has the potential to impact on avifauna through: habitat destruction and disturbance of birds (both during construction predominantly); and collision of birds with the overhead cables during the operational phase. Birds are also able to cause electrical faults on the power line, through mechanisms explained in this report.

The study area is home to a broad diversity of bird species, up to 442 bird species having been recorded by the first and second Southern African Bird Atlas Projects (Harrison *et al,* 1997; www.sabap2.adu.org.za) in the broader area within which the site is located. A fair number of these (30 species) are regionally Red

Listed species (Taylor *et al*, 2015), and several of these will be at risk of interaction with the proposed power line. The likelihood and implication of these interactions has been assessed by this study.

We draw the following conclusions for this proposed project:

- Collision of birds with the overhead power line (specifically the earth wires) is likely to occur if no mitigation is implemented. Since some of the species at risk are regionally and globally Red Listed, this is an important impact to mitigate.
- Habitat destruction will occur at each tower footprint and along the construction/servitude road and on substation site. Most of this habitat destruction is unavoidable. However certain control measures can be put in place to keep this to a minimum.
- Disturbance of birds could occur during construction but is only really significant if Red Listed birds are disturbed, particularly whilst breeding. We have not found any such breeding sites.
- Nesting of various bird species on the towers is a possible impact. Although this appears to be positive for birds at face value, it is in fact more complex as it places birds at collision risk and sometimes requires management by Eskom.
- Electrical faulting is a possibility as a result of large birds perching on towers. This is an impact on the business not the birds as the birds are seldom harmed.

We recommend the following mitigation for the above identified impacts:

1. The sections of line identified by this study (see Figure 7) must be installed with a suitable anti bird collision marking device as follows:
    - Devices must be installed as soon as the earth wire is strung as the risk begins immediately
    - Devices must be installed for the full length of each span, not only the middle 60% as previously believed
    - Light and dark colour devices must be alternated to ensure contrast against dark and light backgrounds respectively
    - These marking devices must be maintained in working order for the full life span of the power line
    - The effective spacing between devices must be no more than 10m. This means that on each earth wire devices can be 20m apart if they are staggered between the two earth wires
    - The most suitable available Eskom approved device available at the time of construction must be used

2. Destruction and alteration of any natural habitat must be kept to an absolute minimum
3. Staff, vehicles and machinery movement must be strictly controlled at all times and restricted to designated routes and turning and batching areas
4. No vehicles or machinery are to cross wetlands or streams
5. Construction camps, offices and labour housing must be situated in areas where no additional impact to the natural environment will result
6. During the operational phase of the substation and power line staff must keep to recognised roads and access routes
7. The Environmental Control Officer and Contractors Environmental Officer must be made aware of the need to identify any such sites that may arise during construction.
8. Construction workers must also be trained in awareness of priority species in the event that a nest is discovered.
9. Should an active nest of a priority species be discovered in or near the servitude, a suitable avifaunal specialist should be notified and asked for case specific recommendations on how to manage the situation.
10. Any nests identified on the towers (or in substation) once operational should be managed strictly according to Eskom Transmission Nest Management Guidelines, and national and provincial legislation.
11. Any nest management should be done under the supervision of a suitable avifaunal specialist.
12. On these identified towers Bird Guards should be fitted in accordance with Eskom Transmission guidelines.

Provided that the above recommendations are accepted we believe that the project can proceed with acceptable risk to avifauna.

Contents

1. INTRODUCTION & BACKGROUND

Nemai Consulting was appointed by Eskom in 2009 to undertake the EIA as part of the 2006 EIA Regulations for the following projects:

1. Construction of the Rockdale B Substation (now referred to as Emkhiweni Substation), with 2x500MVA 400/132kV transformers; and
2. Construction of the Rockdale B to Wolwekraal 400kV line (now referred to as the Emkhiweni Substation to Silimela 400kV line).

The projects were authorised in May 2011 (Emkhiweni Substation) and July 2011 (Emkhiweni-Silimela 400kV line). Eskom has decided to proceed with the construction of Emkhiweni-Silimela 400kV line (which is approximately 80kms long) however the previous Record of Decision (RoD) has lapsed. Therefore Nemai Consulting are undertaking a new application for Environmental Authorisation (EA) as part of the 2014 EIA Regulations, as amended (07 April 2017).

The proposed activity entails the construction of a 400kV power line from the Middelburg area in the south to the Marble Hall/Wolwekraal area in the north. The proposed line originates at the Silimela Substation, which is situated approximately 13km to the southeast of Marble Hall (Limpopo Province) on the Farm Loskop Noord No. 12 JS and runs south-eastwards. The line terminates at the proposed Emkhiweni Substation within Mpumalanga. The proposed development falls within the Steve Tshwete Local Municipality (LM), Elias Motsoaledi LM and Ephraim Mogale LM.

In January 2019 Nemai Consulting appointed WildSkies Ecological Services (Pty) Ltd to conduct the avifaunal impact assessment study for this project. We conducted a brief site visit in January 2019 to examine the study area.

A project of this nature has the potential to impact on avifauna through: habitat destruction and disturbance of birds (both during construction predominantly); and collision of birds with the overhead cables during the operational phase. Birds are also able to cause electrical faults on the power line, through mechanisms explained in this report.

The study area is home to a broad diversity of bird species, up to 442 bird species having been recorded by the first and second Southern African Bird Atlas Projects (Harrison *et al*, 1997; www.sabap2.adu.org.za) in the broader area within which the site is located. A fair number of these (30 species) are regionally Red

Listed species (Taylor *et al*, 2015), and several of these will be at risk of interaction with the proposed power line. The likelihood and implication of these interactions has been assessed by this study.

1.1. Terms of reference

The following terms of reference were utilized for this study:

- Determine ecological status of the receiving environment from an avifauna perspective, including the identification of endangered or protected avifauna species.
- A complete potential avifaunal list must be provided.
- The conservation status of each species listed must be determined.
- Prepare an avifauna sensitivity map, based on the findings of the study.
- Assess impacts to avifauna population as a result of the project.
- Provide suitable mitigation measures to protect avifauna during project life-cycle.
- Make recommendations on preferred options from an avifauna perspective.
- Recommend monitoring programme and indicators for project life-cycle, where findings from survey would serve as baseline data.
- Comply with specific requirements and guidelines of mandated authorities.

1.2 Description of proposed project

The proposed project consists of:

- A new substation called Emkhiweni with 2x500MVA 400/132kV transformers
- Construction of the new Emkhiweni to Silimela 400kV power line
- Loop in lines for substation

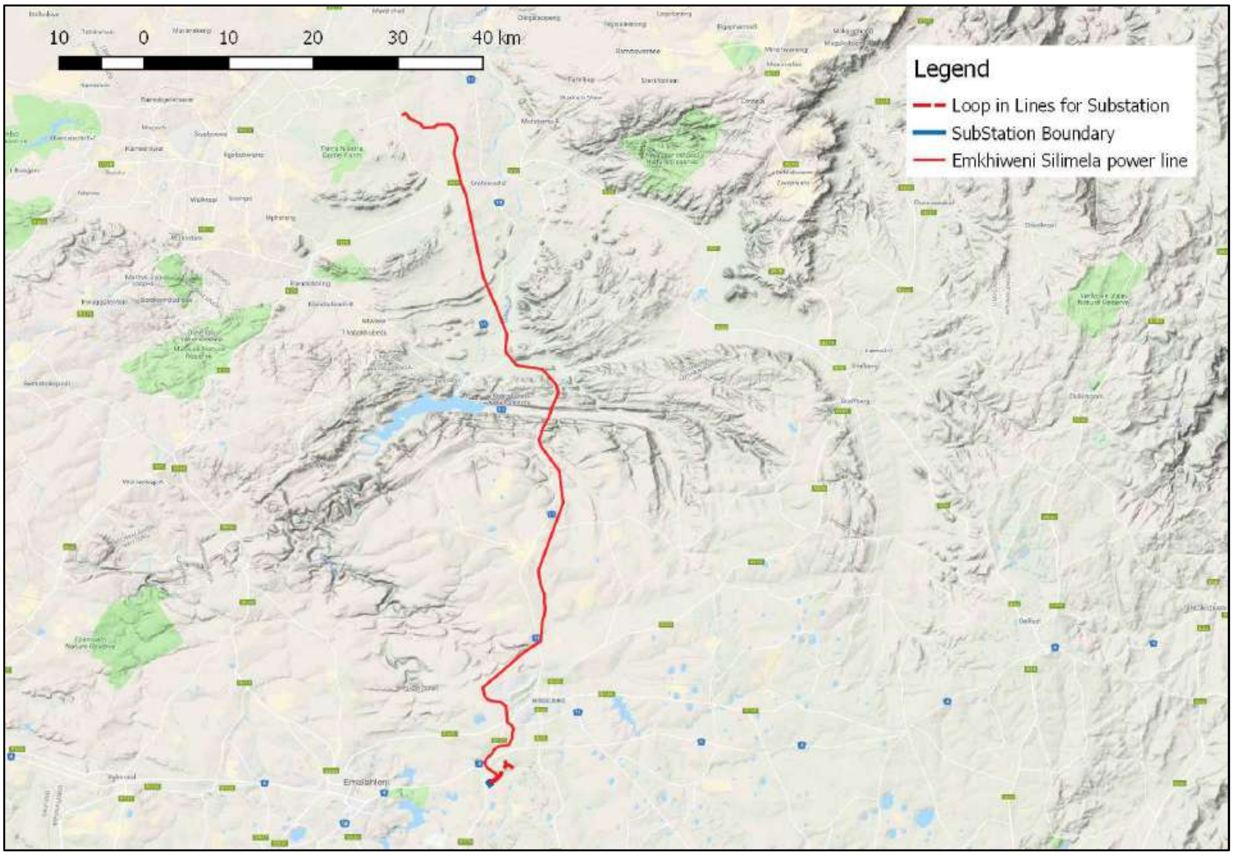

Figure 1. The general study area and proposed route for the "Emkhiweni Substation & 400kV Line from Emkhiweni Substation to Silimela Substation" site.

2. POTENTIAL IMPACTS OF PROPOSED POWER LINE ON BIRDS

2.1. Bird collision with conductors and earth wires

Collision with power lines is a well-known conservation problem for many birds and for some species it can be a significant source of mortality (Bevanger 1998, Erickson *et al.* 2005, Drewitt & Langston 2008, Shaw *et al.* 2010, Jenkins *et al.* 2011). The reasons for collisions are complex, with each case involving a variety of biological, topographical, meteorological and technical factors (Bevanger 1994). Although all birds have the potential to be affected by collisions, those most heavily impacted are generally large, flocking species which fly often, with waterfowl, gamebirds, cranes, bustards and storks usually among the most frequently reported casualties (Bevanger 1998, Janss 2000, Jenkins *et al.* 2010). The large body size of such species mean that they have limited maneuverability in the air and are less able to take necessary evasive action to avoid colliding with power lines (Bevanger 1998).

In South Africa, incidentally discovered mortality incidents reported by Eskom staff, conservationists and the general public are collated in the Central Incident Register, which is maintained by the Eskom-Endangered Wildlife Trust Strategic Partnership (Eskom-EWT). These data, together with those from more systematic power line surveys near De Aar (Anderson 2002), in the Overberg (Shaw *et al.* 2010) and across the Karoo (Jenkins *et al.* 2011, Shaw 2013) highlight the high levels of large terrestrial bird mortality caused by existing power lines in this country. Particularly affected are Red-listed birds including cranes, bustards, storks, Secretarybirds *Sagittarius serpentarius*, flamingos and vultures, which are generally long-lived and slow to reproduce (Shaw 2013). These species have not evolved to cope with high adult mortality, with the result that consistent mortality in this age group over an extended period could seriously affect a population's ability to sustain itself in the long or even medium term. The cumulative effects of collisions together with other anthropogenic threats to these species (e.g. habitat destruction, disturbance) are unknown over the long term.

Mitigating bird collisions with power lines typically involves the installation of line marking devices on the cables in order to make them more visible to approaching birds. Worldwide, a variety of marking devices are used, but very few have been adequately field-tested (Jenkins *et al.* 2010). Great uncertainty remains about which are best, as they vary enormously in effectiveness between species and in different conditions (van Rooyen & Ledger 1999, Anderson 2002). Generally though, marking seems to be fairly effective, with a recent meta-analysis showing a 78% decrease in mortality rates on marked lines (Barrientos *et al.* 2011).

The reason for this apparently low efficacy is likely to be a result of the visual capacity of bustards. A recent South African study on Kori Bustards *Ardeotis kori*, Blue Cranes *Anthropoides paradiseus* and White Storks *Ciconia ciconia* demonstrated that these birds have a narrow field of frontal vision, so when in flight, head movements in the vertical plane (pitching the head to look downwards, perhaps to look for other birds or foraging patches) will render the bird blind in the direction of travel and they will not see the power line at all (Martin & Shaw 2010). Similar visual constraints were subsequently found in *Gyps* vultures, including White-backed Vultures *Gyps africanus* (Martin *et al.* 2012). Development of additional mitigation to draw the bird's attention to the marked line (which must still be marked, because the bird will see the markers if it is looking at the line) is a priority for future research for these groups of birds.

While collisions generally occur in hot-spots (i.e. many collisions, sometimes of multiple species in small areas) and are not spread evenly across the landscape, the factors describing these locations are still very difficult to understand. Landscape level GIS studies on Blue Cranes and Ludwig's Bustard in South Africa have failed to find useful contributory factors (Shaw *et al.* 2010, Shaw 2013). Some locations are clearly high risk for resident birds with predictable movement patterns, such as lines in close proximity to roosting dams for cranes.

2.2. Habitat destruction

During the construction phase of power lines and substations, a certain amount of habitat destruction and alteration takes place on the site. This happens with the construction of access roads, the clearing of the site itself and any associated infrastructure. The servitude also has to be maintained free of any natural vegetation, amongst other reasons to minimize the risk of fire. The destruction or alteration of natural habitat has an impact on birds breeding, foraging and roosting in close proximity to the site.

2.3. Disturbance

Similarly, the above mentioned construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. The potential exists for the impact of disturbance to influence a greater area than the site itself. This site is relatively un-disturbed by other infrastructure in parts, particularly in the protected areas. There is a strong likelihood of sensitive species such as large eagles and storks nesting in the vicinity of the proposed power line alignments. This means that the impact of disturbance could be significant for this project.

2.4. Electrocution of birds on tower structures

Electrocution refers to the scenario whereby a bird bridges the gap between two phases or a phase and an earthed component thereby causing an electrical short circuit. The larger bird species such as vultures and eagles are particularly vulnerable to this impact, as obviously the larger the wingspan and other dimensions of a bird, the greater the likelihood of it being able to bridge the gap between hardware. On 400kV transmission lines such the proposed power line the impact of electrocutions is not possible due to the large clearances between phases and/or phases and earthed structures. This impact is not discussed further in this report.

2.5. Nesting on power lines

Raptors, large eagles, crows, Hadeda Ibises *Bostrychia hagedash* and Egyptian Geese *Alopochen aegyptiaca* have learnt to nest on transmission towers, and this has allowed them to breed in areas of the country where breeding would not previously have been possible due to limited nesting substrates (van Rooyen & Ledger 1999, de Goede & Jenkins 2001). This has probably resulted in a range expansion for some of these species, and large eagles such as Tawny *Aquila rapax*, Martial *Polemaetus bellicosus* and Verreaux's *Aquila verreauxii* are now quite common inhabitants of transmission towers in the Karoo (e.g. de Goede & Jenkins 2001). Cape Vultures *Gyps coprotheres* and White-backed Vultures have also taken to roosting on power lines in certain areas in large numbers, while Lappet-faced Vultures *Torgos tracheliotus* are also known to use power lines as roosts, especially in areas where large trees are scarce (J. Smallie pers. obs.). At face value this appears a positive contribution that power lines can make to these species. However the situation is more complex in that nesting on the tower places the adults and young at much greater risk of collision with the overhead cables than would otherwise be the case. Due to the electrical faulting that these birds can cause on transmission towers, Eskom also sometimes wishes to remove nests in order to manage the risk of faulting, with negative effects for the birds if not correctly handled.

The actual nesting of birds on the proposed new power line only becomes an issue if Eskom need to intervene with nesting and breeding activities. It is essential that all activities related to raptor nests be subject to Eskom Transmissions nest management guidelines, and to the relevant provincial and national legislation.

2.6. Electrical faulting due to birds

Birds are able to cause electrical faults on transmission power lines through their faeces and/or nest material. Large birds sitting above live conductors can cause flashovers when they produce long continuous 'streamers' of excrement which bridges the critical air gap, or through buildup of faeces on insulators to the point where the insulation is compromised and a fault occurs. Material used to build nests on towers can also intrude into the air gap and cause short circuits.

3. METHODOLOGY

3.1. General methods

In predicting the interactions between the proposed development and birds, a combination of science, field experience and common sense is required. More specifically the methodology used to predict impacts in the current study was as follows:

- The various avifaunal data sets listed below and the micro habitats within the study area were examined to determine the likelihood of these relevant species occurring on or near the site, and the importance of the study area for these species.
- Sensitive areas within the proposed site, where the above impacts are likely to occur, were identified using field work, various GIS (Geographic Information System) layers and Google Earth.
- The potential impacts of the proposed facility on these above species and habitats were described and evaluated
- Recommendations were made for the management and mitigation of impacts.

In simple terms, this study assesses which bird species could occur on site, how important they are, how important the site is for them, how the project will affect them, and how to mitigate these effects.

3.2. Field methods

The field investigation followed the following methods:

1. General sampling of avifauna
    a. This was achieved through driving and walking as much as possible of the study area. All birds were recorded, and the landscape was periodically scanned with 10x25 binoculars for larger birds and raptors. All bird species were recorded for the general bird list (Appendix 4), but particular attention was given to large terrestrial, raptor and Red Listed species.
2. Sensitive species breeding survey
    a. During the above described time spent on site, all possible nesting substrate for raptors was surveyed using the same equipment as above. These areas included the stands of Eucalyptus trees, and the existing power line infrastructure.
3. Assessment of micro habitats
    a. During field work all available different micro habitats available to avifauna, and any sensitive avifaunal features were photographed, mapped and described.

4. Assessment of alternative power line routes
    a. Whilst in the field any relevant factors to determining the optimal route for the proposed power line were investigated and noted.

3.3. Information sources used

The following information sources were consulted in order to conduct this study:

- Bird distribution data of the first and second Southern African Bird Atlas Project (Harrison *et al*, 1997; www.sabap2.adu.org.za) was obtained for the broader area within which the study area is located, as a means to ascertain which species occur within the study area.
- The regional conservation status of all bird species occurring in the aforementioned quarter degree squares was determined with the use of The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al*, 2015).
- The global conservation status of species was determined from the IUCN Red List (2019).
- Google Earth was used to examine the study area on a desktop level.
- The location of the project in relation to the Important Bird & Biodiversity Areas (IBA's) (Barnes 1998, Marnewick *et al*, 2015) was examined.
- The location of Co-ordinated Water bird Counts (CWAC) (Taylor *et al,* 1999) and Coordinated Avifaunal Roadcount (CAR) routes relative to the study area were examined.
- A brief site visit was conducted in January 2019 to examine the micro-habitats available in the area and get an overall idea of what the site looks like. The site had been visited previously for an avifaunal walk through study for this power line.
- A database on vulture restaurant locations (feeding sites) obtained from Ms K. Wolter several years back was consulted to check if any vulture restaurants exist close to the proposed power line. Although this database is not totally up to date, it contains no known restaurants near the site.

3.4. Assumptions & limitations

This study made the assumption that the above sources of information are reliable. The following factors may potentially detract from the accuracy of the predicted results:

- This report is the result of a short term study, no long term studies were conducted on site.
- The budget was limited for this project on account of it being an update of a previous authorisation. This limited how in depth this study could be. Since the project had been authorised previously, Eskom's expectation was that only an update of the avifaunal report was

required and this constrained the budget available to us. The previous avifaunal report was however done nearly ten years ago by a different consultant.

- This study therefore depends heavily upon secondary or existing data sources such as those listed above. This study assumes a reasonable degree of accuracy of these data.
- Predictions in this study are based on experience of these and similar species in different parts of South Africa, through the authors' experience working in the field of wildlife – energy interaction since 2000. However bird behaviour can't be reduced to formulas that will hold true under all circumstances.

3.5. Relevant legislation

The relevant legislation to this specialist field and development includes the following:

The Convention on Biological Diversity: dedicated to promoting sustainable development. The Convention recognizes that biological diversity is about more than plants, animals and micro-organisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. It is an international convention signed by 150 leaders at the Rio 1992 Earth Summit. South Africa is a signatory. An important principle encompassed by the CBD is the precautionary principle which essentially states that where serious threats to the environment exist, lack of full scientific certainty should not be used a reason for delaying management of these risks. The burden of proof that the impact will *not* occur lies with the proponent of the activity posing the threat.

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include 117 (as of 1 June 2012) Parties from Africa, Central and South America, Asia, Europe and Oceania. South Africa is a signatory to this convention.

The African-Eurasian Waterbird Agreement. The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA) is the largest of its kind developed so far under the CMS. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including many species of divers, grebes, pelicans, cormorants, herons, storks, rails, ibises, spoonbills, flamingos, ducks, swans, geese, cranes, waders, gulls, terns, tropic birds, auks, frigate birds and even the South African penguin. The agreement covers 119 countries and the European Union (EU) from Europe, parts of Asia and Canada, the Middle East and Africa.

National Environmental Management – Biodiversity Act - Threatened Or Protected Species list (TOPS). Several of the species that could occur on this site are listed by TOPS. These are identified in Table 1 and Appendix 3.

The Mpumalanga Nature Conservation Act 10 of 1998 is relevant.

4. DESCRIPTION OF RECEIVING ENVIRONMENT

4.1. Vegetation & micro-habitats

This site is comprised of a complex set of vegetation types, particularly in the north. The line traverses" 'Central Sandy Bushveld'; 'Loskop Thornveld' and 'Loskop Mountain Bushveld' in this area. In the southern half of the route the vegetation is entirely classified as 'Rand Highveld Grassland', with small patches of 'Eastern Temperate Freshwater Wetlands' which are avoided by the line. In functional terms this means that the vegetation on site consists of bushveld and grassland and the bird species occurring in these areas will correspond to these habitats. The bird species in the study area are discussed later in this report, but at this stage it is worth pointing out that the bushveld areas could support species such as Southern Ground Hornbill *Bucorvus leadbeateri*, Tawny Eagle *Aquila rapax* and Martial Eagle *Polemaetus bellicosus*. The grassland areas could support species such as Blue Korhaan *Eupodotis caerulescens* and Blue Crane.

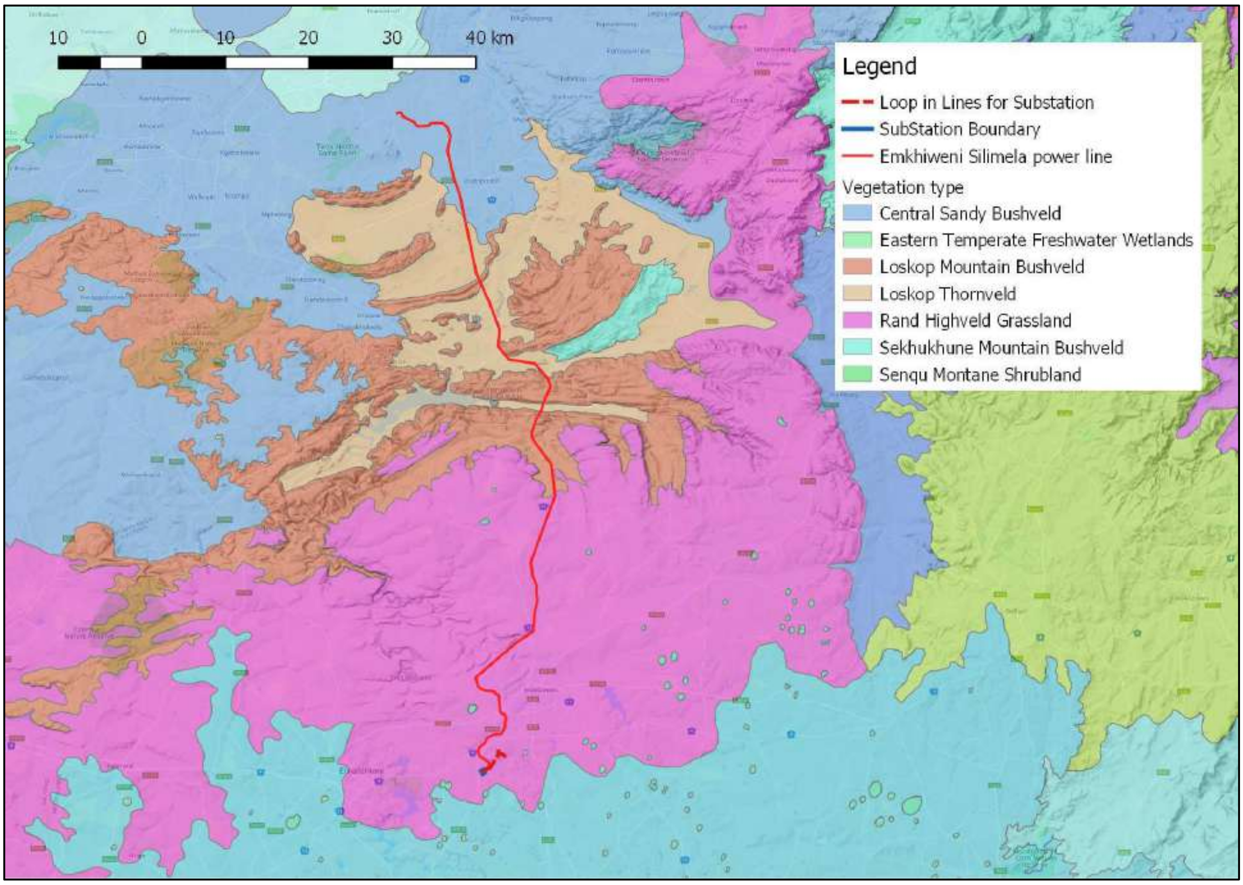

Figure 2. Vegetation classification for the "Emkhiweni Substation & 400kv Line from Emkhiweni Substation to Silimela Substation" site.

Micro habitats are sometimes more useful in understanding bird distribution and abundance than vegetation types, particularly where vegetation has already been transformed by human activities (such as much of this study area). Micro habitats are formed by a number of factors, one of which is vegetation, others including land use, topography, and other anthropogenic influences.

The most distinct micro habitats present in the study area are: bushveld; grassland; wetland; dams; rivers and drainage lines; arable lands; mining and exotic trees. These are pictured in Figure 3. In general the more natural untransformed micro habitats are more sensitive for avifauna. However some species utilise transformed habitats extensively. Examples are Blue Crane, which uses arable crop lands at times to forage, and Lesser Kestrel, which roosts in stands of exotic trees.

Upon leaving the proposed Emkhiweni Substation site northwards, the proposed line passes through arable land, pasture, grassland, and a stream/wetland system before reaching the N4. The line then swings eastwards through fairly degraded grassland skirting around a mining area before weaving between mines and the western edge of Middelburg. Once north of Middelburg it swings to head due north more or less adjacent to the existing Middelburg Selonsrivier 1 & 2 88kV lines and fairly close to the N11. The mining/urban area is left behind at this stage and the landscape takes on more of a farming nature. For the next 20km the land use is mostly arable lands alternating with some undeveloped grassland and associated wetland. The line then enters an area of steeper topography where most natural vegetation is still intact and takes on a more bushveld nature. This continues for approximately 20km until the power line route joins the N11 route again. From here on large centre pivot irrigated arable lands are present where water is available, such as the Olifants River. The line skirts Groblersdal to the west before reaching its end point.

Figure 3. Typical micro habitats on site.

4.2. Relevant bird populations

4.2.1. Southern African Bird Atlas data

The main data source for bird distribution and abundance used for this study is the Southern African Bird Atlas Project (SABAP1 – first -Harrison *et al*, 1997; & second – www.sabap2.adu.org.za). These data provide a good indication of which species occur in the broader area. Up to approximately 442 bird species have been recorded across the broader area within which the proposed project falls by the Southern African Bird Atlas Project 1 and 2 (Harrison *et al,* 1997; www.sabap2.adu.org.za) (Appendix 2). It is important to note that these species could have been recorded anywhere in the broader area and not necessarily in the exact study area. It does however mean that these species could occur in the proposed study area if conditions are right on site. A total of 30 regionally Red Listed species have been recorded, of which 7 are "Endangered", 13 are "Vulnerable" and 10 are "Near-threatened". In addition, a number of species are endemic or near-endemic to southern Africa.

The most important of these species have been identified on the basis of their likely occurrence on site, conservation status, and known susceptibility to power line impacts. These are shown in Table 1.

4.2.2. Important Bird & Biodiversity Area data

Important Bird & Biodiversity Areas are classified on the basis of the following criteria (Marnewick *et al*, 2015):

- The site regularly holds significant numbers of a globally threatened species;
- The site is thought to hold a significant component of a group of species whose breeding distributions define an Endemic Bird Area (EBA) or Secondary Area; and
- The site is known or thought to hold a significant component of a group of species whose distributions are largely or wholly confined to one biome.

The proposed power line and substation are located close to one IBA (6km at closest point), the Loskop Dam Nature Reserve (Figure 4). Given that the proposed power line crosses the same river and riparian system as that in the reserve, an understanding of the avifauna of the IBA is relevant to the power line assessment. Loskop Dam Nature Reserve is on the Olifants River and consists of the dam itself and the surrounding vegetation. This reserve is at the ecotone between rocky Highveld grassland and mixed bushveld and offers birds a wide variety of micro habitats. Grassland bird species regularly recorded in the IBA include Secretarybird, Lesser Kestrel *Falco naumanni*, Tawny Eagle, Pallid Harrier *Circus marourus*, Blue Crane, African Grass Owl *Tyto capensis* and White-bellied Korhaan *Eupodotis senegalensis*. Goliath Heron *Ardea goliath* and large numbers of water fowl are found at the dam. The cliffs used to hold Black Stork *Ciconia nigra* and Peregrine Falcon *Falco peregrinus* although this has not been confirmed recently. The riverine areas hold White-backed Night Heron *Gorsachius leuconotus* and African Finfoot *Podica senegalensis*. Martial Eagle is an occasional visitor but has not been recorded breeding. The bushveld areas hold Striped Pipit *Anthus lineiventris* and Bushveld Pipit *Anthus caffer*.

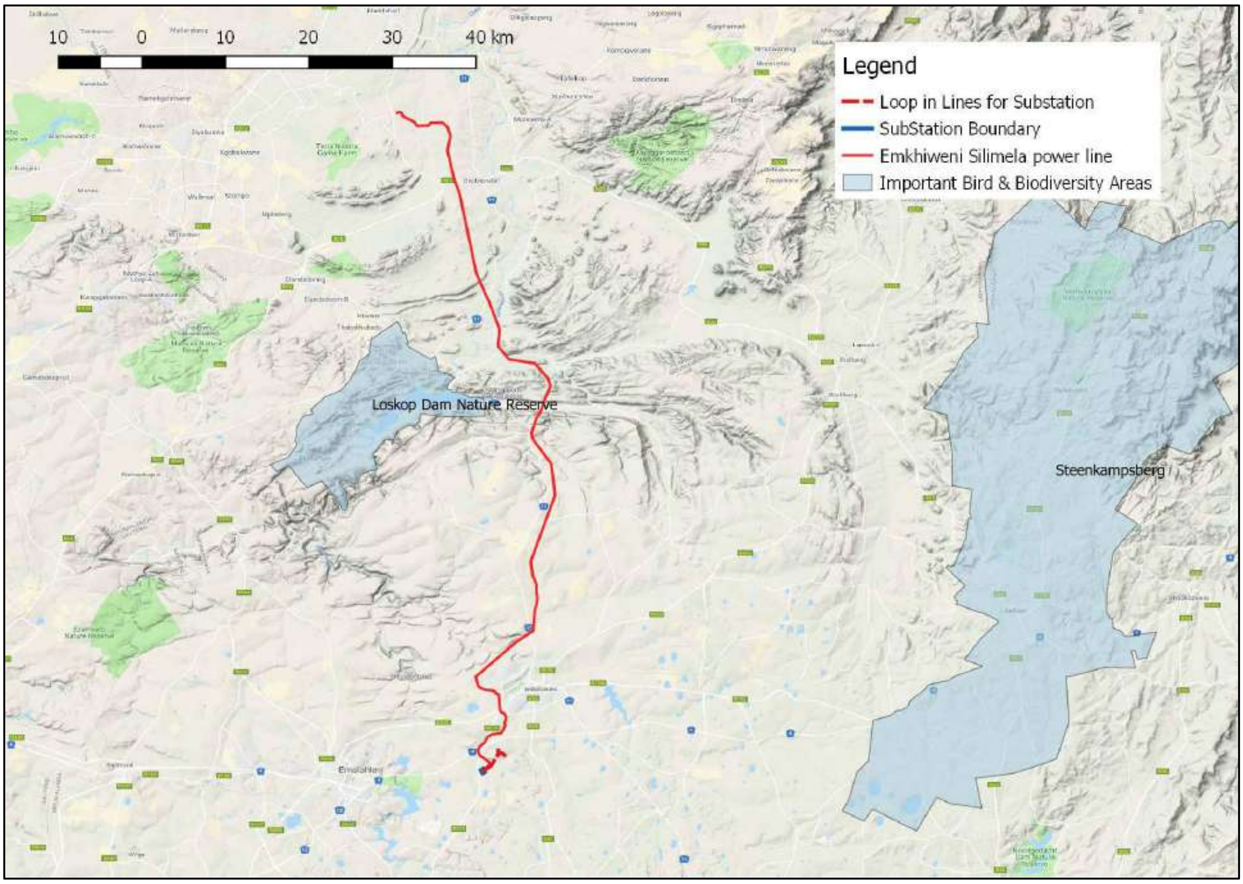

Figure 4. Important Bird & Biodiversity Areas in the Emkhiweni study area.

4.2.3. Specialist field work data

Our own brief field visit recorded only 14 species, all common birds which one would expect on the site. These were: Common Shelduck *Tadorna tadorna*; Cape Turtle Dove *Streptopelia capicola*; Barn Swallow *Hirundo rustica*; Southern Red Bishop *Euplectes orix*; Yellow Weaver *Ploceus subaureus*; Common Moorhen *Gallinula chloropus*; Blacksmith Lapwing *Vanellus armatus*; African Mourning Dove *Streptopelia decipiens*; Pin-tailed Whydah *Vidua macroura*; Helmeted Guineafowl *Numida meleagris*; Fork-tailed Drongo *Dicrurus adsimilis*; Lesser Kestrel; Crowned Lapwing *Vanellus coronatus*. Of these species only Lesser Kestrel is a priority species on account of its 'Vulnerable' TOPS status, and it has recently been downgraded in conservation status, having been regionally Red Listed in the previous classification (Barnes, 2000).

4.3. Priority bird species for this assessment

Table 1 shows the species from the bird atlas data which are either regionally or globally Red Listed, protected by TOPS or endemic. These are considered the priority species for this assessment in theory. Table 1 also presents the likelihood of occurrence of each species on site.

This group of priority bird species includes: woodland species, such as vultures and large eagles; riverine species such as White-backed Night Heron, Half-collared Kingfisher *Alcedo semitorquata* and Yellow-billed Stork *Mycteria ibis*; and open woodland/grassland large terrestrials such as Secretarybird. The vultures and eagles are anticipated to interact with the power line predominantly through perching, nesting and roosting on the infrastructure. This may also place them at risk of collision with the earth wires. The storks and large terrestrials will be at risk of collision with the power line. Most of the priority species are physically large species. These are the species most at risk of direct interaction with the proposed power line. However all species, including the small passerines, could be affected by the power line, particularly through disturbance and habitat destruction. This impact assessment also focuses by necessity on the Red Listed species. This does not mean that the impacts on non-Red Listed species are totally ignored. It is believed that the mitigation proposed for Red Listed species will also provide protection for non-Red Listed species in many cases.

4.3.1. Large terrestrials

Blue Korhaan

Blue Korhaan is almost endemic to South Africa, with a small overlap into Lesotho. It prefers the grassland and grassy Karoo in the central parts of SA. Its preferred habitat is short or burnt grassland, mostly close to water. The species restricted range, as well as the general threats to grassland result in it being a species of conservation concern. Korhaans are susceptible to collision with overhead power lines, and could also be disturbed by construction whilst breeding. Any destruction of grassland habitat in this species range would be of concern.

White-bellied Korhaan

White-bellied Korhaan is classified as Vulnerable regionally (Taylor *et al*, 2015). This species has also undergone a reduction in population and range (Taylor *et al,* 2015). This species prefers longer grassland or pasture and is also found in Fynbos/Renosterveld and thicket. Habitat loss is once again the primary threat to the species. Korhaans are susceptible to collision with power lines, and as with all species will be at risk of disturbance during breeding, and habitat destruction.

Greater Flamingo

Greater Flamingo is classified as Near-threatened regionally (Taylor *et al*, 2015) and Least Concern globally (IUCN 2019). The regional population size is unknown and the global population was estimated at 800 000 birds in 1992 (in Taylor *et al*, 2015). Movements within the region are erratic and driven by rainfall and the species is well known to appear suddenly 'out of the blue' at a dam or pan. This species is highly susceptible to collision with overhead power lines, at least partially due to its occasional nocturnal flights.

Lesser Flamingo

Lesser Flamingo is classified as Near-threatened both regionally and Globally. As with Greater Flamingo its movements are unpredictable and it is highly susceptible to power line collision.

Blue Crane

The Blue Crane is classed as Near-threatened regionally by Taylor *et al* (2015) and Vulnerable globally (IUCN, 2019). It is almost endemic to South Africa (a small population exists in Namibia) and is our national bird. It has the most restricted range of any of the 15 crane species worldwide. The population is estimated at a minimum of 25 000 birds (Taylor *et al*, 2015). This species is highly susceptible to collision with overhead power lines and prime areas for the species should be avoided by the new power line. The species is at particularly high collision risk close to its roost sites in the shallows of dams, where multiple birds enter and exit the roost in low light conditions at dusk and dawn.

Secretarybird

Secretarybird is classified as Vulnerable by Taylor *et al* (2015), having been upgraded from Near-threatened previously. This upgrade was as a result of having undergone more than 30% population reduction in the last ten years. The population in the region is estimated at less than 10 000 birds. Habitat loss is the biggest threat to this species. It is also very susceptible to collision with overhead power lines. Close to breeding sites this species will be susceptible to disturbance and habitat destruction, and young fledglings will be at particularly high collision risk.

Southern Ground Hornbill

Southern Ground-Hornbill is classified as Vulnerable regionally (Taylor et al, 2015) and there is concern for its declining numbers. Its population is estimated at 1500 – 2000 birds in South Africa. This species is susceptible to collision and electrocution on power lines. We found reference on the 'Friends of Loskop' website (www.friendsofloskop.org) to re-introduction of this species to the Loskop Dam area and assume that this went ahead and some birds are in the broader area.

4.3.2. Raptors

Cape Vulture

Cape Vulture is classified as regionally and globally Endangered (Taylor *et al,* 2015; IUCN, 2019). This is a highly threatened species which is also very susceptible to impacts from power lines, particularly electrocution and collision. The risk of impacts is greater closer to areas where the birds are known to congregate, such as regular feeding sites (vulture restaurants), roosts and breeding colonies. When the birds are not at these sites they range widely searching for food and can appear almost anywhere temporarily if food is available.

Tawny Eagle

Tawny Eagle is classified as Endangered regionally and Least Concern globally (Taylor *et al*, 2015; IUCN, 2019). This species is susceptible to electrocution on smaller power lines, collision to some extent, and disturbance and habitat destruction.

African Grass Owl

This species is classified as Vulnerable regionally (Taylor *et al* 2015) and Least Concern globally (IUCN 2019). It has experienced a reduction in population size and the regional population is estimated at 5000 to 15000 birds. This species breeds and forages in rank grassland (normally, but not always associated with wetland). This species will be highly susceptible to destruction of any of its required habitat, and disturbance if construction takes place too close to nests.

Martial Eagle

The Martial Eagle is classified as globally Near-threatened, and regionally Endangered (Taylor *et al* 2015, BirdLife International 2013). The species is well known to have adapted to using Eskom transmission line towers for perching, roosting and nesting. Although nesting on power lines appears at face value to be a positive impact (allowing the birds to expand their range into areas previously unsuitable for breeding due to a lack of trees) residing on a power line also increases the risk of collision that the birds face, particularly for young birds recently fledged (who can also become entangled and die in the tower lattice when fledging; J. Shaw pers. obs.). The species ranges widely and when on site it will be susceptible to collision with the power lines and will perch on pylons. This species is large enough to be capable of causing electrical faults with its faeces whilst perched on pylons.

Lanner Falcon

The Lanner Falcon is classed as Vulnerable and the species does seem to be in decline (Taylor *et al,* 2015). This species is susceptible to collision with overhead cables such as power lines, and also has a tendency to nest on power line structures, which could bring it into close proximity of the proposed power line. We believe the species to be a likely resident on site due to the suitable habitat and abundant prey. This species will be susceptible to collision with power lines and will perch and nest on pylons.

4.3.3. Riverine species

Several regionally Red Listed species which are dependent on riverine or riparian habitats occur in the study area and could frequent any of the rivers or streams which still have good quality vegetation. These include: Half-collared Kingfisher; African Finfoot; and White-backed Night Heron. These species are not typically at risk of mortality from power lines but will be vulnerable to destruction of habitat and disturbance.

Table 1. Priority bird species as identified from the above data sources.

Common name	Taxonomic name	SAB AP1	SAB AP2	RD (Regional, Global)	TOPS	E	Habitat	Likelihood of occurring on site
Grey Crowned Crane	*Balearica regulorum*	1		EN, EN	EN		Grassland, wetland, cultivated land, dams	Possible
Vulture, Cape	*Gyps coprotheres*		1	EN, EN	EN		Open grassland or woodland, cliff	Possible
Marsh-harrier, African	*Circus ranivorus*	1	1	EN, LC	PR		Wetland & adjacent grassland	Probable
Eagle, Tawny	*Aquila rapax*	1	1	EN, LC	VU		Open woodland	Confirmed at Loskop
Stork, Yellow-billed	*Mycteria ibis*	1		EN, LC			Riverine & water body shoreline	Possible
Ground-hornbill, Southern	*Bucorvus leadbeateri*		1	EN, VU	PR		Open woodland & grassland	Confirmed at Loskop – reintroduced
Eagle, Martial	*Polemaetus bellicosus*	1	1	EN, VU	VU		Open woodland, shrubland	Confirmed at Loskop
Korhaan, Blue	*Eupodotis caerulescens*	1	1	LC, NT	VU	SLS	Open grassland & grassy Karoo, lands	Possible
Rock-thrush, Sentinel	*Monticola explorator*	1	1	LC, NT		SLS	Boulder grassland & edge of cultivated lands	Probable
Sandpiper, Curlew	*Calidris ferruginea*	1		LC, NT			Lagoons, estuaries, wetlands	Possible
Flamingo, Greater	*Phoenicopterus ruber*	1	1	NT, LC			Open water bodies	Possible
Kingfisher, Half-collared	*Alcedo semitorquata*	1	1	NT, LC			Well vegetated rivers	Probable
Roller, European	*Coracias garrulus*	1	1	NT, LC			Open woodland	Probable
Stork, Abdim's	*Ciconia abdimii*	1	1	NT, LC			Grassland, open savannah, lands	Possible
Falcon, Red-footed	*Falco vespertinus*		1	NT, NT			Open arid/semi arid savannah	Possible
Flamingo, Lesser	*Phoenicopterus minor*	1	1	NT, NT			Open water bodies	Possible
Harrier, Pallid	*Circus macrourus*	1		NT, NT			Grassland adjacent pans/floodplains, cultivated lands	Confirmed at Loskop
Pratincole, Black-winged	*Glareola nordmanni*	1		NT, NT			Open grassland, pans, lands	Possible
Crane, Blue	*Anthropoides paradiseus*	1	1	NT, VU	EN		Grassland, wetland, cultivated land, dams	Confirmed at Loskop
Duck, Maccoa	*Oxyura maccoa*	1	1	NT, VU			Deep inland waterbodies	Possible
Grass-owl, African	*Tyto capensis*	1	1	VU, LC	VU		Rank or short dense grassland	Confirmed at Loskop
Stork, Black	*Ciconia nigra*	1	1	VU, LC	VU		Mountainous, rivers, cliffs	Confirmed at Loskop
Eagle, Verreaux's	*Aquila verreauxii*	1	1	VU, LC			Mountainous & rocky areas, cliffs	Possible
Falcon, Lanner	*Falco biarmicus*	1	1	VU, LC			Open grassland or woodland near nest	Probable

							substrate	
Finfoot, African	*Podica senegalensis*	1	1	VU, LC			Slow flowing streams overhanging veg	Confirmed at Loskop
Korhaan, White-bellied	*Eupodotis senegalensis*	1	1	VU, LC			Grassland, open savannah, lands	Confirmed at Loskop
Night-Heron, White-backed	*Gorsachius leuconotus*		1	VU, LC			Overhanging riverine vegetation	Confirmed at Loskop
Tern, Caspian	*Sterna caspia*	1	1	VU, LC			Waterbodies	Possible
Bustard, Denham's	*Neotis denhami*	1	1	VU, NT	PR		Grassland, shrubland, cultivated land	Possible
Eagle, African Crowned	*Stephanoaetus coronatus*	1	1	VU, NT			Closed canopy forest, plantation	Probable
Ibis, Southern Bald	*Geronticus calvus*	1	1	VU, VU	VU	SLS	High altitude short grassland & cultivated lands	Possible
Secretarybird	*Sagittarius serpentarius*	1	1	VU, VU			Open grassland, lands	Confirmed at Loskop
Falcon, Peregrine	*Falco peregrinus*		1		VU		Open habitats close to large cliffs	Confirmed at Loskop
Kestrel, Lesser	*Falco naumanni*	1	1		VU		Open savanna, grassland, lands	Confirmed at Loskop
White-eye, Cape	*Zosterops virens*	1	1			(*)	All wooded habitats	Probable
Buzzard, Jackal	*Buteo rufofuscus*	1	1			(*)	Generalist	Probable
Cisticola, Cloud	*Cisticola textrix*	1	1			(*)	Short grassland	Probable
Flycatcher, Fairy	*Stenostira scita*	1	1			(*)	Drainage line woodland, gardens	Probable
Flycatcher, Fiscal	*Sigelus silens*	1	1			(*)	Open woodland, gardens	Probable
Grassbird, Cape	*Sphenoeacus afer*	1	1			(*)	Rank grassland & Fynbos	Probable
Lark, Melodious	*Mirafra cheniana*		1			(*)	Short climax grassland	Probable
Prinia, Karoo	*Prinia maculosa*	1				(*)	Fynbos, coastal shrubland, gardens, along drainage lines	Probable
Thrush, Karoo	*Turdus smithi*	1	1			(*)	Riverine woodland, gardens	Probable
Waxbill, Swee	*Coccopygia melanotis*	1	1			(*)	Forest edges, plantations, gardens	Probable
Weaver, Cape	*Ploceus capensis*	1	1			(*)	Grassland, Fynbos, thicket, farmland	Probable
Lark, Eastern Long-billed	*Certhilauda semitorquata*	1	1			SLS	Upland grassland & shrubland, rocky slopes	Probable
Prinia, Drakensberg	*Prinia hypoxantha*	1				SLS	Rank grassland along drainage lines	Probable
Rock-thrush, Cape	*Monticola rupestris*	1	1			SLS	Rocky slopes	Probable
Starling, Pied	*Spreo bicolor*	1	1			SLS	Open grassland, shrubland	Probable
Sunbird, Greater Double-collared	*Cinnyris afer*	1	1			SLS	Forest margins, gardens	Probable

5. EVALUATION OF IMPACTS & CHOICE OF ALTERNATIVE

5.1. Evaluation of impacts

The impacts of the proposed power line have been assessed and rated using the table below and the criteria found in Appendix 1 (standard criteria for a study of this nature):

Collision of birds with the overhead power line (specifically the earth wires) is likely to occur if no mitigation is implemented. Since some of the species at risk are regionally and globally Red Listed, this is an important impact to mitigate. We recommend the following mitigation measures be implemented:

1. The sections of line identified by this study (see Figure 7) must be installed with a suitable anti bird collision marking device as follows:
    - Devices must be installed as soon as the earth wire is strung as the risk begins immediately
    - Devices must be installed for the full length of each span, not only the middle 60% as previously believed
    - Light and dark colour devices must be alternated to ensure contrast against dark and light backgrounds respectively
    - These marking devices must be maintained in working order for the full life span of the power line
    - The effective spacing between devices must be no more than 10m. This means that on each earth wire devices can be 20m apart if they are staggered between the two earth wires
    - The most suitable available Eskom approved device available at the time of construction must be used

Habitat destruction will occur at each tower footprint and along the construction/servitude road and on substation site. Most of this habitat destruction is unavoidable. However certain control measures can be put in place to keep this to a minimum. We recommend the following during construction:

2. Destruction and alteration of any natural habitat must be kept to an absolute minimum
3. Staff, vehicles and machinery movement must be strictly controlled at all times and restricted to designated routes and turning and batching areas
4. No vehicles or machinery are to cross wetlands or streams
5. Construction camps, offices and labour housing must be situated in areas where no additional impact to the natural environment will result

6. During the operational phase of the substation and power line staff must keep to recognised roads and access routes

Disturbance of birds could occur during construction but is only really significant if Red Listed birds are disturbed, particularly whilst breeding. We have not found any such breeding sites, but make the following general recommendations in case such sites are found later in the project:

7. The Environmental Control Officer and Contractors Environmental Officer must be made aware of the need to identify any such sites that may arise during construction.
8. Construction workers must also be trained in awareness of priority species in the event that a nest is discovered.
9. Should an active nest of a priority species be discovered in or near the servitude, a suitable avifaunal specialist should be notified and asked for case specific recommendations on how to manage the situation.

Nesting of various bird species on the towers is a possible impact. Although this appears to be positive for birds at face value, it is in fact more complex as it places birds at collision risk and sometimes requires management by Eskom. We recommend:

10. Any nests identified on the towers (or in substation) once operational should be managed strictly according to Eskom Transmission Nest Management Guidelines, and national and provincial legislation.
11. Any nest management should be done under the supervision of a suitable avifaunal specialist.

Electrical faulting is a possibility as a result of large birds perching on towers. This is an impact on the business not the birds as the birds are seldom harmed. We recommend the following mitigation:

12. On the tower identified previously by the walk through Bird Guards should be fitted in accordance with Eskom Transmission guidelines. These towers are identified in the table below.

Tower number	**Comment**	**Risk**	**Mitigation**
6-13	Streams, dams, wetlands	Faulting	Install Bird Guards
15 – 19	Small stream/drainage line	Faulting	Install Bird Guards
44 - 45	Canal	Faulting	Install Bird Guards
116 -122	Close to large dam, drainage lines	Faulting	Install Bird Guards

140 - 144	Drainage line, flight path, small dams	Faulting	Install Bird Guards
145 - 148	Drainage line, flight path, small dams	Faulting	Install Bird Guards
148 - 149	Stream crossing	Faulting	Install Bird Guards
154 - 155	Small drainage line	Faulting	install Bird Guards
165 - 166	Drainage line	Faulting	Install Bird Guards
183 - 185	Drainage line, dam	Faulting	Install Bird Guards
199 - 207	Drainage line, wetland, dam	Faulting	Install Bird Guards
207 - 214	Drainage line	Faulting	Install Bird Guards
220 - 224	Drainage line, flight path, wetland	Faulting	Install Bird Guards
242 - 243	Drainage line, flight path	Faulting	Install Bird Guards
251 - 257	Drainage line, dams	Faulting	Install Bird Guards
260	Dam	Faulting	Install Bird Guards
267	Dam	Faulting	Install Bird Guards
285 - 290	Drainage line, flight path, dams	Faulting	Install Bird Guards
293 - 297	Drainage line, wetland, flight path	Faulting	Install Bird Guards

Table 2. Impact ratings (criteria supplied by Nemai Consulting).

Impact	Project component	Management Measures	+/- impact	Extent	Magnitude	Duration	Probability	Significance
Collision of birds with overhead cables of power lines	Power lines	Before mitigation	-	Regional	Medium	Long term	Likely	1 – No significant impact after mitigation
		After mitigation	-	Regional	Low	Long term	Unlikely	
Habitat destruction during construction of proposed development	Substation & power lines	Before mitigation	-	Local	Medium	Long term	Almost certain	1 – No significant impact after mitigation
		After mitigation	-	Local	Low	Long term	Almost certain	
Disturbance of birds during construction & operation (lesser extent)	Substation & power lines	Before mitigation	-	Local	Low	Short term	Unlikely	1 – No significant impact after mitigation
		After mitigation	-	Local	Low	Short term	Unlikely	
Nesting of birds on infrastructure	Substation & power lines	Before mitigation	+	Local	Low	Long term	Moderate	1 – No significant impact after mitigation
		After mitigation	+	Local	Low	Long term	Moderate	
Electrical faulting caused by birds	Power lines	Before mitigation	- For business	Local	Medium	Long term	Moderate	1 – No significant impact after mitigation
		After mitigation	- - For business	Local	Low	Long term	Unlikely	

5.2. Comparison of alternatives

No alternative positions for the substation or alignments for the power line were provided for assessment. The original avifaunal impact assessment for this proposed power line compared two alternative routes and recommended the selection of this route currently under assessment (Ross, 2009).

6. SENSITIVITY MAPPING

We have delineated the various micro habitats along the project alignment, as shown in Figures 5 and 6. The bushveld, grassland, wetland and rivers/streams are the most sensitive micro habitats.

Most of the power line is adjacent to an existing 88kV power line, which is an advantage as this is an existing linear impact in the landscape.

The sections of power line that are most sensitive are those posing a bird collision risk and requiring the installation of anti-bird collision line marking devices. These are shown in Figure 7. We identified high risk sections of the power line using a combination of micro habitats, land use and topography. These factors combine to result in certain areas where flight of the relevant bird species is more likely. The high risk sections were often in close association with surface water sources. An avifaunal walk through was done previously for this power line, where by the specialist visited on foot or by vehicle the full alignment of the line in detail, and could identify the above factors at fine spatial scale.

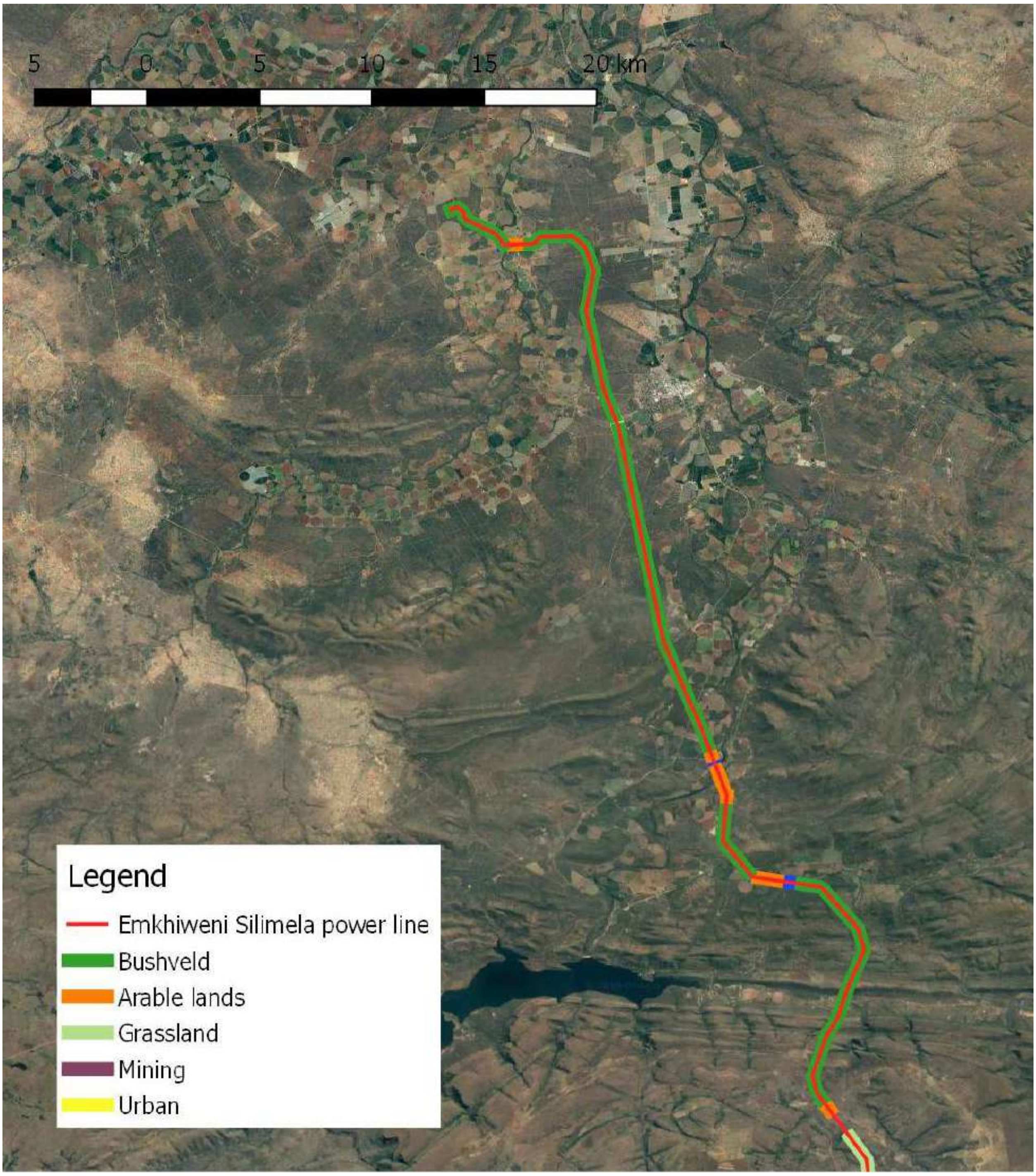

Figure 5. Micro habitats along the alignment – northern section.

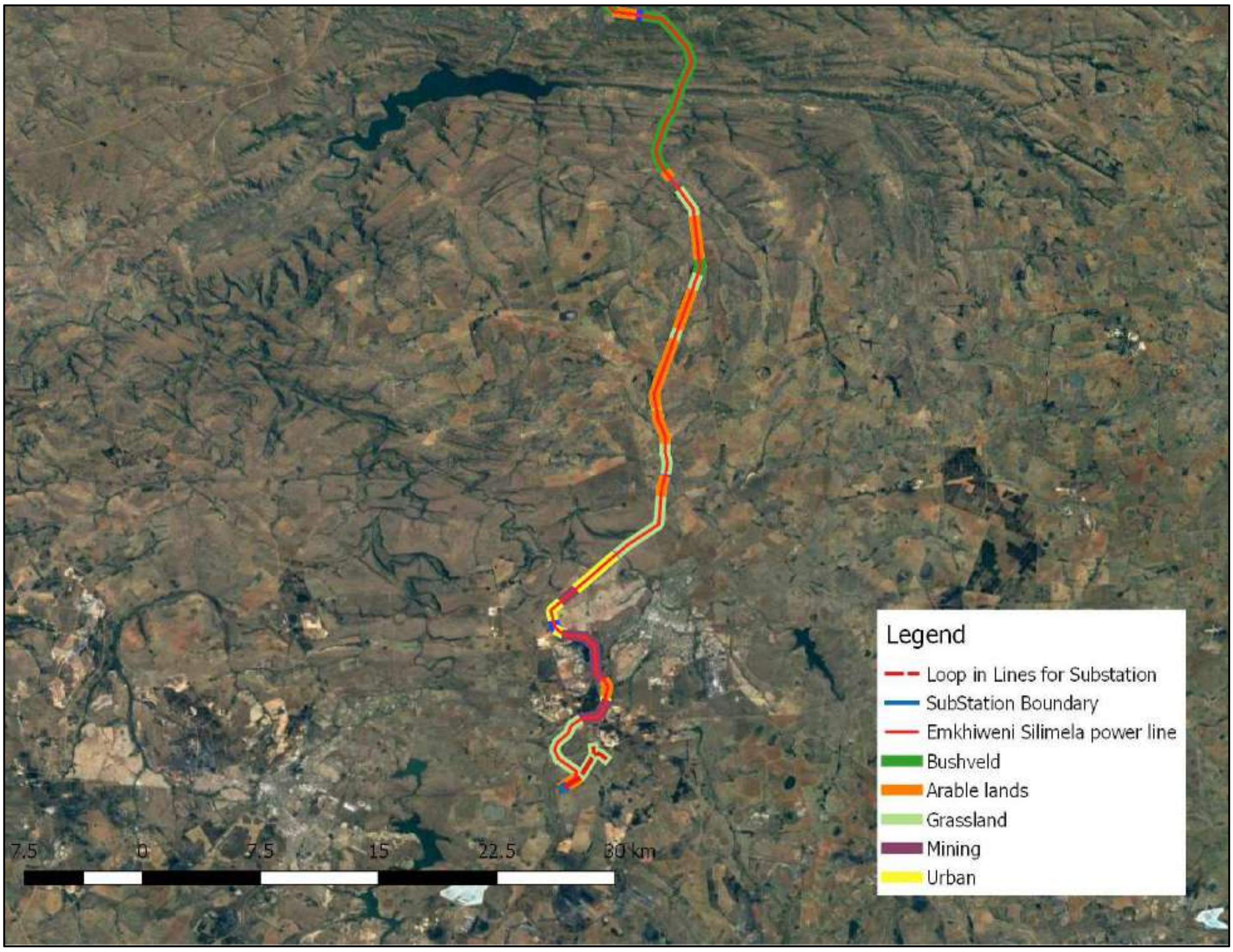

Figure 6. Micro habitats along the alignment – southern section.

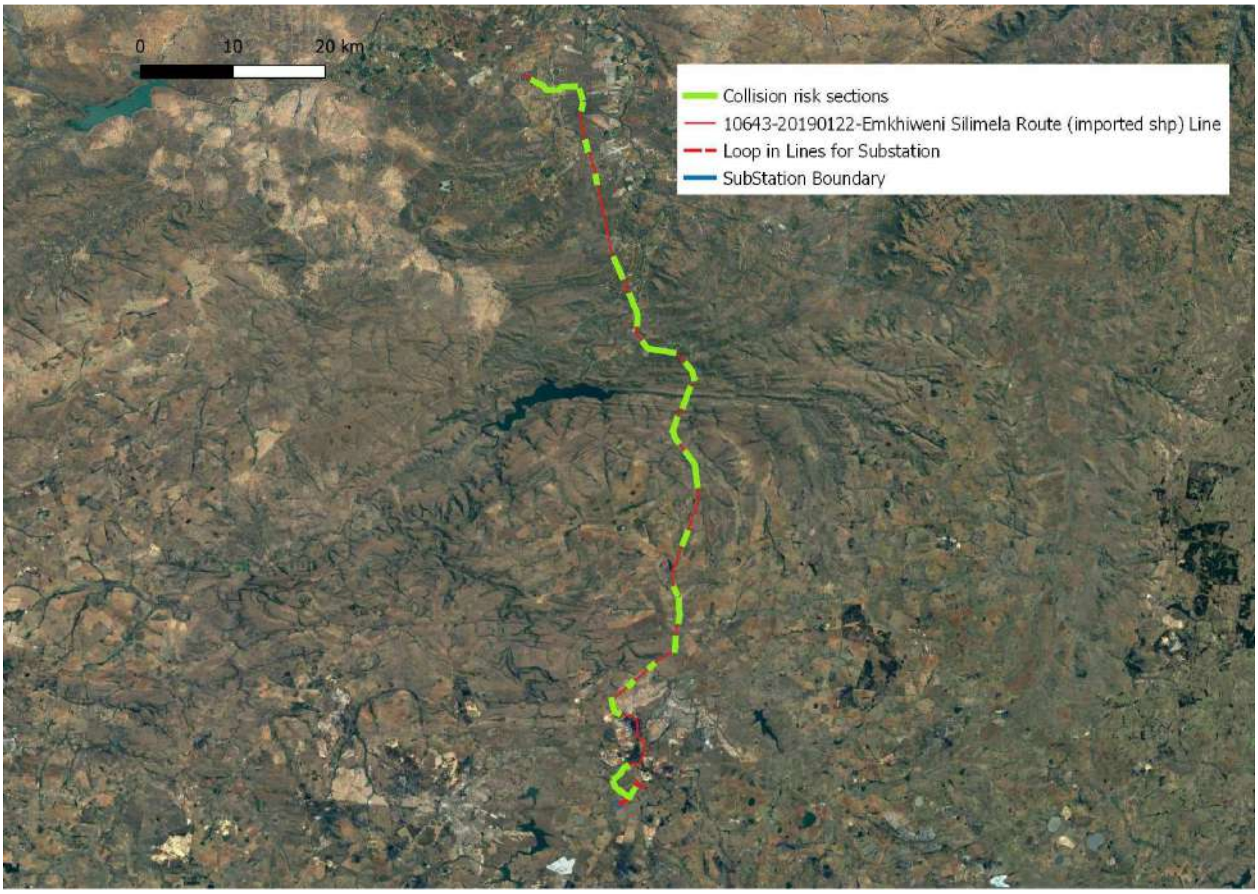

Figure 7. Sections of line requiring collision mitigation.

The table below also identified the sections of line requiring collision mitigation by tower number.

Tower number	**Comment**	**Risk**	**Mitigation**
6-13	Streams, dams, wetlands	Collision	Install marking device as explained above.
15 – 19	Small stream/drainage line	Collision	Install marking device as explained above.
48 - 50	Dam	Collision	Install marking device as explained above.
75 - 94	Ridge line, lands, flats, water, river crossing	Collision	Install marking device as explained above.
101 -110	Lands, flats, river crossing	Collision	Install marking device as explained above.
116 -122	Close to large dam, drainage lines	Collision	Install marking device as explained above.
127 - 134	Dropping off ridge line, valley, flight path	Collision	Install marking device as explained above.

140 - 144	Drainage line, flight path, small dams	Collision	Install marking device as explained above.
145 - 148	Drainage line, flight path, small dams	Collision	Install marking device as explained above.
148 - 149	Stream crossing	Collision	Install marking device as explained above.
154 - 155	Small drainage line	Collision	Install marking device as explained above.
155 - 166	Good grassland, drainage line	Collision	Install marking device as explained above.
182 to 186	Drainage line, flight path, dam	Collision	Install marking device as explained above.
199 - 207	Drainage line, wetland, dam	Collision	Install marking device as explained above.
220 - 224	Drainage line, flight path, wetland	Collision	Install marking device as explained above.
224 - 236	Grassland, nature reserve	Collision	Install marking device as explained above.
242 - 243	Drainage line, flight path	Collision	Install marking device as explained above.
251 - 257	Drainage line, dams	Collision	Install marking device as explained above.
285 - 290	Drainage line, flight path, dams	Collision	Install marking device as explained above.
293 - 297	Drainage line, wetland, flight path	Collision	Install marking device as explained above.

7. CONCLUSION & IMPACT STATEMENT

We draw the following conclusions for this proposed project:

- Collision of birds with the overhead power line (specifically the earth wires) is likely to occur if no mitigation is implemented. Since some of the species at risk are regionally and globally Red Listed, this is an important impact to mitigate.
- Habitat destruction will occur at each tower footprint and along the construction/servitude road and on substation site. Most of this habitat destruction is unavoidable. However certain control measures can be put in place to keep this to a minimum.
- Disturbance of birds could occur during construction but is only really significant if Red Listed birds are disturbed, particularly whilst breeding. We have not found any such breeding sites.
- Nesting of various bird species on the towers is a possible impact. Although this appears to be positive for birds at face value, it is in fact more complex as it places birds at collision risk and sometimes requires management by Eskom.
- Electrical faulting is a possibility as a result of large birds perching on towers. This is an impact on the business not the birds as the birds are seldom harmed.

We recommend the following mitigation for the above identified impacts:

1. The sections of line identified by this study (Figure 7) must be installed with a suitable anti bird collision marking device as follows:
    - Devices must be installed as soon as the earth wire is strung as the risk begins immediately
    - Devices must be installed for the full length of each span, not only the middle 60% as previously believed
    - Light and dark colour devices must be alternated to ensure contrast against dark and light backgrounds respectively
    - These marking devices must be maintained in working order for the full life span of the power line
    - The effective spacing between devices must be no more than 10m. This means that on each earth wire devices can be 20m apart if they are staggered between the two earth wires
    - The most suitable available Eskom approved device available at the time of construction must be used
2. Destruction and alteration of any natural habitat must be kept to an absolute minimum
3. Staff, vehicles and machinery movement must be strictly controlled at all times and restricted to designated routes and turning and batching areas

4. No vehicles or machinery are to cross wetlands or streams
5. Construction camps, offices and labour housing must be situated in areas where no additional impact to the natural environment will result
6. During the operational phase of the substation and power line staff must keep to recognised roads and access routes
7. The Environmental Control Officer and Contractors Environmental Officer must be made aware of the need to identify any such sites that may arise during construction.
8. Construction workers must also be trained in awareness of priority species in the event that a nest is discovered.
9. Should an active nest of a priority species be discovered in or near the servitude, a suitable avifaunal specialist should be notified and asked for case specific recommendations on how to manage the situation.
10. Any nests identified on the towers (or in substation) once operational should be managed strictly according to Eskom Transmission Nest Management Guidelines, and national and provincial legislation.
11. Any nest management should be done under the supervision of a suitable avifaunal specialist.
12. On the towers identified by this study Bird Guards should be fitted in accordance with Eskom Transmission guidelines.

Provided that the above recommendations are accepted we believe that the project can proceed with acceptable risk to avifauna.

8. REFERENCES

Barnes, K.N. (ED.) 1998. The Important Bird Areas of Southern Africa. Birdlife South Africa, Johannesburg.

Benson, P (Phd). 2012. Research Officer, School of Animal, Plant & Environmental Sciences, University of the Witwatersrand. Personal communication.

Harrison, J. A., Allan, D. G., Underhill, L. G., Herremans, M., Tree, A. J., Parker, V & Brown, C.J. (EDS). 1997. The atlas of southern African birds. Vol. 1&2. BirdLife South Africa: Johannesburg.

Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (Eds) 2005. Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

IUCN 2019. IUCN Red List of Threatened Species. <www.iucnredlist.org>.

Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.

Mucina, L; Rutherford, C. 2006. The Vegetation of South Africa, Lesotho and Swaziland, South African National Biodiversity Institute, Pretoria.

Ross, M. 2009. ESKOM Holdings Ltd: Highveld North West Lowveld Strengthening Scheme Development. Wolwekraal-RockdaleB 400kV Powerline Alternatives
Avifaunal Survey

Shaw, J.M. 2009. The End of the Line for South Africa's National Bird? Modelling Power Line Collision Risk for the Blue Crane. Master of Science in Conservation Biology. Percy FitzPatrick Institute of African Ornithology

Shaw J, Jenkins AR and Ryan PG 2010a. Modelling power line collision risk in the Blue Crane Anthropoides paradiseus in South Africa. Ibis 152: 590-599.

Shaw J, Jenkins AR, Ryan PG and Smallie J. 2010b. A preliminary survey of avian mortality on power lines in the Overberg, South Africa. Ostrich 81: 109-113.

Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A., & Kieswetter, S.L. 1999. TOTAL CWAC Report: Coordinated Water bird Counts in South Africa, 1992 – 1997. Avian Demography Unit, Cape Town.

Taylor, M. R, Peacock, F., & Wanless, R. 2015. The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho & Swaziland.

APPENDIX 1 - CRITERIA FOR ASSESSMENT OF THE IMPACTS

METHODOLOGY TO ASSESS THE IDENTIFIED IMPACTS

The EIA quantitative impact assessment will further focus on the direct and indirect impacts associated with the project. All impacts will be analysed with regard to their nature, extent, magnitude, duration, probability and significance. The following definitions 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.

APPENDIX 2. BIRD SPECIES RECORDED IN THE BROADER STUDY AREA BY THE SABAP1 & SABAP2.

'1' denotes presence not abundance

SABAP 1/SABAP2 – species recorded in the broader area by the respective bird atlas project. These are species that could be expected to occur on the proposed site. These are not necessarily recorded on site by our own work.

TOPS – on the national 'Threatened or Protected Species" list.

Regional/Global = regionally Red Listed (Taylor *et al* 2015) or Globally Red Listed (IUCN 2019).

E – *=endemic, (*) = near-endemic, SLS=endemic to South Africa, Lesotho or Swaziland.

Common name	Taxonomic name	SAB AP1	SAB AP2	RD (Regional, Global)	TOPS	E
Apalis, Bar-throated	*Apalis thoracica*	1	1			
Avocet, Pied	*Recurvirostra avosetta*	1	1			
Babbler, Arrow-marked	*Turdoides jardineii*	1	1			
Babbler, Southern Pied	*Turdoides bicolor*		1			
Barbet, Acacia Pied	*Tricholaema leucomelas*	1	1			
Barbet, Black-collared	*Lybius torquatus*	1	1			
Barbet, Crested	*Trachyphonus vaillantii*	1	1			
Batis, Cape	*Batis capensis*		1			
Batis, Chinspot	*Batis molitor*	1	1			
Bee-eater, European	*Merops apiaster*	1	1			
Bee-eater, Little	*Merops pusillus*	1	1			
Bee-eater, Southern Carmine	*Merops nubicoides*	1				
Bee-eater, Swallow-tailed	*Merops hirundineus*	1	1			
Bee-eater, White-fronted	*Merops bullockoides*	1	1			
Bishop, Southern Red	*Euplectes orix*	1	1			
Bishop, Yellow	*Euplectes capensis*	1	1			
Bishop, Yellow-crowned	*Euplectes afer*	1	1			
Bittern, Dwarf	*Ixobrychus sturmii*	1				
Bittern, Little	*Ixobrychus minutus*	1	1			
Bokmakierie	*Telophorus zeylonus*	1	1			
Boubou, Southern	*Laniarius ferrugineus*	1	1			
Brownbul, Terrestrial	*Phyllastrephus terrestris*		1			
Brubru	*Nilaus afer*	1	1			
Buffalo-weaver, Red-billed	*Bubalornis niger*	1	1			
Bulbul, Dark-capped	*Pycnonotus tricolor*	1	1			
Bunting, Cape	*Emberiza capensis*	1	1			
Bunting, Cinnamon-breasted	*Emberiza tahapisi*	1	1			
Bunting, Golden-breasted	*Emberiza flaviventris*	1	1			

Bush-shrike, Grey-headed	*Malaconotus blanchoti*	1	1			
Bush-shrike, Orange-breasted	*Telophorus sulfureopectus*	1	1			
Bustard, Denham's	*Neotis denhami*	1	1	VU, NT	PR	
Buttonquail, Kurrichane	*Turnix sylvaticus*	1	1			
Buzzard, Jackal	*Buteo rufofuscus*	1	1			(*)
Buzzard, Lizard	*Kaupifalco monogrammicus*	1	1			
Buzzard, Steppe	*Buteo vulpinus*	1	1			
Camaroptera, Green-backed	*Camaroptera brachyura*	1	1			
Camaroptera, Grey-backed	*Camaroptera brevicaudata*	1	1			
Canary, Black-throated	*Crithagra atrogularis*	1	1			
Canary, Brimstone	*Crithagra sulphuratus*		1			
Canary, Cape	*Serinus canicollis*	1	1			
Canary, Yellow	*Crithagra flaviventris*		1			
Canary, Yellow-fronted	*Crithagra mozambicus*	1	1			
Chat, Anteating	*Myrmecocichla formicivora*	1	1			
Chat, Familiar	*Cercomela familiaris*	1	1			
Cisticola, Cloud	*Cisticola textrix*	1	1			(*)
Cisticola, Desert	*Cisticola aridulus*	1	1			
Cisticola, Lazy	*Cisticola aberrans*	1	1			
Cisticola, Levaillant's	*Cisticola tinniens*	1	1			
Cisticola, Pale-crowned	*Cisticola cinnamomeus*	1	1			
Cisticola, Rattling	*Cisticola chiniana*	1	1			
Cisticola, Red-faced	*Cisticola erythrops*	1	1			
Cisticola, Wailing	*Cisticola lais*	1	1			
Cisticola, Wing-snapping	*Cisticola ayresii*	1	1			
Cisticola, Zitting	*Cisticola juncidis*	1	1			
Cliff-chat, Mocking	*Thamnolaea cinnamomeiventris*	1	1			
Cliff-swallow, South African	*Hirundo spilodera*	1	1			
Coot, Red-knobbed	*Fulica cristata*	1	1			
Cormorant, Reed	*Phalacrocorax africanus*	1	1			
Cormorant, White-breasted	*Phalacrocorax carbo*	1	1			
Coucal, Burchell's	*Centropus burchelli*	1				
Coucal, Burchell's	*Centropus burchellii*	1	1			
Coucal, White-browed	*Centropus superciliosus*	1				
Courser, Temminck's	*Cursorius temminckii*	1	1			
Crake, African	*Crecopsis egregia*	1	1			
Crake, Baillon's	*Porzana pusilla*		1			
Crake, Black	*Amaurornis flavirostris*	1	1			
Crane, Blue	*Anthropoides paradiseus*	1	1	NT, VU	EN	
Crane, Grey Crowned	*Balearica regulorum*	1		EN, EN	EN	
Crombec, Long-billed	*Sylvietta rufescens*	1	1			
Crow, Cape	*Corvus capensis*	1	1			
Crow, Pied	*Corvus albus*	1	1			
Cuckoo, African	*Cuculus gularis*	1	1			
Cuckoo, Black	*Cuculus clamosus*	1	1			

Cuckoo, Common	*Cuculus canorus*	1	1		
Cuckoo, Diderick	*Chrysococcyx caprius*	1	1		
Cuckoo, Great Spotted	*Clamator glandarius*		1		
Cuckoo, Jacobin	*Clamator jacobinus*	1	1		
Cuckoo, Klaas's	*Chrysococcyx klaas*	1	1		
Cuckoo, Levaillant's	*Clamator levaillantii*	1	1		
Cuckoo, Red-chested	*Cuculus solitarius*	1	1		
Cuckoo-shrike, Black	*Campephaga flava*	1	1		
Darter, African	*Anhinga rufa*	1	1		
Dove, Laughing	*Streptopelia senegalensis*	1	1		
Dove, Namaqua	*Oena capensis*	1	1		
Dove, Red-eyed	*Streptopelia semitorquata*	1	1		
Dove, Rock	*Columba livia*	1	1		
Dove, Tambourine	*Turtur tympanistria*	1	1		
Drongo, Fork-tailed	*Dicrurus adsimilis*	1	1		
Duck, African Black	*Anas sparsa*	1	1		
Duck, Domestic	*Anas platyrhynchos*		1		
Duck, Fulvous	*Dendrocygna bicolor*	1	1		
Duck, Knob-billed	*Sarkidiornis melanotos*	1	1		
Duck, Maccoa	*Oxyura maccoa*	1	1	NT, VU	
Duck, Mallard	*Anas platyrhynchos*		1		
Duck, White-backed	*Thalassornis leuconotus*	1	1		
Duck, White-faced	*Dendrocygna viduata*	1	1		
Duck, Wood	*Aix sponsa*		1		
Duck, Yellow-billed	*Anas undulata*	1	1		
Eagle, African Crowned	*Stephanoaetus coronatus*	1	1	VU, NT	
Eagle, Long-crested	*Lophaetus occipitalis*	1			
Eagle, Martial	*Polemaetus bellicosus*	1	1	EN, VU	VU
Eagle, Tawny	*Aquila rapax*	1	1	EN, LC	VU
Eagle, Verreaux's	*Aquila verreauxii*	1	1	VU, LC	
Eagle, Wahlberg's	*Aquila wahlbergi*	1	1		
Eagle-owl, Cape	*Bubo capensis*	1			
Eagle-owl, Spotted	*Bubo africanus*	1	1		
Eagle-owl, Verreaux's	*Bubo lacteus*	1			
Egret, Cattle	*Bubulcus ibis*	1	1		
Egret, Great	*Egretta alba*	1	1		
Egret, Little	*Egretta garzetta*	1	1		
Egret, Yellow-billed	*Egretta intermedia*	1	1		
Eremomela, Burnt-necked	*Eremomela usticollis*	1	1		
Eremomela, Green-capped	*Eremomela scotops*	1	1		
Eremomela, Yellow-bellied	*Eremomela icteropygialis*	1			
Falcon, Amur	*Falco amurensis*	1	1		
Falcon, Lanner	*Falco biarmicus*	1	1	VU, LC	
Falcon, Peregrine	*Falco peregrinus*		1		VU
Falcon, Red-footed	*Falco vespertinus*		1	NT, NT	

Finch, Cuckoo	*Anomalospiza imberbis*	1	1			
Finch, Cut-throat	*Amadina fasciata*	1	1			
Finch, Red-headed	*Amadina erythrocephala*	1	1			
Finch, Scaly-feathered	*Sporopipes squamifrons*	1	1			
Finfoot, African	*Podica senegalensis*	1	1	VU, LC		
Firefinch, African	*Lagonosticta rubricata*	1	1			
Firefinch, Jameson's	*Lagonosticta rhodopareia*	1	1			
Firefinch, Red-billed	*Lagonosticta senegala*	1	1			
Fiscal, Common (Southern)	*Lanius collaris*	1	1			
Fish-eagle, African	*Haliaeetus vocifer*	1	1			
Flamingo, Greater	*Phoenicopterus ruber*	1	1	NT, LC		
Flamingo, Lesser	*Phoenicopterus minor*	1	1	NT, NT		
Flufftail, Buff-spotted	*Sarothrura elegans*		1			
Flufftail, Red-chested	*Sarothrura rufa*	1	1			
Flycatcher, African Dusky	*Muscicapa adusta*		1			
Flycatcher, Ashy	*Muscicapa caerulescens*		1			
Flycatcher, Fairy	*Stenostira scita*	1	1			(*)
Flycatcher, Fiscal	*Sigelus silens*	1	1			(*)
Flycatcher, Marico	*Bradornis mariquensis*	1	1			
Flycatcher, Pale	*Bradornis pallidus*	1	1			
Flycatcher, Southern Black	*Melaenornis pammelaina*	1	1			
Flycatcher, Spotted	*Muscicapa striata*	1	1			
Francolin, Coqui	*Peliperdix coqui*	1	1			
Francolin, Crested	*Dendroperdix sephaena*	1	1			
Francolin, Orange River	*Scleroptila levaillantoides*		1			
Francolin, Red-winged	*Scleroptila levaillantii*	1	1			
Francolin, Shelley's	*Scleroptila shelleyi*	1	1			
Go-away-bird, Grey	*Corythaixoides concolor*	1	1			
Goose, Domestic	*Anser anser*		1			
Goose, Egyptian	*Alopochen aegyptiacus*	1	1			
Goose, Spur-winged	*Plectropterus gambensis*	1	1			
Goshawk, African	*Accipiter tachiro*		1			
Goshawk, Gabar	*Melierax gabar*	1	1			
Grass-owl, African	*Tyto capensis*	1	1	VU, LC	VU	
Grassbird, Cape	*Sphenoeacus afer*	1	1			(*)
Grebe, Great Crested	*Podiceps cristatus*	1	1			
Grebe, Little	*Tachybaptus ruficollis*	1	1			
Green-pigeon, African	*Treron calvus*	1	1			
Greenbul, Yellow-bellied	*Chlorocichla flaviventris*		1			
Greenshank, Common	*Tringa nebularia*	1	1			
Ground-hornbill, Southern	*Bucorvus leadbeateri*		1	EN, VU	PR	
Guineafowl, Helmeted	*Numida meleagris*	1	1			
Gull, Grey-headed	*Larus cirrocephalus*	1	1			
Hamerkop	*Scopus umbretta*	1	1			
Harrier, Montagu's	*Circus pygargus*		1			

Harrier, Pallid	*Circus macrourus*	1		NT, NT		
Harrier-Hawk, African	*Polyboroides typus*	1	1			
Hawk, African Cuckoo	*Aviceda cuculoides*	1				
Hawk-eagle, African	*Aquila spilogaster*	1	1			
Helmet-shrike, Retz's	*Prionops retzii*	1				
Helmet-shrike, White-crested	*Prionops plumatus*	1	1			
Heron, Black	*Egretta ardesiaca*	1	1			
Heron, Black-headed	*Ardea melanocephala*	1	1			
Heron, Goliath	*Ardea goliath*	1	1			
Heron, Green-backed	*Butorides striata*	1	1			
Heron, Grey	*Ardea cinerea*	1	1			
Heron, Purple	*Ardea purpurea*	1	1			
Heron, Squacco	*Ardeola ralloides*	1	1			
Hobby, Eurasian	*Falco subbuteo*	1	1			
Honey-buzzard, European	*Pernis apivorus*		1			
Honeybird, Brown-backed	*Prodotiscus regulus*	1	1			
Honeyguide, Greater	*Indicator indicator*	1	1			
Honeyguide, Lesser	*Indicator minor*	1	1			
Hoopoe, African	*Upupa africana*	1	1			
Hornbill, African Grey	*Tockus nasutus*	1	1			
Hornbill, Damara	*Tockus damarensis*	1				
Hornbill, Hybrid Damara/Red-billed	*Tockus damarensis/erythrorhynchus*	1				
Hornbill, Red-billed	*Tockus erythrorhynchus*	1	1			
Hornbill, Redbilled	*Tockus erythrorhynchus*	1				
Hornbill, Southern Red-billed	*Tockus rufirostris*		1			
Hornbill, Southern Yellow-billed	*Tockus leucomelas*	1	1			
House-martin, Common	*Delichon urbicum*	1	1			
Ibis, African Sacred	*Threskiornis aethiopicus*	1	1			
Ibis, Glossy	*Plegadis falcinellus*	1	1			
Ibis, Hadeda	*Bostrychia hagedash*	1	1			
Ibis, Southern Bald	*Geronticus calvus*	1	1	VU, VU	VU	SLS
Indigobird, Dusky	*Vidua funerea*	1	1			
Indigobird, Purple	*Vidua purpurascens*	1	1			
Indigobird, Village	*Vidua chalybeata*	1	1			
Jacana, African	*Actophilornis africanus*	1	1			
Kestrel, Greater	*Falco rupicoloides*	1	1			
Kestrel, Lesser	*Falco naumanni*	1	1		VU	
Kestrel, Rock	*Falco rupicolus*	1	1			
Kingfisher, Brown-hooded	*Halcyon albiventris*	1	1			
Kingfisher, Giant	*Megaceryle maximus*	1	1			
Kingfisher, Grey-headed	*Halcyon leucocephala*		1			
Kingfisher, Half-collared	*Alcedo semitorquata*	1	1	NT, LC		
Kingfisher, Malachite	*Alcedo cristata*	1	1			
Kingfisher, Pied	*Ceryle rudis*	1	1			
Kingfisher, Striped	*Halcyon chelicuti*	1	1			

Kingfisher, Woodland	*Halcyon senegalensis*	1	1			
Kite, Black	*Milvus migrans*	1				
Kite, Black-shouldered	*Elanus caeruleus*	1	1			
Kite, Yellow-billed	*Milvus aegyptius*	1	1			
Korhaan, Blue	*Eupodotis caerulescens*	1	1	LC, NT	VU	SLS
Korhaan, Northern Black	*Afrotis afraoides*		1			
Korhaan, Red-crested	*Lophotis ruficrista*	1	1			
Korhaan, White-bellied	*Eupodotis senegalensis*	1	1	VU, LC		
Lapwing, African Wattled	*Vanellus senegallus*	1	1			
Lapwing, Blacksmith	*Vanellus armatus*	1	1			
Lapwing, Crowned	*Vanellus coronatus*	1	1			
Lark, Eastern Clapper	*Mirafra fasciolata*	1	1			
Lark, Eastern Long-billed	*Certhilauda semitorquata*	1	1			SLS
Lark, Fawn-coloured	*Calendulauda africanoides*		1			
Lark, Flappet	*Mirafra rufocinnamomea*	1	1			
Lark, Melodious	*Mirafra cheniana*		1			(*)
Lark, Monotonous	*Mirafra passerina*	1				
Lark, Pink-billed	*Spizocorys conirostris*	1				
Lark, Red-capped	*Calandrella cinerea*	1	1			
Lark, Rufous-naped	*Mirafra africana*	1	1			
Lark, Sabota	*Calendulauda sabota*	1	1			
Lark, Spike-heeled	*Chersomanes albofasciata*	1	1			
Longclaw, Cape	*Macronyx capensis*	1	1			
Lovebird, Rosy-faced	*Agapornis roseicollis*		1			
Mannikin, Bronze	*Spermestes cucullatus*	1	1			
Marsh-harrier, African	*Circus ranivorus*	1	1	EN, LC	PR	
Martin, Banded	*Riparia cincta*	1	1			
Martin, Brown-throated	*Riparia paludicola*	1	1			
Martin, Rock	*Hirundo fuligula*	1	1			
Martin, Sand	*Riparia riparia*	1	1			
Masked-weaver, Lesser	*Ploceus intermedius*	1	1			
Masked-weaver, Southern	*Ploceus velatus*	1	1			
Moorhen, Common	*Gallinula chloropus*	1	1			
Mousebird, Red-faced	*Urocolius indicus*	1	1			
Mousebird, Speckled	*Colius striatus*	1	1			
Mousebird, White-backed	*Colius colius*	1				
Myna, Common	*Acridotheres tristis*	1	1			
Neddicky	*Cisticola fulvicapilla*	1	1			
Night-Heron, Black-crowned	*Nycticorax nycticorax*	1	1			
Night-Heron, White-backed	*Gorsachius leuconotus*		1	VU, LC		
Nightjar, European	*Caprimulgus europaeus*	1	1			
Nightjar, Fiery-necked	*Caprimulgus pectoralis*	1	1			
Nightjar, Freckled	*Caprimulgus tristigma*	1	1			
Nightjar, Rufous-cheeked	*Caprimulgus rufigena*	1	1			
Olive-pigeon, African	*Columba arquatrix*	1				

Oriole, Black-headed	*Oriolus larvatus*	1	1		
Oriole, Eurasian Golden	*Oriolus oriolus*	1	1		
Osprey	*Pandion haliaetus*	1	1		
Ostrich, Common	*Struthio camelus*	1	1		
Owl, Barn	*Tyto alba*	1	1		
Owl, Marsh	*Asio capensis*	1	1		
Owlet, Pearl-spotted	*Glaucidium perlatum*	1	1		
Oxpecker, Red-billed	*Buphagus erythrorhynchus*	1	1		
Palm-swift, African	*Cypsiurus parvus*	1	1		
Paradise-flycatcher, African	*Terpsiphone viridis*	1	1		
Paradise-whydah, Long-tailed	*Vidua paradisaea*	1	1		
Peacock, Common	*Pavo cristatus*		1		
Penduline-tit, Cape	*Anthoscopus minutus*	1			
Penduline-tit, Grey	*Anthoscopus caroli*	1	1		
Petronia, Yellow-throated	*Petronia superciliaris*	1	1		
Pigeon, Speckled	*Columba guinea*	1	1		
Pipit, African	*Anthus cinnamomeus*	1	1		
Pipit, Buffy	*Anthus vaalensis*	1	1		
Pipit, Bushveld	*Anthus caffer*	1	1		
Pipit, Long-billed	*Anthus similis*	1	1		
Pipit, Plain-backed	*Anthus leucophrys*	1	1		
Pipit, Striped	*Anthus lineiventris*	1	1		
Plover, Common Ringed	*Charadrius hiaticula*	1			
Plover, Kittlitz's	*Charadrius pecuarius*	1	1		
Plover, Three-banded	*Charadrius tricollaris*	1	1		
Pochard, Red-crested	*Netta rufina*		1		
Pochard, Southern	*Netta erythrophthalma*	1	1		
Pratincole, Black-winged	*Glareola nordmanni*	1		NT, NT	
Prinia, Black-chested	*Prinia flavicans*	1	1		
Prinia, Drakensberg	*Prinia hypoxantha*	1			SLS
Prinia, Karoo	*Prinia maculosa*	1			(*)
Prinia, Spotted	*Prinia hypoxantha*	1			
Prinia, Tawny-flanked	*Prinia subflava*	1	1		
Puffback, Black-backed	*Dryoscopus cubla*	1	1		
Pygmy-Kingfisher, African	*Ispidina picta*		1		
Pytilia, Green-winged	*Pytilia melba*	1	1		
Quail, Common	*Coturnix coturnix*	1	1		
Quail, Harlequin	*Coturnix delegorguei*	1			
Quailfinch, African	*Ortygospiza atricollis*	1	1		
Quelea, Red-billed	*Quelea quelea*	1	1		
Rail, African	*Rallus caerulescens*	1	1		
Reed-warbler, African	*Acrocephalus baeticatus*	1	1		
Reed-warbler, Great	*Acrocephalus arundinaceus*	1	1		
Robin-chat, Cape	*Cossypha caffra*	1	1		
Robin-chat, White-throated	*Cossypha humeralis*	1	1		

Rock-thrush, Cape	*Monticola rupestris*	1	1		SLS
Rock-thrush, Sentinel	*Monticola explorator*	1	1	LC, NT	SLS
Rock-thrush, Short-toed	*Monticola brevipes*	1	1		
Roller, European	*Coracias garrulus*	1	1	NT, LC	
Roller, Lilac-breasted	*Coracias caudatus*	1	1		
Roller, Purple	*Coracias naevius*	1			
Ruff	*Philomachus pugnax*	1	1		
Rush-warbler, Little	*Bradypterus baboecala*	1	1		
Sandgrouse, Double-banded	*Pterocles bicinctus*	1	1		
Sandpiper, Common	*Actitis hypoleucos*	1	1		
Sandpiper, Curlew	*Calidris ferruginea*	1		LC, NT	
Sandpiper, Marsh	*Tringa stagnatilis*	1	1		
Sandpiper, Wood	*Tringa glareola*	1	1		
Saw-wing, Black (Southern race)	*Psalidoprocne holomelaena*	1	1		
Scimitarbill, Common	*Rhinopomastus cyanomelas*	1	1		
Scops-owl, African	*Otus senegalensis*	1	1		
Scops-owl, Southern White-faced	*Ptilopsis granti*	1	1		
Scrub-robin, Kalahari	*Cercotrichas paena*	1	1		
Scrub-robin, White-browed	*Cercotrichas leucophrys*	1	1		
Secretarybird	*Sagittarius serpentarius*	1	1	VU, VU	
Seedeater, Streaky-headed	*Crithagra gularis*	1	1		
Shelduck, South African	*Tadorna cana*	1			
Shikra	*Accipiter badius*	1	1		
Shoveler, Cape	*Anas smithii*	1	1		
Shrike, Crimson-breasted	*Laniarius atrococcineus*	1	1		
Shrike, Lesser Grey	*Lanius minor*	1	1		
Shrike, Magpie	*Urolestes melanoleucus*	1	1		
Shrike, Red-backed	*Lanius collurio*	1	1		
Shrike, Southern White-crowned	*Eurocephalus anguitimens*	1	1		
Snake-eagle, Black-chested	*Circaetus pectoralis*	1	1		
Snake-eagle, Brown	*Circaetus cinereus*	1	1		
Snipe, African	*Gallinago nigripennis*	1	1		
Sparrow, Cape	*Passer melanurus*	1	1		
Sparrow, Great	*Passer motitensis*	1			
Sparrow, Grey-headed	*Passer diffusus*	1			
Sparrow, House	*Passer domesticus*	1	1		
Sparrow, Northern Grey-headed	*Passer griseus*	1			
Sparrow, Southern Grey-headed	*Passer diffusus*	1	1		
Sparrow-weaver, White-browed	*Plocepasser mahali*	1	1		
Sparrowhawk, Black	*Accipiter melanoleucus*	1	1		
Sparrowhawk, Little	*Accipiter minullus*	1	1		
Sparrowhawk, Ovambo	*Accipiter ovampensis*	1	1		
Sparrowlark, Chestnut-backed	*Eremopterix leucotis*	1	1		
Spoonbill, African	*Platalea alba*	1	1		
Spurfowl, Natal	*Pternistis natalensis*	1	1		

Spurfowl, Swainson's	*Pternistis swainsonii*	1	1			
Starling, Cape Glossy	*Lamprotornis nitens*	1	1			
Starling, Common	*Sturnus vulgaris*		1			
Starling, Pied	*Spreo bicolor*	1	1			SLS
Starling, Red-winged	*Onychognathus morio*	1	1			
Starling, Violet-backed	*Cinnyricinclus leucogaster*	1	1			
Starling, Wattled	*Creatophora cinerea*	1	1			
Stilt, Black-winged	*Himantopus himantopus*	1	1			
Stint, Little	*Calidris minuta*	1	1			
Stonechat, African	*Saxicola torquatus*	1	1			
Stork, Abdim's	*Ciconia abdimii*	1	1	NT, LC		
Stork, Black	*Ciconia nigra*	1	1	VU, LC	VU	
Stork, White	*Ciconia ciconia*	1	1			
Stork, Yellow-billed	*Mycteria ibis*	1		EN, LC		
Sunbird, Amethyst	*Chalcomitra amethystina*	1	1			
Sunbird, Greater Double-collared	*Cinnyris afer*	1	1			SLS
Sunbird, Malachite	*Nectarinia famosa*	1	1			
Sunbird, Marico	*Cinnyris mariquensis*	1	1			
Sunbird, Scarlet-chested	*Chalcomitra senegalensis*	1				
Sunbird, White-bellied	*Cinnyris talatala*	1	1			
Swallow, Barn	*Hirundo rustica*	1	1			
Swallow, Greater Striped	*Hirundo cucullata*	1	1			
Swallow, Grey-rumped	*Pseudhirundo griseopyga*		1			
Swallow, Lesser Striped	*Hirundo abyssinica*	1	1			
Swallow, Pearl-breasted	*Hirundo dimidiata*	1	1			
Swallow, Red-breasted	*Hirundo semirufa*	1	1			
Swallow, White-throated	*Hirundo albigularis*	1	1			
Swallow, Wire-tailed	*Hirundo smithii*		1			
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*	1	1			
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Swift, Common	*Apus apus*	1	1			
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Tchagra, Brown-crowned	*Tchagra australis*	1	1			
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Teal, Hottentot	*Anas hottentota*	1				
Teal, Red-billed	*Anas erythrorhyncha*	1	1			
Tern, Caspian	*Sterna caspia*	1	1	VU, LC		
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Tern, White-winged	*Chlidonias leucopterus*	1	1			
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Thick-knee, Water	*Burhinus vermiculatus*	1	1			
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Tit, Ashy	*Parus cinerascens*	1	1			
Tit, Southern Black	*Parus niger*	1	1			
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Vulture, Cape	*Gyps coprotheres*		1	EN, EN	EN	
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Widowbird, White-winged	*Euplectes albonotatus*	1	1
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Wren-warbler, Barred	*Calamonastes fasciolatus*	1	1
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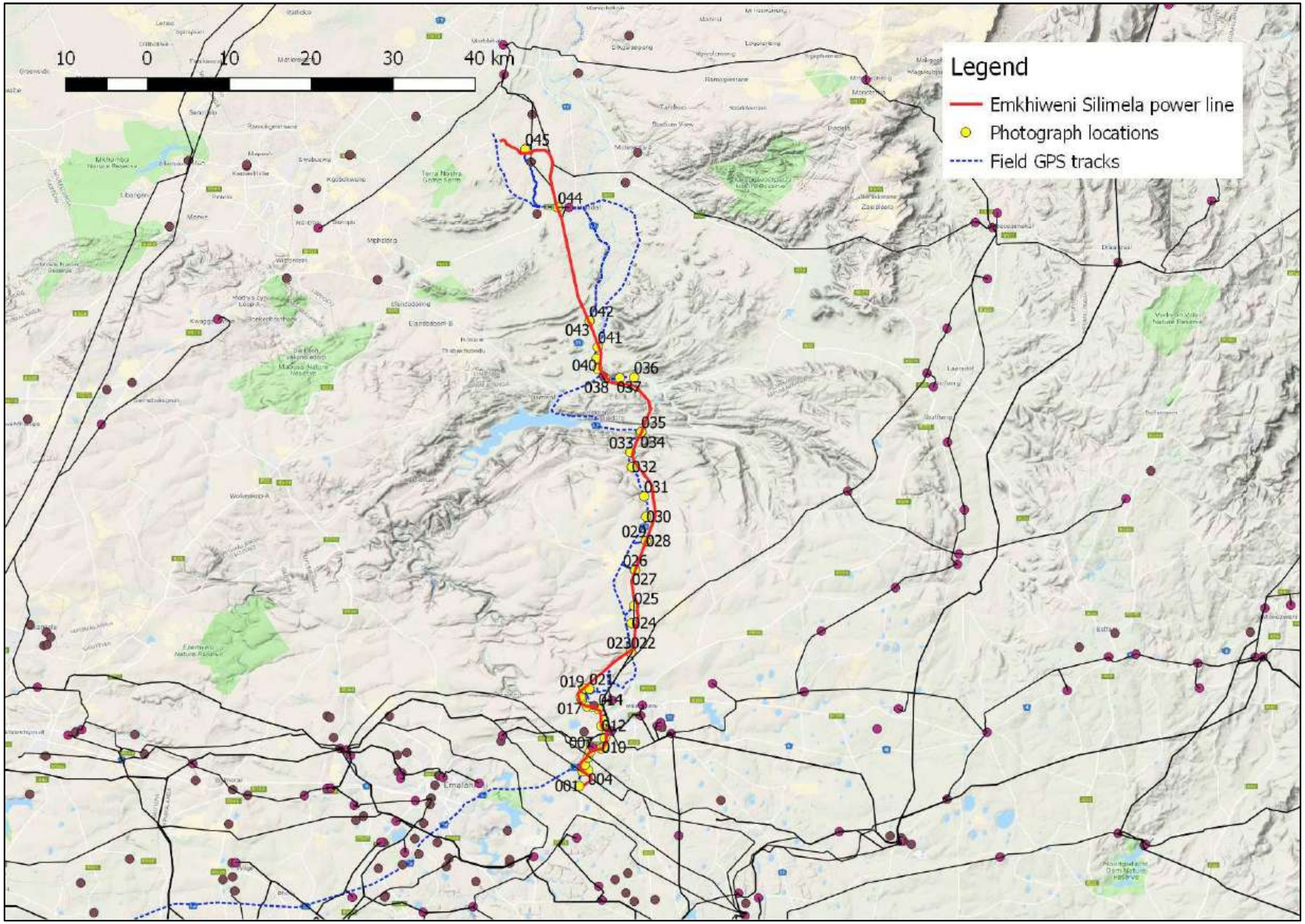
APPENDIX 3. FIELD TRACKS, PHOTOGRAPH LOCATIONS & PHOTOGRAPHS

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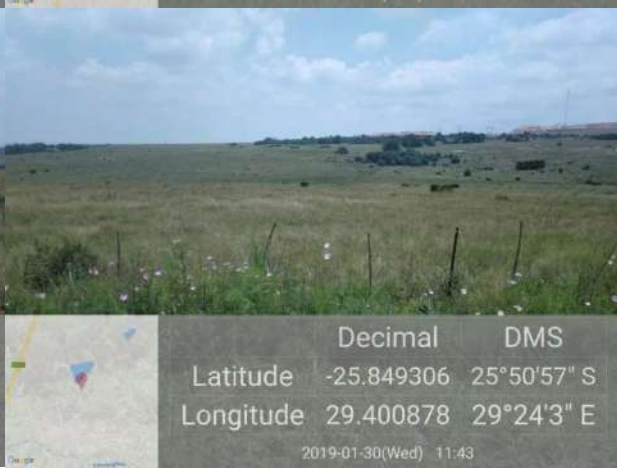
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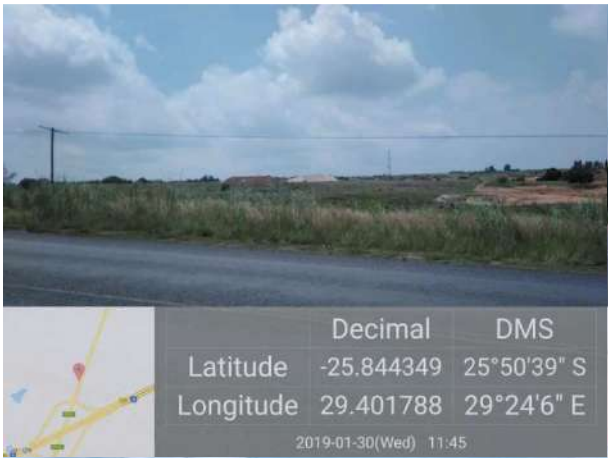
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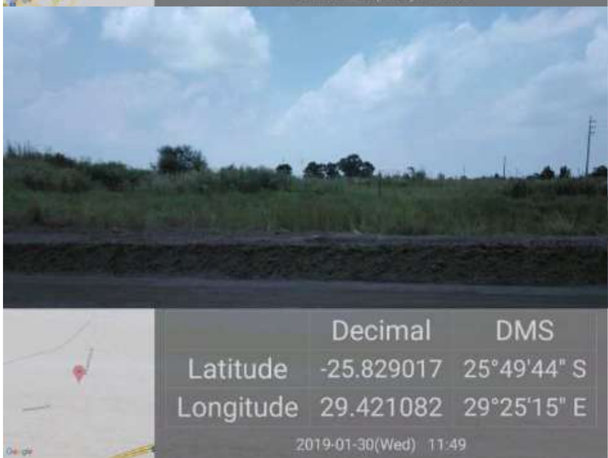
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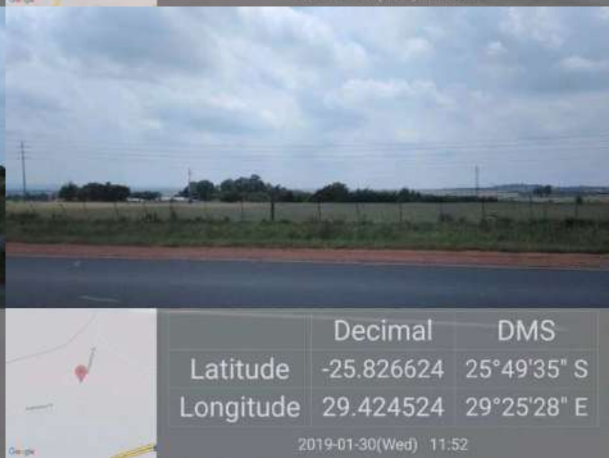
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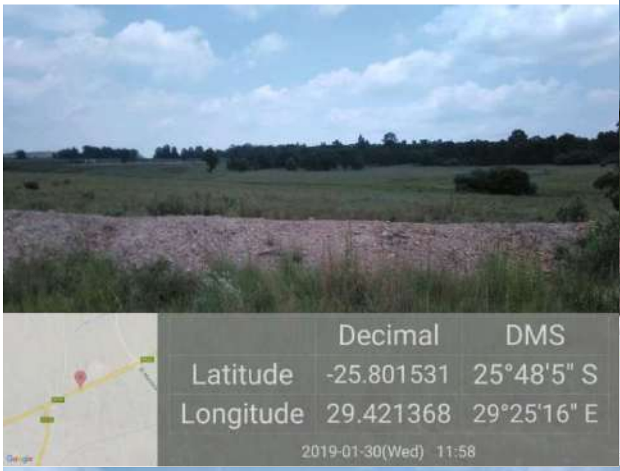
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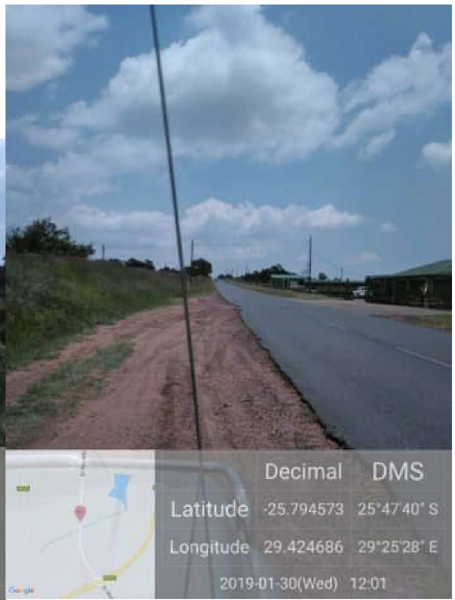
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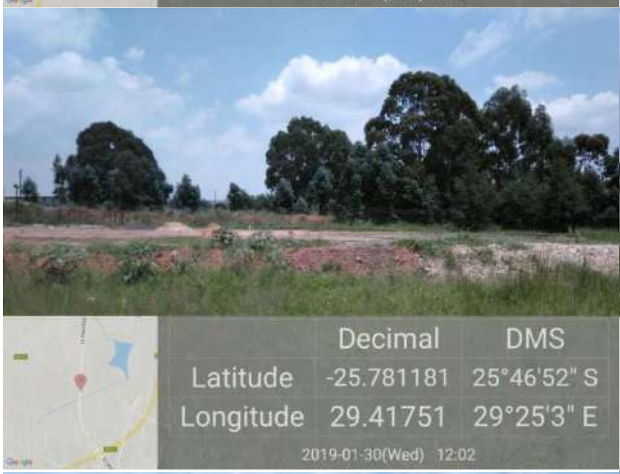
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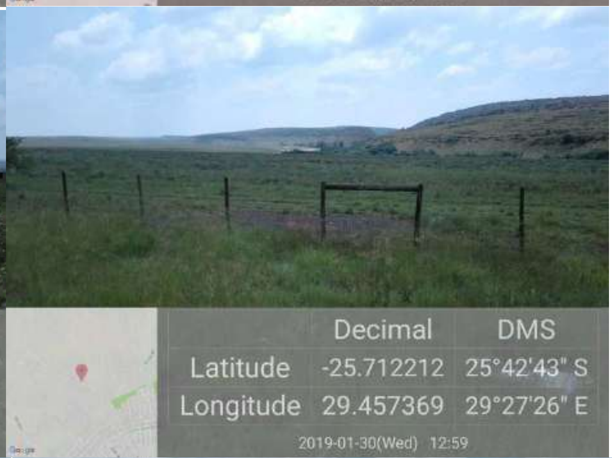
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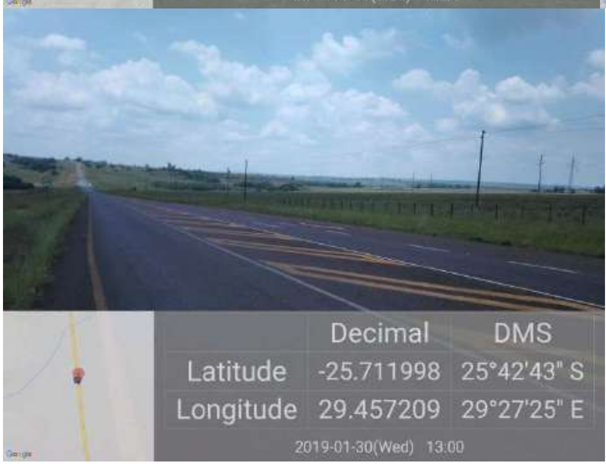
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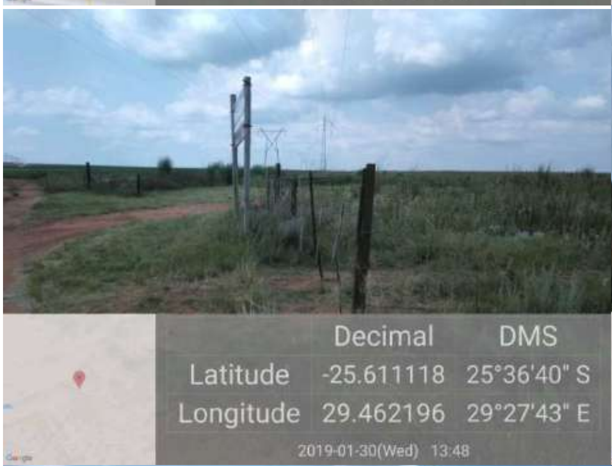
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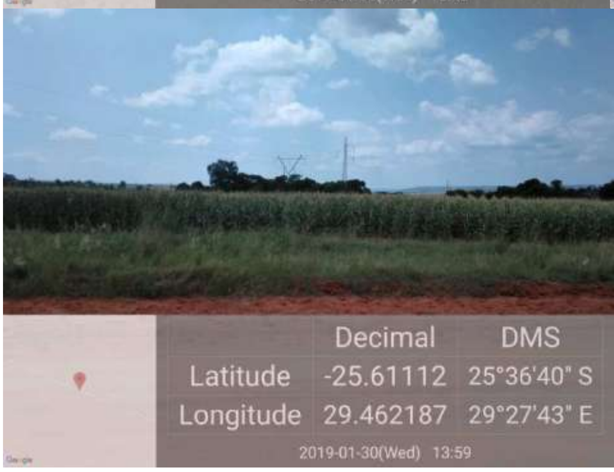
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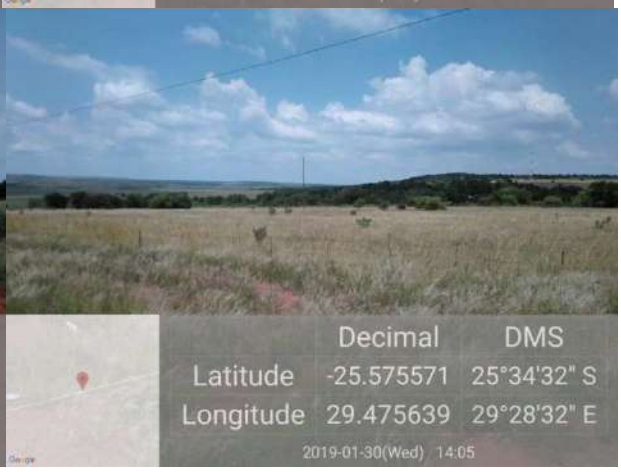
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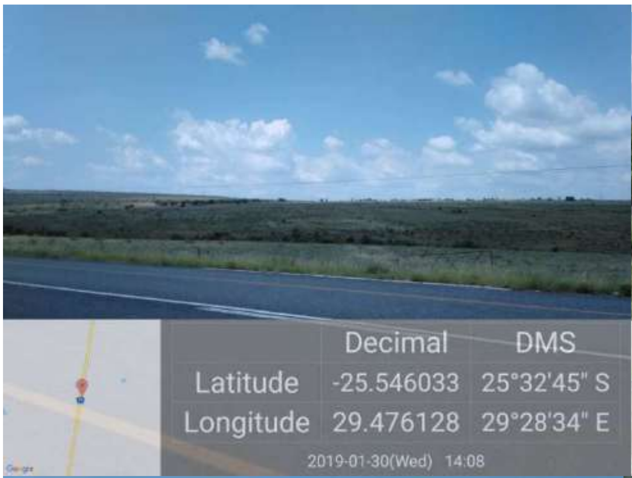
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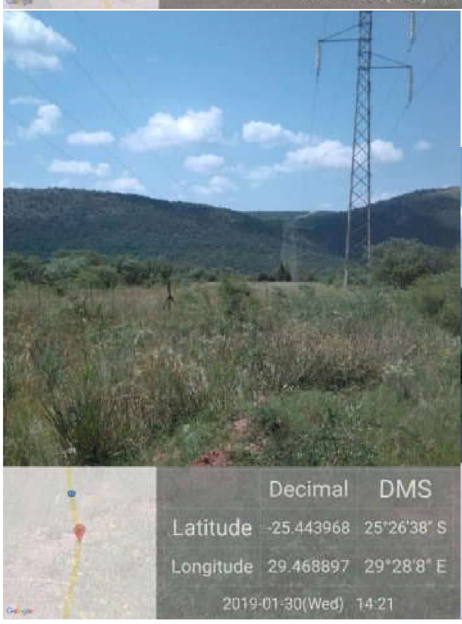
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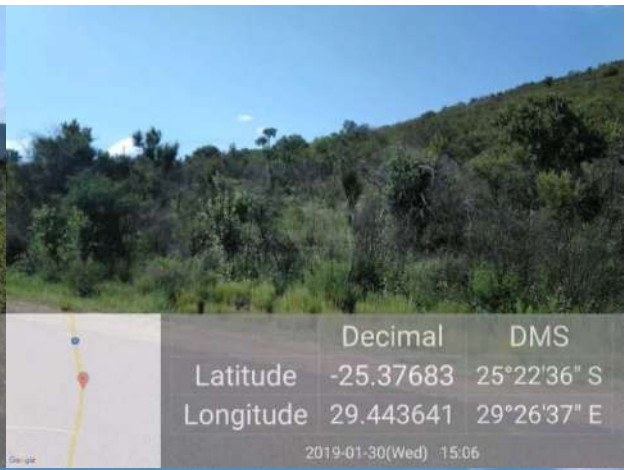
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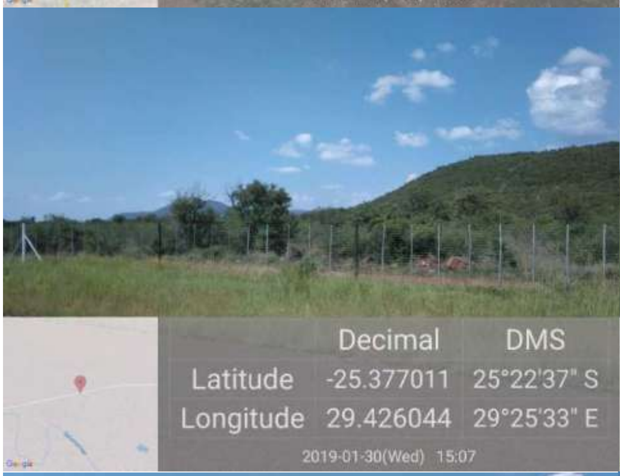
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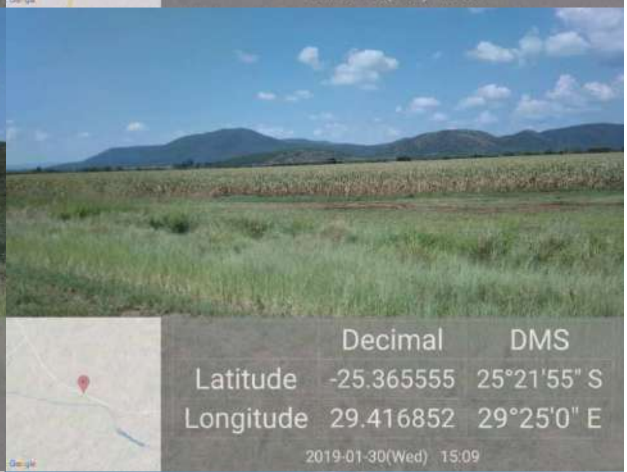
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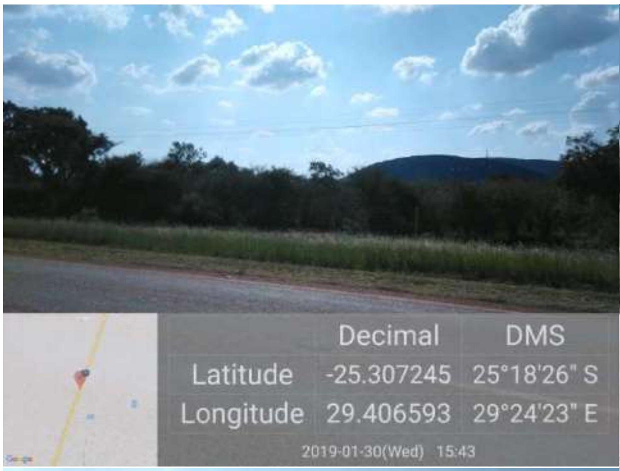
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Appendix 6C: Heritage Impact Assessment

Archaeological and Heritage EMP Walk down Report for proposed Emkhiweni Substation and 400 kv line from Emkhiweni substation to Silimela in Limpopo and Mpumalanga Province.

August 2019

Reveal. Sustain

NZUMBULULO

Archaeological and Heritage EMP Walk down for proposed Emkhiweni substation and 400 kv Powerline from Emkhiweni substation to Silimela in Limpopo and Mpumalanga Province

August 2019

For and on behalf of

Eskom Transmission (Megawatt Park)

Approved by: Dr. McEdward Murimbika

Signed:

Position: Principal Investigator

This report has been prepared by Nzumbululo Cultural Heritage and Development the trading name of Nzumbululo (Pty) Limited, one of the few consultancies able to combine natural, cultural and social environmental expertise under a one-stop consultancy supported by local expertise and knowledge with sub-Saharan regional reach and experience.

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This report is provided solely for the purposes set out in it and may not, in whole or in part, be used for any other purpose without Nzumbululo (EHS) prior written consent. Reproduction of this report is a criminal offence.

Document information

TITLE:	**ARCHAEOLOGICAL AND HERITAGE EMP WALK DOWN REPORT FOR: Emkhiweni substation and 400 Kv line from Emkhiweni substation to Silimela**
PURPOSE OF SCOPE: **The purpose of this document is to describe the cultural values and heritage factors that may be impacted on by the proposed construction of the proposed development. The proposed electrification is located in Limpopo and Mpumalanga Province.**	
DOCUMENT VERIFICATION	
Signature:	Position: Principle Investigator
Name:	Date: 2019-08-25
Consulted:	
ENDORSED **Client Project Responsible Officer to sign off.**	
Signature	Position
Name:	Date:

Nzumbululo RACIE Terms

R	Responsible: the person actually produces the document
A	Accountable: the person who has to answer for quality assurances
C	Consulted: those who are consulted before the document is finalized
I	Informed: those who must be informed when the document is published
E	Endorsed: those who must approve the final document before it is published by the client

Issue	Date	Reason For Issue	Responsible	Accountable
1		Archaeological and Heritage EMP Walk down Report	M.Murimbika	Dr. M. Murimbika

Citation:	Emkhiweni substation and 400 kv Powerline from Emkhiweni substation to Silimela.
Recipients:	Eskom Transmission Megawatt Park Sunninghill
Eskom Soc Reference	Emkhiweni substation and 400 kv powerline from Emkhiweni Substation to Silimela

Caveat

This HIA Report has been prepared for Eskom Transmission by Nzumbululo Heritage Solutions for the expressed purpose of fulfilling the requirements of the National Heritage Resources Act, Act 25 of 1999 and SAHRA regulations in terms of Sec. 38 of the Act.

Authorship: This Report has been prepared by Dr. M. Murimbika (Principal Investigator & Professional Archaeologist). The report is for the review of the Heritage Resources Agency (PHRA).

Geographic Co-ordinate Information: Geographic co-ordinates in this report were obtained using a hand-held Garmin Global Positioning System device. The manufacturer states that these devices are accurate to within +/- 5 m.
Maps: Maps included in this report use data extracted from the NTS Map and Google Earth Pro.

Disclaimer: The Author is not responsible for omissions and inconsistencies that may result from information not available at the time this report was prepared.
The Archaeological and Heritage Impact Assessment Study was carried out within the context of tangible and intangible cultural heritage resources as defined by the SAHRA Regulations and Guidelines as to the authorisation for Powerline Project being proposed by Eskom Transmission Megawatt Park

Signed by Principal Investigator:

McEdward Murimbika (Ph.D.), August 2019.

CONTENT

1. EXECUTIVE SUMMARY

1.1 Background

In March 2010 SAHRA issued a Record of Decision on the Heritage Impact Assessment Report (dated February 2009) submitted by Jan van Schalkwyk regarding the proposed development of the Marble Hall-Rockdale B powerline establishment. In line with the National Heritage Act No. 25 of 1999 Section 38 (1), SAHRA upheld the findings of the HIA Report and, among other conditions, instructed that a professional Archaeologist should conduct a final walk down survey on the tower placements along the entire 105 km (301 towers) route and the construction campsites, roads/access routes and equipment storage sites (see Appendix 1). In partial fulfilment of SAHRA conditions, Eskom Transmission appointed the Nzumbululo Heritage Solutions to conduct an Archaeological and Heritage Walk Down Survey as part of the overall Construction Environmental Management Plan development. 2019 Nemai appointed Nzumbululo to update the report with the new tower position. This report covers the Archaeological Walk Down of the alignment of the overall 108km 400kv Emkhiweni to Silimela substation

1.2 Summary Findings

The HIA Phase 1 survey recorded a number of sites within the project area. As such, this walk-down survey was conducted after Eskom has finalised the individual location of each tower within the approved servitude. The survey checked the previously recorded sites in the project in relation to final proposed tower positions and the study did not identify any significant archaeological or physical cultural property that is likely to be destroyed by the placement of the power line towers or associated development. The towers will be erected on land portions that are currently degraded or were previously disturbed, previous and current agricultural land, existing developed settlements, industrial developments area, previous road works, etc. However, although no archaeological sites classified from local, provincial or national levels of significance were recorded on the direct part of the tower position, the different archaeological materials recorded in the general project area are an indication of the potential to yield chance finds once construction begins.

The archaeology of the project area within the Limpopo and Mpumalanga Provinces is very rich and an important area of study and the potential value for addressing landscape and environmental questions in archaeology of the project region must be taken cognisance of.

1.3 Recommendations

The overall management objective of archaeological and heritage resources is the conservation of the resource *in situ* and demarcation of such sites as “no-go” areas during construction. However, where the cost implication and socio-economic implications outweigh such an option, the next option would be mitigating the impact on the resource by means of the documentation of the site by means of sampling / surface collections and in some cases-controlled excavations to collect a representative sample for further study of the site. In the present project, although no significant archaeological or heritage sites were recorded on direct path of the tower locations, but several archaeological materials were recorded in the project area during HIA Phase 1 study. No immediate intervention is recommended prior to the proposed development.

Furthermore, should any chance archaeological or physical cultural remains, such as previously unknown human remains, be exhumed or discovered subsurface during the construction work, activities on the affected tower positions, chance finds procedures should be activated. This will include caseation of any construction work on affected work site and the heritage authority (SAHRA) be notified immediately. As a cautionary measure, when construction begins, heritage rescue or salvage procedures are applicable as part of the project's Construction Environmental Management Plan.

Certain sections of the project area have yielded considerable density of archaeological sites although not associated directly with any specific planned tower position, it is likely that such section will yield chance finds during subsurface construction. As such, towers positions located in such servitude sections should be monitored by an archaeologist during construction phase.

It is the final observation of this study that the approved, substation, powerline servitude and identified powerline tower positions may proceed as planned within the approved servitude. As such the powerline may be developed subject to construction monitoring in some sections of the project area and inclusion of general heritage management plan into the project CEMP.

ABBREVIATIONS

AIA	Archaeological Impact Assessment
C	Contractor
CECO	Construction Environmental Conservation Officer
EAP	Environmental Assessment Practitioner
ECO	Environmental Conservation Officer
EIA	Environmental Impact Assessment
EM	Environmental Manager
EMP	Environmental Management Plan
HIA	Heritage Impact Assessment
LIA	Late Iron Age
NHRA	Nation Heritage Resources Act, Act 25 of 1999
PM	Project Manager
SM	Site Manager
SAHRA	South African Heritage Resources Agency
ROD	Record of Decision

DEFINITIONS

The following terms used in this Archaeological /Heritage Impact Assessment are defined in the National Heritage Resources Act [NHRA], Act Nr. 25 of 1999, South African Heritage Resources Agency [SAHRA] Policies as well as the Australia ICOMOS Charter (Burra Charter):

Archaeological Material remains resulting from human activities, which are in a state of disuse and are in, or on, land and which are older than 100 years, including artifacts, human and hominid remains, and artificial features and structures.

Chance Finds means Archaeological artefacts, features, structures or historical cultural remains such as human burials that are found accidentally in context previously not identified during cultural heritage scoping, screening and assessment studies. Such finds are usually found during earth moving activities such as water pipeline trench excavations.

Compatible use means a use, which respects the cultural significance of a place. Such a use involves no, or minimal, impact on cultural significance.

Conservation means all the processes of looking after a place so as to retain its cultural significance.

Cultural Heritage Resources Same as ***Heritage Resources*** as defined and used in the National Heritage Resources Act *(Act No. 25 of 1999*). Refer to physical cultural properties such as archaeological and palaeolontological sites; historic and prehistoric places, buildings, structures and material remains; cultural sites such as places of ritual or religious importance and their associated materials; burial sites or graves and their associated materials; geological or natural features of cultural importance or scientific significance. ***Cultural Heritage Resources*** also include ***intangible resources*** such as religion practices, ritual ceremonies, oral histories, memories and indigenous knowledge.

Cultural significance means aesthetic, historic, scientific, social or spiritual value for past, present or future generations.

Cultural Significance also encompasses the complexities of what makes a place, materials or intangible resources of value to society or part of, customarily assessed in terms of aesthetic, historical, scientific/research and social values.

Environment The surroundings within which humans exist and that are made up of: i. the land, water and atmosphere of the earth;

ii. micro-organisms, plant and animal life;

iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and,

iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being. This includes the economic, social, cultural, historical and political circumstances, conditions and objects that affect the existence and development of an individual, organism or group.

Environmental impact assessment An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of any proposed project, plan, programme or policy which requires authorisation of permission by law and which may significantly affect the environment. The EIA includes an evaluation of alternatives. As well as recommendations for appropriate mitigation measures for minimising or avoiding negative impacts, measures enhancing the positive aspects of the proposal and environmental management and monitoring measures.

Expansion means the modification, extension, alteration or upgrading of a facility, structure or infrastructure at which an activity takes place in such a manner that the capacity of the facility or the footprint of the activity is increased;

Fabric means all the physical material of the place including components, fixtures, contents and objects.

Grave A place of interment *(variably referred to as burial)*, including the contents, headstone or other marker of such a place, and any other structure on or associated with such place. A grave may occur in isolation or in association with others where upon it is referred to as being situated in a cemetery *(contemporary)* or **Burial Ground** *(historic).*

Heritage impact assessment (HIA) refers to the process of identifying, predicting and assessing the potential positive and negative cultural, social, economic and biophysical impacts of any proposed project, plan, programme or policy which requires authorisation of permission by law and which may significantly affect the cultural and natural heritage resources. The HIA includes recommendations for appropriate mitigation measures for minimising or avoiding negative impacts, measures enhancing the positive aspects of the proposal and heritage management and monitoring measures.

Historic Material remains resulting from human activities, which are younger than 100 years, but no longer in use, including artefacts, human remains and artificial features and structures.

Impact The positive or negative effects on human well-being and / or on the environment.

In Situ material culture and surrounding deposits in their original location and context, for example an archaeological site that has not been disturbed by farming.

Interested and affected parties Individuals, communities or groups, other than the proponent or the authorities, whose interests may be positively or negatively affected by the proposal or activity and/ or who are concerned with a proposal or activity and its consequences.

Interpretation means all the ways of presenting the cultural significance of a place.

Late Iron Age this period is associated with the development of complex societies and state systems in southern Africa.

Material culture means buildings, structure, features, tools and other artefacts that constitute the remains from past societies.

Mitigate The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action.

Place means site, area, land, landscape, building or other work, group of buildings or other works, and may include components, contents, spaces and views.

Protected area means those protected areas contemplated in section 9 of the NEMPAA and the core area of a biosphere reserve and shall include their buffers;

Public participation process A process of involving the public in order to identify issues and concerns, and obtain feedback on options and impacts associated with a proposed project, programme or development. Public Participation Process in terms of ***NEMA*** refers to: a process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to specific matters

Setting means the area around a place, which may include the visual catchment.

Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgments and science-based criteria (i.e. biophysical, physical cultural, social and economic).

Site A distinct spatial cluster of artefacts, structures, organic and environmental remains, as residues of past human activity.

Use means the functions of a place, as well as the activities and practices that may occur at the place.

2 INTRODUCTION

2.1 Background

This report emanates from the results of a detailed Walk-down HIA survey of 302 powerline tower positions for the proposed construction of a 108km long 400kV powerline in Limpopo and Mpumalanga Provinces. The proposed route fall within three local municipalities of: Elias Motsoaledi, and Ephraim Mogale Local Municipality in Limpopo Province and Steve Tshwete Local Municipality in Mpumalanga. The urban areas consist of the town of Marble Hall, Groblersdal, and Middleburg. Major farming areas include De Loskop North and South, Selons River Valley. The farming areas contain a number of farm settlements and agribusiness infrastructure and factories. The walk-down survey focused on all tower positions within the final approved powerline servitude following the pre-issued GPS coordinates for each tower.

The aim of the study is to identify all archaeological sites, document, and assess their importance within the Local, Provincial and National context in order assist the developer in managing any heritage resources that may be associated with the development area in a responsible manner in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

The report outlines the approach and methodology utilised before and during the survey, which includes in Phase 1: Information collection from desktop sources; Phase 2: Physical surveying of the area on foot and by vehicle; and Phase 3: Reporting the outcome of the study.

The study was designed to ensure that any significant archaeological or cultural physical property or sites that fall on the direct path of the substation and powerline towers were located and recorded, and site significance is evaluated to assess the nature and extent of expected impacts from the development. Based on this assessment, recommendations to either relocate the affected pylon of to rescue or salvage the affected site were to be made.

3 BRIEF LEGISLATION BACKGROUND

Phase 1 AIA and HIA studies were conducted to fulfil the requirements of Section 38 (1) of the National Heritage Resources Act (No 25 of 1999). This particular development also triggered the regulations applicable under the National Environmental Management Act and Environmental Conservation Act, 1989 (No 73 of 1989). As such the EIA study included a HIA specialist study and the EIAR was produced and the relevant authorities, including SAHRA's comments were invited. Following the granting of the Record of Decision for the development by the environmental authority, a detailed Walk-down archaeological and heritage survey was required. This report is an outcome of the walk-down survey of the 302-tower locations along the approved servitude.

4 PROJECT DESCRIPTION

4.1 Approved Development

Eskom SOC Limited proposes to construct 302 400kv Powerline towers over a 108km long servitude that is from Emkhiweni to Silimela (Fig. 1) traversing from Limpopo to Mpumalanga provinces. The proposed development is meant to cater for electricity requirements of the Marble Hall, Groblersdal and Middleburg areas and proposed new developments within the farming communities along the servitude, (Please refer to Fig. 1 and 2).

4.2 Project Location

The approved route fall within three local municipalities: Elias Motsoaledi, and Ephraim Mogale in Limpopo Province and Steve Tshwete Local Municipality in Mpumalanga Province. The urban areas consist of the town of Marble Hall, Groblersdal, and Middleburg. Farming areas include farms (De Loskop north and south and Selons River Valley). The farming areas are characterised by extensive cultivated lands, irrigation schemes infrastructure, commercial animal husbandry grazing areas, game farms, farm factories and farm settlements.

The project area is accessed from the R101 and R519 Road to N11 South East Highway to Marble Hall onward to Middleburg. (Refer to Fig. 1 and 2 – Google Route Map).

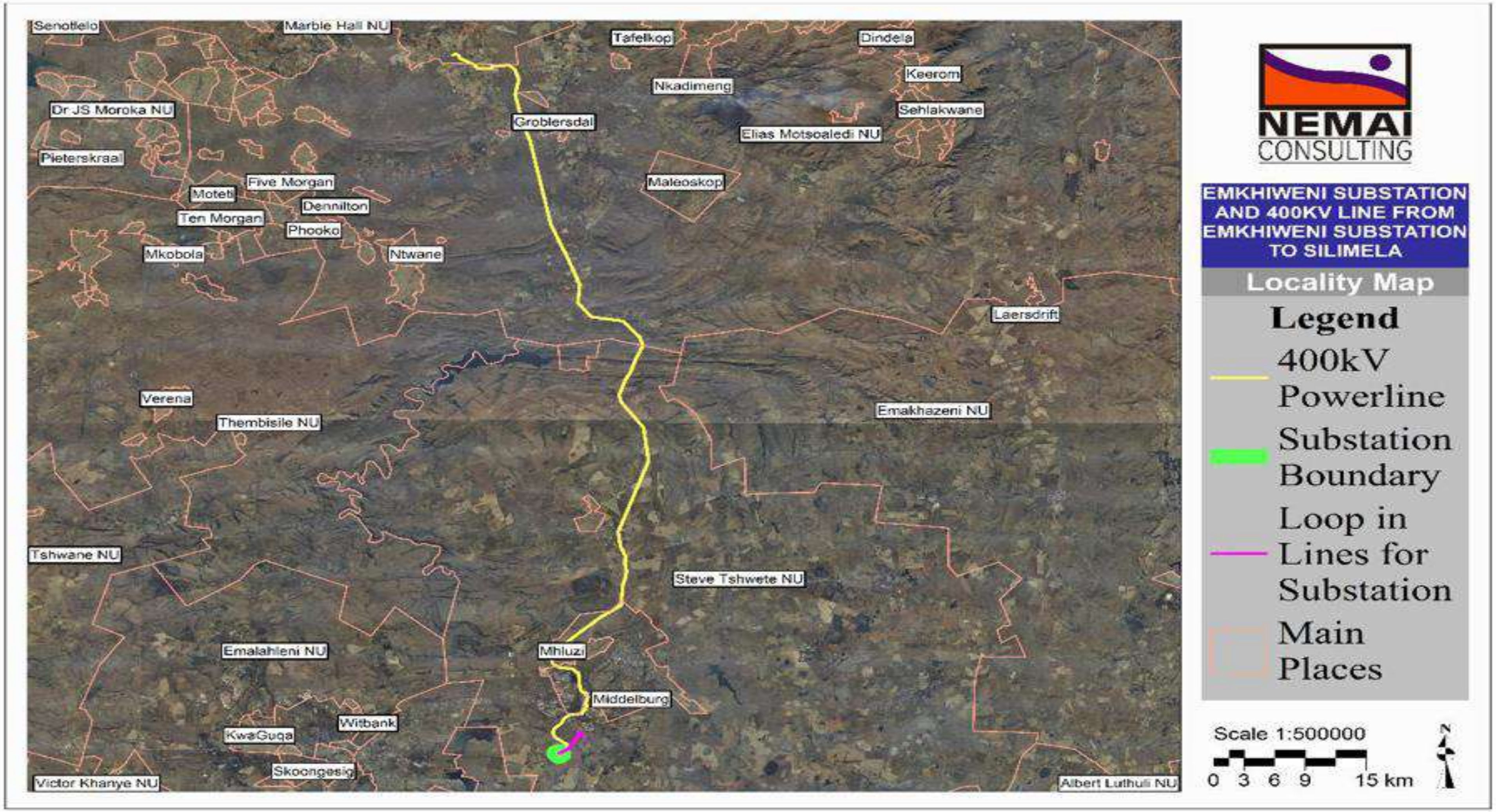


Figure 1: Locality Map of the project route (Source: Nemai Consulting BID, 2018).

Figure 2: Topographic map showing the proposed powerline servitude (Source: Nemai Consulting BID, 2018).

4.3 The Construction Process

The following is a process that will be adopted for the entire route, beginning at the starting point of the new line. Each activity will follow the previous one, such that at any one point an observer will see a chain of events, with different teams involved over time. At any one time some or all of the different teams may be working at different points along the line. There may be days of no activity in the process. Table 1 provides generic description of activities associated with the powerline development.

Table 1: Activity scheduled associated with the power line development.

Activity	**Approx. team size**	**Approx. duration at a point**
1. Centre line pegging and identification of *access*	N/A	N/A
2. Access Negotiations • an access plan is developed and agreed to by the landowners, Eskom and the contractor • rehabilitation measures are agreed to • photographs are taken before hand • access road will be established through recurring use (i.e. there will be no blading or scraping of a new road) *(light vehicle access)*	N/A	N/A
3. Tower Pegging • a surveyor has undertaken this work • the footing of the pylons will be set out • the contractor will report back if anything odd is found and the tower will be moved accordingly	N/A	N/A
4. New Access where required	N/A	N/A
5. Foundation nominations (for main structure and anchors) • soil types are checked to determine foundation requirements • trial pits are dug at the main foundation points – usually using mechanical back-actor/auger methods, though in a few circumstances manual labour may be used. *(heavy vehicle access)*	N/A	N/A
6. Excavation of foundation • foundation squares are excavated and depth depend on soil conditions • foundation pits then need to be covered or fenced off until foundation is poured *(heavy vehicle access)*	N/A	N/A
7. Foundation steelwork (reinforcing) • the steelwork is usually made up at the base camp and brought on to site by truck • all fitting, wiring is done on site (limited welding on site) *(heavy vehicle access)*	N/A	N/A
8. Foundation (concrete) pouring • shuttering • standard concrete truck used • if there are access problems, concrete will be mixed on site *(heavy usage of the servitude roads during this phase)*	N/A	N/A

Activity	Approx. team size	Approx. duration at a point
9. Delivery of tower steelwork • steelwork is delivered in sections and assembled on site • one truck can transport one tower • transported from the factory to site (the towers are individually designed for each location) • access roads are clearly marked to ensure the correct tower is delivered *(heavy vehicle access)* *(extra long trucks will be used)*	N/A	N/A
10. Assembly team / Punching and painting • the steelwork is fitted together and assembled on the ground • nuts are punched and non-corrosive paint is placed on the nuts *(light vehicle access)*	N/A	N/A
11. Erection • Cranes pick up the towers for final assembly. *(abnormal load vehicle access)*	N/A	N/A
12. Stringing • cable drums are placed next to each other within the servitude • stringing takes place in both directions from the drum stations • the working area at each drum station will be as long as 130m, but will be confined to the servitude width. Intensive vehicle movement may take place within this working area • a pilot tractor will place the pilot cable on the ground • this cable is then pulled up through the use of a pulley • conductors are never to touch the ground • in mountainous areas, a helicopter can be used or the pilot rope can be shot across valleys *(abnormal load vehicle access)* *(intensive vehicle activity likely within the working area)*	N/A	N/A
13. Sag and tension The line is tensioned from each cable station to ensure minimum ground clearance heights are achieved *(heavy vehicle access)*	N/A	N/A
14. Rehabilitation • rehabilitation is a continuous process during the construction phase • rehabilitation will typically only commence after the towers have been strung *(heavy and light vehicle access)*	N/A	N/A

4.4 Construction Camps

The entire construction workforce is usually stationed at ‘construction camps’ that will be situated at various points along the route. The location is selected by the contractor who will take into account such aspects as access to the construction site, access to services, access to materials, etc. The contractor will enter into an agreement with a landowner for the establishment of the construction camp.

The various teams will travel from the camp to the construction site each day. The site moves continuously with the progression of the line, so the teams will perhaps travel a different distance to the site each time.

All materials are stored at the construction camp with the exception of those materials which may come direct from the factory and concrete unless the site is very remote, when concrete may be mixed on site.

5 METHODOLOGY

This Heritage and Archaeological Walk Down (AWD) report was compiled in line with the stipulated guidelines in the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (no 107 of 1998) and as was requested by SAHRA. The AWD process consisted of three steps:

- Step I – Literature Review: The background information to the field survey leans greatly on the HIA Phase 1 and archaeological desktop survey completed for the EIA report.

- Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by the author aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

- Step III – The final step involved the recording and documentation of relevant archaeological resources, as well as the assessment of resources in terms of the archaeological impact assessment criteria and report writing, as well as mapping and constructive recommendations

5.1 Physical Surveying

The study area for the proposed projects covers approximately 108 kilometres. Due to the nature of cultural remains, with the majority of artefacts occurring below surface, an intensive foot-survey that covered the study area was conducted.

The survey focussed on the centre line of the servitude of 55 metres that will in most cases also be utilised for the tower positioning as well as other services such as service roads and construction related activities associated with the proposed new powerline line. Each accessible pylon footprint (As provided by Eskom and Nemai) was then surveyed and documented.

Table 2: SHOWING TOWER LATITUDE LONGITUDE- EAST DEGREES, MINUTES AND SECONDS SOUTH DEGREES, MINUTES AND SECONDS

	Tower			Latitude	Longitude
No.	Easting	Northing			
1	29,29873	-25,0864		29°17'55.44"E	25°5'10.98"S
2	29,29923	-25,0862		29°17'57.23412"E	25°5'10.1853600000055"S
3	29,30144	-25,0852		29°18'5.19587999999629"E	25°5'6.62747999999453"S
4	29,30421	-25,0871		29°18'15.1653599999986"E	25°5'13.3857599999956"S
5	29,30492	-25,0903		29°18'17.7263999999991"E	25°5'25.2106800000021"S
6	29,30822	-25,092		29°18'29.5959600000029"E	25°5'31.0858800000048"S
7	29,31163	-25,0937		29°18'41.8762799999979"E	25°5'37.1641200000013"S
8	29,31576	-25,0957		29°18'56.7262800000049"E	25°5'44.5131599999996"S
9	29,31905	-25,0973		29°19'8.57711999999452"E	25°5'50.377560000004"S
10	29,32068	-25,0997		29°19'14.4523199999972"E	25°5'58.7850000000032"S
11	29,32229	-25,102		29°19'20.2418399999962"E	25°6'7.06968000000018"S
12	29,32499	-25,1019		29°19'29.9769599999968"E	25°6'6.68735999999598"S
13	29,32922	-25,1017		29°19'45.1981200000054"E	25°6'6.08903999999995"S
14	29,33348	-25,1015		29°20'0.529439999996839"E	25°6'5.48567999999619"S
15	29,336	-25,1014		29°20'9.59640000000377"E	25°6'5.12891999999653"S
16	29,33809	-25,0984		29°20'17.1358800000021"E	25°5'54.1586400000014"S
17	29,34307	-25,0983		29°20'35.0671200000008"E	25°5'53.7467999999976"S
18	29,34774	-25,0982		29°20'51.8553599999947"E	25°5'53.3608800000025"S
19	29,35272	-25,098		29°21'9.78155999999842"E	25°5'52.9479599999988"S
20	29,35564	-25,1006		29°21'20.2892399999976"E	25°6'2.16503999999503"S
21	29,35844	-25,1031		29°21'30.3987599999994"E	25°6'11.0321999999948"S
22	29,35965	-25,1066		29°21'34.7364000000036"E	25°6'23.8928400000057"S
23	29,36087	-25,1102		29°21'39.1197600000049"E	25°6'36.8873999999957"S
24	29,36205	-25,1138		29°21'43.3767600000004"E	25°6'49.5064799999975"S
25	29,36126	-25,1177		29°21'40.5529199999984"E	25°7'3.73547999999914"S
26	29,36053	-25,1214		29°21'37.8972000000041"E	25°7'17.115959999997"S
27	29,3599	-25,1246		29°21'35.646840000002"E	25°7'28.4538000000029"S
28	29,35927	-25,1278		29°21'33.3543599999936"E	25°7'40.0029599999971"S
29	29,35857	-25,1313		29°21'30.8660399999988"E	25°7'52.538879999999"S
30	29,35941	-25,1349		29°21'33.867360000003"E	25°8'5.77247999999429"S
31	29,3602	-25,1384		29°21'36.715679999997"E	25°8'18.3310800000055"S
32	29,36097	-25,1418		29°21'39.4952400000059"E	25°8'30.5854800000046"S
33	29,36158	-25,1445		29°21'41.6966399999987"E	25°8'40.2900000000056"S
34	29,3624	-25,1481		29°21'44.6241599999973"E	25°8'53.1956400000053"S
35	29,36312	-25,1513		29°21'47.246760000001"E	25°9'4.75632000000616"S
36	29,3639	-25,1547		29°21'50.0410800000034"E	25°9'17.0737199999996"S
37	29,36469	-25,1582		29°21'52.8757200000038"E	25°9'29.5667999999998"S
38	29,36549	-25,1618		29°21'55.7784000000063"E	25°9'42.3608399999998"S
39	29,3664	-25,1657		29°21'59.0291999999971"E	25°9'56.6866799999949"S
40	29,36756	-25,1687		29°22'3.23183999999685"E	25°10'7.49856000000619"S
41	29,36889	-25,1722		29°22'8.00508000000121"E	25°10'19.7778000000014"S

42	29,37014	-25,1754		29°22'12.5029199999975"E	25°10'31.3478399999966"S
43	29,37149	-25,1788		29°22'17.3470799999993"E	25°10'43.8081599999975"S
44	29,37281	-25,1822		29°22'22.1124000000006"E	25°10'56.0643600000049"S
45	29,37344	-25,1853		29°22'24.3944400000021"E	25°11'6.91260000000625"S
46	29,37413	-25,1885		29°22'26.8690800000033"E	25°11'18.6766800000052"S
47	29,37486	-25,192		29°22'29.4812400000001"E	25°11'31.0930800000045"S
48	29,37556	-25,1953		29°22'31.9994399999987"E	25°11'43.0620000000056"S
49	29,37614	-25,1981		29°22'34.1014799999942"E	25°11'53.0523599999961"S
50	29,37679	-25,2012		29°22'36.456959999997"E	25°12'4.24692000000306"S
51	29,37746	-25,2043		29°22'38.8567200000057"E	25°12'15.6502799999944"S
52	29,37817	-25,2077		29°22'41.4166800000064"E	25°12'27.8161199999946"S
53	29,37882	-25,2108		29°22'43.7530800000036"E	25°12'38.9188800000031"S
54	29,37953	-25,2142		29°22'46.2939599999987"E	25°12'50.9911199999965"S
55	29,38018	-25,2173		29°22'48.6375600000034"E	25°13'2.12556000000433"S
56	29,38083	-25,2203		29°22'50.9754000000046"E	25°13'13.2330000000036"S
57	29,38157	-25,2239		29°22'53.6422800000014"E	25°13'25.902480000006"S
58	29,38226	-25,2271		29°22'56.1280800000051"E	25°13'37.7104799999938"S
59	29,383	-25,2307		29°22'58.8158400000029"E	25°13'50.477519999998"S
60	29,38372	-25,2341		29°23'1.40964000000253"E	25°14'2.79743999999539"S
61	29,38442	-25,2374		29°23'3.90300000000508"E	25°14'14.6403599999948"S
62	29,38517	-25,241		29°23'6.60443999999643"E	25°14'27.4696799999978"S
63	29,38586	-25,2443		29°23'9.10464000000218"E	25°14'39.3428400000053"S
64	29,3865	-25,2473		29°23'11.4097200000043"E	25°14'50.290440000004"S
65	29,3871	-25,2501		29°23'13.5607199999964"E	25°15'0.503999999993709"S
66	29,38785	-25,2537		29°23'16.2466799999987"E	25°15'13.2577199999957"S
67	29,38856	-25,2571		29°23'18.8307599999999"E	25°15'25.526880000001"S
68	29,3893	-25,2606		29°23'21.4688400000054"E	25°15'38.0505600000006"S
69	29,39005	-25,2642		29°23'24.1918800000062"E	25°15'50.9788799999967"S
70	29,39074	-25,2674		29°23'26.6499600000057"E	25°16'2.64612000000227"S
71	29,39146	-25,2708		29°23'29.2520399999998"E	25°16'14.9980800000031"S
72	29,3922	-25,2744		29°23'31.9282800000036"E	25°16'27.7006799999961"S
73	29,39285	-25,2774		29°23'34.2653999999965"E	25°16'38.7929999999977"S
74	29,394	-25,2801		29°23'38.4097200000053"E	25°16'48.4852799999965"S
75	29,39594	-25,2847		29°23'45.4009200000041"E	25°17'4.83503999999499"S
76	29,39669	-25,2864		29°23'48.1001999999958"E	25°17'11.1469199999976"S
77	29,39943	-25,2928		29°23'57.9433200000051"E	25°17'34.1627999999946"S
78	29,40081	-25,2961		29°24'2.92103999999455"E	25°17'45.7998000000049"S
79	29,40241	-25,2998		29°24'8.67779999999442"E	25°17'59.2591200000032"S
80	29,40401	-25,3035		29°24'14.4277200000039"E	25°18'12.7004399999959"S
81	29,40553	-25,3071		29°24'19.9177199999943"E	25°18'25.533719999994"S
82	29,40687	-25,3091		29°24'24.7474799999941"E	25°18'32.6070000000055"S
83	29,40798	-25,312		29°24'28.7315999999981"E	25°18'43.0488000000022"S
84	29,40906	-25,3148		29°24'32.6325600000024"E	25°18'53.2727999999989"S
85	29,4102	-25,3178		29°24'36.7066799999967"E	25°19'3.95003999999716"S
86	29,4113	-25,3207		29°24'40.6929600000004"E	25°19'14.396160000006"S
87	29,41264	-25,3242		29°24'45.5072399999983"E	25°19'27.0112799999998"S

88	29,41426	-25,3284		29°24'51.3291600000051"E	25°19'42.2662799999947"S
89	29,41601	-25,333		29°24'57.6277200000055"E	25°19'58.7690400000034"S
90	29,41748	-25,3368		29°25'2.91036000000275"E	25°20'12.6077999999978"S
91	29,41902	-25,3409		29°25'8.48640000000103"E	25°20'27.2158800000042"S
92	29,42088	-25,3458		29°25'15.1849199999944"E	25°20'44.7615599999992"S
93	29,42051	-25,3501		29°25'13.8212399999944"E	25°21'0.3153599999942"S
94	29,42012	-25,3544		29°25'12.4496400000041"E	25°21'15.9562799999969"S
95	29,41978	-25,3583		29°25'11.2213199999999"E	25°21'29.9642399999991"S
96	29,41943	-25,3624		29°25'9.94943999999833"E	25°21'44.4650400000052"S
97	29,41911	-25,366		29°25'8.78772000000509"E	25°21'57.7152000000021"S
98	29,42118	-25,3686		29°25'16.2454799999949"E	25°22'6.81780000000344"S
99	29,4234	-25,3713		29°25'24.2403599999946"E	25°22'16.5748800000048"S
100	29,42584	-25,3743		29°25'33.0311999999978"E	25°22'27.3028799999952"S
101	29,42723	-25,3759		29°25'38.0110799999997"E	25°22'33.3796800000005"S
102	29,43052	-25,38		29°25'49.8853199999942"E	25°22'47.8689599999998"S
103	29,43213	-25,3819		29°25'55.6611599999997"E	25°22'54.9163200000027"S
104	29,43557	-25,3824		29°26'8.05991999999748"E	25°22'56.7785999999973"S
105	29,4387	-25,3829		29°26'19.3325999999965"E	25°22'58.4709600000014"S
106	29,44185	-25,3834		29°26'30.650279999997"E	25°23'0.17015999999586"S
107	29,44572	-25,384		29°26'44.5934399999965"E	25°23'2.26320000000129"S
108	29,44976	-25,3846		29°26'59.1345600000005"E	25°23'4.4455200000013"S
109	29,45434	-25,3853		29°27'15.640559999996"E	25°23'6.92232000000217"S
110	29,45892	-25,3859		29°27'32.1238799999949"E	25°23'9.39515999999514"S
111	29,4628	-25,3865		29°27'46.0972800000025"E	25°23'11.4910799999959"S
112	29,46336	-25,3872		29°27'48.0790799999997"E	25°23'13.7425199999979"S
113	29,46635	-25,3905		29°27'58.8484800000006"E	25°23'25.9792799999954"S
114	29,46881	-25,3933		29°28'7.69836000000311"E	25°23'36.0344400000014"S
115	29,47135	-25,3962		29°28'16.8762000000012"E	25°23'46.4614800000047"S
116	29,4736	-25,3988		29°28'24.9553200000005"E	25°23'55.6393200000028"S
117	29,47581	-25,4013		29°28'32.9253600000041"E	25°24'4.69331999999895"S
118	29,47818	-25,404		29°28'41.4357600000042"E	25°24'14.3603999999974"S
119	29,47891	-25,4048		29°28'44.0799600000045"E	25°24'17.363519999997"S
120	29,47993	-25,4081		29°28'47.7519600000062"E	25°24'29.3133600000053"S
121	29,48055	-25,4102		29°28'49.9835999999942"E	25°24'36.5749200000045"S
122	29,48162	-25,4136		29°28'53.831639999994"E	25°24'49.0946399999962"S
123	29,48183	-25,4143		29°28'54.5768400000054"E	25°24'51.5196000000051"S
124	29,48042	-25,4174		29°28'49.5263999999975"E	25°25'2.77356000000282"S
125	29,4795	-25,4195		29°28'46.1827199999956"E	25°25'10.2234000000024"S
126	29,47834	-25,4221		29°28'42.0060000000046"E	25°25'19.5294000000018"S
127	29,4769	-25,4253		29°28'36.8525999999957"E	25°25'31.0101600000024"S
128	29,47551	-25,4284		29°28'31.8295200000006"E	25°25'42.2007600000015"S
129	29,47483	-25,4299		29°28'29.3984399999968"E	25°25'47.6162400000035"S
130	29,4742	-25,4318		29°28'27.1106400000048"E	25°25'54.4015200000004"S
131	29,47344	-25,434		29°28'24.3922799999947"E	25°26'2.46479999999366"S
132	29,47206	-25,4381		29°28'19.4286000000031"E	25°26'17.1859200000037"S
133	29,47116	-25,4408		29°28'16.1641200000059"E	25°26'26.8674000000041"S

134	29,47007	-25,444		29°28'12.2588400000024"E	25°26'38.4478800000062"S
135	29,46898	-25,4458		29°28'8.32367999999491"E	25°26'44.9501999999961"S
136	29,46794	-25,4475		29°28'4.59660000000184"E	25°26'51.1080000000015"S
137	29,46711	-25,4489		29°28'1.60032000000541"E	25°26'56.0583600000038"S
138	29,46488	-25,4526		29°27'53.5539600000052"E	25°27'9.35207999999818"S
139	29,4641	-25,4548		29°27'50.744160000001"E	25°27'17.4556800000022"S
140	29,46297	-25,4581		29°27'46.6992000000022"E	25°27'29.1196799999955"S
141	29,46101	-25,4638		29°27'39.6233999999995"E	25°27'49.5233999999957"S
142	29,46046	-25,4653		29°27'37.6394400000027"E	25°27'55.2445200000011"S
143	29,45927	-25,4688		29°27'33.3741599999999"E	25°28'7.54139999999779"S
144	29,45878	-25,4702		29°27'31.5972000000048"E	25°28'12.6649200000028"S
145	29,4595	-25,4728		29°27'34.2035999999982"E	25°28'22.0706400000037"S
146	29,4601	-25,475		29°27'36.3722400000046"E	25°28'29.8970400000042"S
147	29,46073	-25,4772		29°27'38.6409600000039"E	25°28'38.0841599999994"S
148	29,46192	-25,4792		29°27'42.9138000000054"E	25°28'45.2197199999969"S
149	29,46374	-25,4817		29°27'49.4582400000016"E	25°28'53.9612399999993"S
150	29,46532	-25,4838		29°27'55.1397600000047"E	25°29'1.54967999999428"S
151	29,46727	-25,4864		29°28'2.17523999999656"E	25°29'10.9467599999965"S
152	29,46886	-25,4885		29°28'7.90968000000419"E	25°29'18.6050400000019"S
153	29,4708	-25,4911		29°28'14.8731599999988"E	25°29'27.9041999999981"S
154	29,47303	-25,4941		29°28'22.901520000006"E	25°29'38.6257200000023"S
155	29,47496	-25,4966		29°28'29.8657199999963"E	25°29'47.9245199999943"S
156	29,47667	-25,4989		29°28'36.0105600000037"E	25°29'56.1296399999952"S
157	29,47877	-25,5017		29°28'43.5730800000027"E	25°30'6.22656000000319"S
158	29,48085	-25,5045		29°28'51.045960000003"E	25°30'16.2039599999957"S
159	29,48269	-25,507		29°28'57.6818400000062"E	25°30'25.0628400000011"S
160	29,48307	-25,5101		29°28'59.0620799999951"E	25°30'36.4694400000047"S
161	29,48343	-25,5131		29°29'0.335039999996525"E	25°30'46.9890000000021"S
162	29,48378	-25,516		29°29'1.61052000000183"E	25°30'57.5287200000048"S
163	29,48417	-25,5192		29°29'3.00624000000539"E	25°31'9.06023999999746"S
164	29,48458	-25,5226		29°29'4.49159999999495"E	25°31'21.3348000000019"S
165	29,48495	-25,5256		29°29'5.8210800000046"E	25°31'32.3173199999994"S
166	29,48538	-25,5292		29°29'7.38492000000321"E	25°31'45.2380799999966"S
167	29,48579	-25,5325		29°29'8.82779999999514"E	25°31'57.1569600000012"S
168	29,4862	-25,5359		29°29'10.3117200000062"E	25°32'9.4153199999954"S
169	29,48659	-25,5392		29°29'11.7214799999948"E	25°32'21.0602399999959"S
170	29,48702	-25,5428		29°29'13.2781199999988"E	25°32'33.9162000000033"S
171	29,48723	-25,5445		29°29'14.028000000001"E	25°32'40.110720000003"S
172	29,48625	-25,5472		29°29'10.483440000005"E	25°32'49.7677199999987"S
173	29,48511	-25,5503		29°29'6.39528000000013"E	25°33'0.903599999997766"S
174	29,48387	-25,5536		29°29'1.93812000000605"E	25°33'13.044960000006"S
175	29,48273	-25,5567		29°28'57.8362799999948"E	25°33'24.2171999999951"S
176	29,48149	-25,5601		29°28'53.3467200000058"E	25°33'36.445319999994"S
177	29,48028	-25,5634		29°28'49.0112400000012"E	25°33'48.2536799999988"S
178	29,47916	-25,5665		29°28'44.9615999999989"E	25°33'59.2819200000062"S
179	29,47781	-25,5701		29°28'40.1185199999969"E	25°34'12.4701599999958"S

180	29,47677	-25,573		29°28'36.3586800000047"E	25°34'22.708200000003"S
181	29,47533	-25,5769		29°28'31.1869199999987"E	25°34'36.7903200000021"S
182	29,47397	-25,5806		29°28'26.3028000000031"E	25°34'50.0883599999958"S
183	29,47296	-25,5833		29°28'22.6639200000048"E	25°34'59.9955599999993"S
184	29,47185	-25,5864		29°28'18.6610799999994"E	25°35'10.8927599999973"S
185	29,47074	-25,5894		29°28'14.6531999999991"E	25°35'21.8029200000061"S
186	29,46972	-25,5922		29°28'10.987320000005"E	25°35'31.7821199999941"S
187	29,46849	-25,5955		29°28'6.5596799999774"E	25°35'43.8341999999949"S
188	29,46722	-25,599		29°28'2.00604000000169"E	25°35'56.2286400000062"S
189	29,46609	-25,602		29°27'57.9279599999995"E	25°36'7.327439999994"S
190	29,46496	-25,6051		29°27'53.8498799999974"E	25°36'18.4258800000032"S
191	29,46418	-25,6072		29°27'51.044040000001"E	25°36'26.0614799999993"S
192	29,46277	-25,6111		29°27'45.9795599999953"E	25°36'39.8433599999942"S
193	29,46132	-25,615		29°27'40.7534400000063"E	25°36'54.0644400000056"S
194	29,46006	-25,6184		29°27'36.221399999994"E	25°37'6.39587999999691"S
195	29,45893	-25,6215		29°27'32.1422400000048"E	25°37'17.4943200000061"S
196	29,45792	-25,6243		29°27'28.5047999999978"E	25°37'27.3907199999985"S
197	29,45839	-25,6274		29°27'30.2115600000039"E	25°37'38.7101999999945"S
198	29,45895	-25,6311		29°27'32.2124399999939"E	25°37'51.9794399999969"S
199	29,45951	-25,6348		29°27'34.224119999995"E	25°38'5.32104000000089"S
200	29,46002	-25,6382		29°27'36.0615600000062"E	25°38'17.5052399999981"S
201	29,46049	-25,6413		29°27'37.7730000000031"E	25°38'28.8520799999941"S
202	29,46244	-25,6453		29°27'44.7937200000015"E	25°38'43.2578400000023"S
203	29,46399	-25,6492		29°27'50.363640000005"E	25°38'57.245639999999"S
204	29,46512	-25,6521		29°27'54.4251600000055"E	25°39'7.44516000000374"S
205	29,46503	-25,655		29°27'54.1054800000043"E	25°39'17.9431200000045"S
206	29,46493	-25,6583		29°27'53.7415199999973"E	25°39'29.9005199999988"S
207	29,46484	-25,6613		29°27'53.4175199999967"E	25°39'40.5432000000025"S
208	29,46556	-25,6649		29°27'56.0015999999979"E	25°39'53.579160000003"S
209	29,46622	-25,6682		29°27'58.3941599999991"E	25°40'5.65031999999661"S
210	29,46579	-25,6711		29°27'56.8346399999999"E	25°40'15.9646800000004"S
211	29,46538	-25,6738		29°27'55.3831199999965"E	25°40'25.5651600000007"S
212	29,465	-25,6763		29°27'53.9884800000056"E	25°40'34.79016"S
213	29,46441	-25,6782		29°27'51.8652000000048"E	25°40'41.4681599999966"S
214	29,46374	-25,6803		29°27'49.466519999996"E	25°40'49.0119599999943"S
215	29,46321	-25,6819		29°27'47.5685999999942"E	25°40'54.9807600000037"S
216	29,46273	-25,6835		29°27'45.8215200000029"E	25°41'0.476160000006018"S
217	29,46247	-25,6868		29°27'44.8812000000007"E	25°41'12.4044000000049"S
218	29,46224	-25,6896		29°27'44.0791200000024"E	25°41'22.5769200000011"S
219	29,46202	-25,6924		29°27'43.2792000000038"E	25°41'32.7220799999972"S
220	29,46176	-25,6957		29°27'42.3457200000047"E	25°41'44.5653600000009"S
221	29,46153	-25,6987		29°27'41.5033199999957"E	25°41'55.2487199999939"S
222	29,46117	-25,7032		29°27'40.2285599999988"E	25°42'11.418119999995"S
223	29,46084	-25,7074		29°27'39.015360000005"E	25°42'26.8016399999954"S
224	29,45833	-25,7091		29°27'29.9912399999999"E	25°42'32.7229199999994"S
225	29,45548	-25,711		29°27'19.7114400000035"E	25°42'39.4678799999983"S

226	29,45247	-25,7129		29°27'8.87544000000446"E	25°42'46.5775199999999"S
227	29,44941	-25,7149		29°26'57.885000000004"E	25°42'53.7875999999986"S
228	29,44697	-25,7165		29°26'49.1053200000033"E	25°42'59.5472399999937"S
229	29,44368	-25,7187		29°26'37.2656400000034"E	25°43'7.31351999999504"S
230	29,44107	-25,7204		29°26'27.8620800000022"E	25°43'13.4817599999946"S
231	29,4392	-25,722		29°26'21.131160000001"E	25°43'19.2363599999948"S
232	29,43725	-25,7237		29°26'14.1046799999992"E	25°43'25.2436799999938"S
233	29,43435	-25,7262		29°26'3.66899999999731"E	25°43'34.1652000000022"S
234	29,43178	-25,7284		29°25'54.4133999999985"E	25°43'42.0772800000063"S
235	29,42935	-25,7304		29°25'45.6448800000004"E	25°43'49.5724799999988"S
236	29,42708	-25,7324		29°25'37.4735999999984"E	25°43'56.5571999999986"S
237	29,42452	-25,7346		29°25'28.2889199999971"E	25°44'4.40735999999532"S
238	29,42189	-25,7368		29°25'18.8108399999948"E	25°44'12.508080000004"S
239	29,4191	-25,7392		29°25'8.77008000000359"E	25°44'21.088680000006"S
240	29,41685	-25,7411		29°25'0.65423999999723"E	25°44'28.024080000005"S
241	29,4146	-25,743		29°24'52.5524400000015"E	25°44'34.9476000000058"S
242	29,41171	-25,7455		29°24'42.1513199999941"E	25°44'43.834559999994"S
243	29,40968	-25,7472		29°24'34.8440399999978"E	25°44'50.0783999999945"S
244	29,40772	-25,7489		29°24'27.7970399999992"E	25°44'56.0990399999957"S
245	29,40504	-25,7512		29°24'18.1407599999991"E	25°45'4.34879999999396"S
246	29,40231	-25,7535		29°24'8.30340000000604"E	25°45'12.7526400000022"S
247	29,39952	-25,7559		29°23'58.2557999999989"E	25°45'21.3357599999952"S
248	29,39741	-25,7577		29°23'50.6885999999963"E	25°45'27.7995599999954"S
249	29,39517	-25,7596		29°23'42.6123600000051"E	25°45'34.697879999996"S
250	29,39246	-25,7619		29°23'32.8693200000015"E	25°45'43.0196400000042"S
251	29,393	-25,7642		29°23'34.8125999999962"E	25°45'51.1729200000005"S
252	29,3935	-25,7663		29°23'36.5838000000008"E	25°45'58.6033200000031"S
253	29,39429	-25,7696		29°23'39.4616399999944"E	25°46'10.6755599999966"S
254	29,39499	-25,7725		29°23'41.9603999999961"E	25°46'21.1583999999996"S
255	29,39785	-25,7754		29°23'52.2668399999969"E	25°46'31.2690000000012"S
256	29,4005	-25,7766		29°24'1.81404000000128"E	25°46'35.848560000006"S
257	29,40265	-25,7777		29°24'9.54683999999503"E	25°46'39.5579999999975"S
258	29,40713	-25,778		29°24'25.6510800000021"E	25°46'40.9403999999989"S
259	29,41176	-25,7784		29°24'42.3496799999972"E	25°46'42.373200000001"S
260	29,4152	-25,7795		29°24'54.7343999999973"E	25°46'46.1424000000002"S
261	29,41664	-25,7821		29°24'59.9040000000036"E	25°46'55.5495600000052"S
262	29,41978	-25,7831		29°25'11.2033199999942"E	25°46'59.1427200000064"S
263	29,42003	-25,7861		29°25'12.0943199999957"E	25°47'9.90636000000393"S
264	29,4203	-25,7893		29°25'13.0666800000014"E	25°47'21.6495600000019"S
265	29,42051	-25,7919		29°25'13.8396000000043"E	25°47'30.9861600000008"S
266	29,4207	-25,7943		29°25'14.5376400000018"E	25°47'39.4188000000003"S
267	29,42099	-25,7978		29°25'15.5733600000062"E	25°47'51.926999999998"S
268	29,42119	-25,8002		29°25'16.29516"E	25°48'0.643320000000074"S
269	29,42139	-25,8025		29°25'17.0014800000047"E	25°48'9.17315999999715"S
270	29,42353	-25,8048		29°25'24.6900000000053"E	25°48'17.3304000000013"S
271	29,42618	-25,8058		29°25'34.2408000000006"E	25°48'20.8871999999997"S

272	29,4275	-25,8081		29°25'38.9848799999967"E	25°48'29.1401999999974"S
273	29,42883	-25,8104		29°25'43.7728799999945"E	25°48'37.4691600000003"S
274	29,42803	-25,8131		29°25'40.9206000000054"E	25°48'47.0131200000051"S
275	29,42707	-25,8163		29°25'37.4516399999976"E	25°48'58.6187999999947"S
276	29,42724	-25,8187		29°25'38.047799999994"E	25°49'7.14791999999619"S
277	29,4274	-25,821		29°25'38.6439600000031"E	25°49'15.6723599999941"S
278	29,42658	-25,8226		29°25'35.6869200000048"E	25°49'21.2102399999941"S
279	29,42476	-25,826		29°25'29.1320400000018"E	25°49'33.4862400000026"S
280	29,42294	-25,8294		29°25'22.5746399999949"E	25°49'45.7662000000062"S
281	29,41901	-25,8298		29°25'8.41907999999449"E	25°49'47.3638800000037"S
282	29,41534	-25,8302		29°24'55.2330000000046"E	25°49'48.8517599999972"S
283	29,41162	-25,8307		29°24'41.8229999999943"E	25°49'50.3644799999995"S
284	29,40849	-25,8328		29°24'30.5557199999944"E	25°49'58.1455199999942"S
285	29,40554	-25,8349		29°24'19.9475999999981"E	25°50'5.47079999999625"S
286	29,40418	-25,838		29°24'15.0400799999977"E	25°50'16.7186399999991"S
287	29,40324	-25,8401		29°24'11.6747999999993"E	25°50'24.4319999999959"S
288	29,4012	-25,8418		29°24'4.31423999999424"E	25°50'30.5901600000055"S
289	29,39863	-25,844		29°23'55.0518000000051"E	25°50'38.339520000001"S
290	29,39657	-25,8457		29°23'47.6556000000056"E	25°50'44.5271999999974"S
291	29,39553	-25,8485		29°23'43.8986399999959"E	25°50'54.5107199999975"S
292	29,39476	-25,8505		29°23'41.1503999999948"E	25°51'1.81440000000293"S
293	29,39601	-25,8532		29°23'45.6410399999965"E	25°51'11.655720000004"S
294	29,39724	-25,8559		29°23'50.0495999999981"E	25°51'21.3163200000034"S
295	29,40069	-25,8584		29°24'2.49048000000215"E	25°51'30.0718800000035"S
296	29,40484	-25,8613		29°24'17.4315599999991"E	25°51'40.5867599999974"S
297	29,40866	-25,864		29°24'31.179599999995"E	25°51'50.260679999999"S
298	29,40831	-25,8664		29°24'29.9257199999991"E	25°51'58.8654000000014"S
299	29,40801	-25,8684		29°24'28.8277199999959"E	25°52'6.4027200000001"S
300	29,40437	-25,8707		29°24'15.7139999999947"E	25°52'14.6841599999976"S
301	29,40141	-25,8726		29°24'5.07095999999962"E	25°52'21.4046400000046"S
302	29,40079	-25,873		29°24'2.8501199999971"E	25°52'22.8068399999944"S

5.2 Assumptions and Limitations

The field survey did not include any form of subsurface inspection beyond the inspection of proposed tower positions and sections of the 80km long servitude. Attention was given to the sections exposed by erosion or earth moving disturbances. Some assumptions were made as part of the study and therefore some limitations, uncertainties and gaps in information would apply. It should however, be noted that these do not invalidate the findings of this study in any significant way.

1. The proposed powerline and substation project development will be limited to specific portions of servitude and laydown areas of the development (see figure 1 & 2).

2. Given the previous surface disturbance nature on most affected project servitude areas and the levels of existing developments within most of the affected landscape, most sections of the project area still have low to high potential to yield high significant in situ archaeological or physical cultural properties.
3. No excavations or sampling was undertaken, since a permit from heritage authorities is required to disturb a heritage resource. As such the results herein discussed are based on surface indicators. However, these surface observations concentrated on areas accessed and sampled since it was not viable at this stage to conduct 100% coverage of the entire servitude and substation sites.
4. No Palaeontological study was conducted as part of this HIA.
5. This study did not include any ethnographic and oral interviews. The existing studies from current and historic researches are accepted as adequate for the purposes of this HIA.

6 BRIEF CULTURE HISTORY BACKGROUND OF THE PROJECT AREA

Based on the literature survey, the description of the archaeology and history of the area is as follows:

6.1 STONE AGE

In South Africa the Stone Age can be divided in three periods showing the human history when lithic material was mainly used to produce tools (Coertze & Coertze 1996; Korsman & Meyer, 1999):

- Early Stone Age (ESA) 2 million – 150 000 years ago
- Middle Stone Age (MSA) 150 000 – 30 000 years ago
- Late Stone Age (LSA) 40 000 years ago – 1850 - A.D.

The project area has not been researched in detail enough to gauge the density of the Stone Age site in the area. As such, there are no known significant or listed Stone Age sites from this area. However, significant Stone Age sites of Middle and Late Stone Age sites have been recorded to the west of the project area stretching to areas such Bela Bela (Bergh 1999).

Rock art site which are usually associated with the Late Stone Age period have also been recorded in areas east of the project areas at locations such as close to Roossenekal (Bergh 1999).

This is evidence enough to suggest that there is potential to encounter stone age sites along the project servitude.

6.2 Iron Age

The Iron Age in South Africa it can be divided in three separate phases according to Huffman (2007) namely:

- Early Iron Age (EIA) 250 – 900 A.D.
- Middle Iron Age (MIA) 900 – 1300 A.D.
- Late Iron Age (LIA) 1300 – 1840 A.D.

The general project area falls within a region that has yield significant archaeological sites both in density and size. A large number of sites are found to the south-east of the project milieu around Roossenekal, Belfast and Machadodorp as well east to Lydenberg (Huffman, 2007). An iron working site was also identified to the east of Groblersdal, close to the Gauteng border (Bergh 1999). This indicates that the project area falls within an active archaeological zone with potential to yield significant sites.

6.3 Historical Age

The Historical Age of South Africa relates to the period covered by oral history and written records. This period relate to the recent peopling of the region extending to the colonial historic period.

The historic peopling of the project region relates to Bantu language speaking communities in the area who were ancestors of the Kgatla, a Tswana-speaking group who settled to the north-west of the Elands River and the Kôpa, a siPedi-speaking group, who stayed to the south-eats of Groblersdal (Bergh 1999).

Missionaries such R Moffat and J Archbell as well as D Livingstone and traders such as R Scoon travelled in this region and their records highlight areas between the Elands and Apies River during the mid 1800s (Bergh 1999).
Another prominant part of the history of this region related to the early white settlers that migrated into the Groblersdal – Marble Hall and Middleberg areas. From the 1830s, Voortrekker party of H van Rensburg trekked through the region and eventually White farmers permanently settled in the western parts of the surveyed area between 1841 and 1850 (Bergh 1999).

The project area has a rich historic period heritage related to the bantu-speaking communities and subsequently colonial historic heritage associated with White farming communities. The current cultural characteristics of the region were largely shaped during the colonial period from mid 1800s to the end of apartheid at the beginning of the 1990s.

7 BRIEF DESCRIPTION OF THE APPROVED SERVITUDE EMKHIWENI TO [LIMPOPO] TO SILIMELA [MPUMALANGA]

Phase 1 AIA and HIA studies conducted in 2009 highlighted the potential for the affected landscape between formal known as Rockdale Substation and Marble Hall Substation (Emkhiweni to Silimela) site to yield archaeological and cultural heritage resources. The study also identified contemporary cultural sites such as the remains of historic farmsteads that were associated with different sections of the route that was presented. This potential to affect such sites triggered the necessity of conducting a detailed Walk-down survey once the final route was approved. This route having been approved, a detailed walk-down survey covering 302 specific powerline pylon locations was conducted (see Figure 1 and 2).

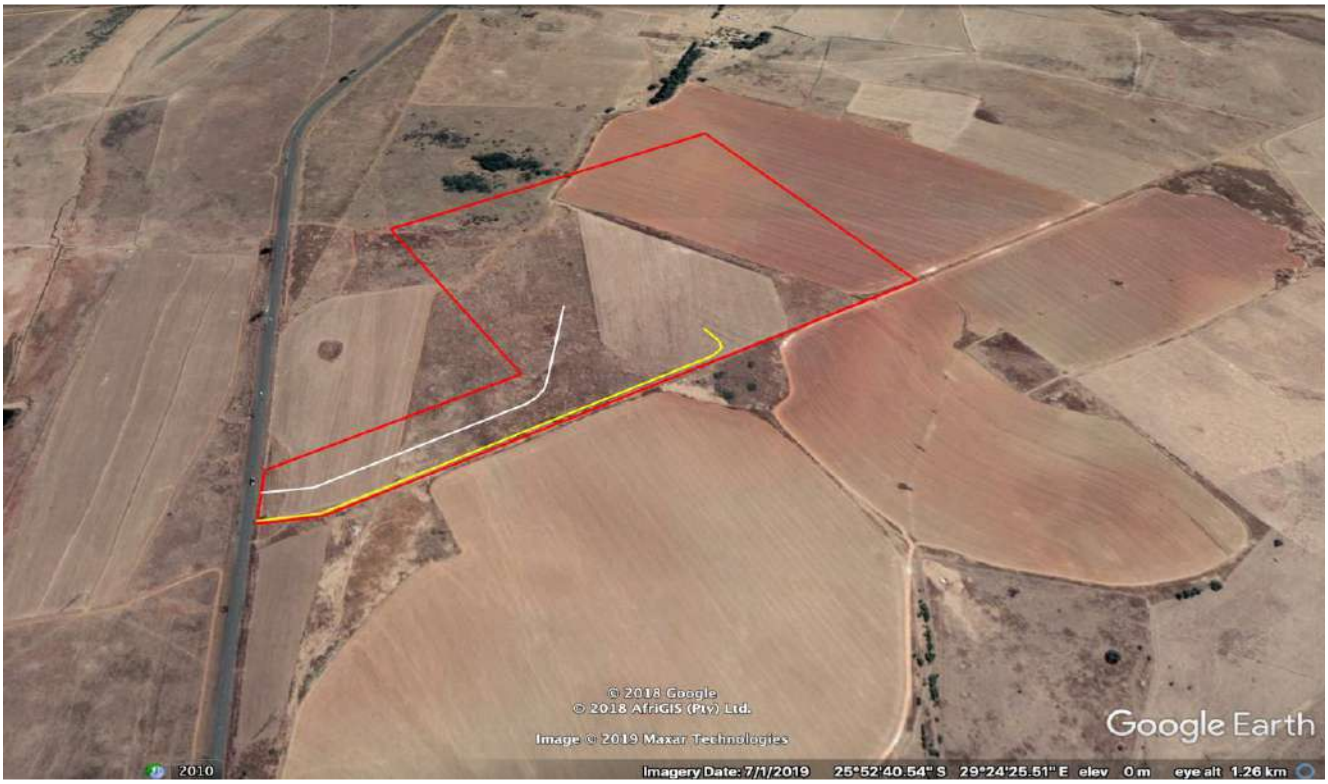


Figure 3 & 4: The Powerline will traverse from Silimela substation (top). The line will run through largely agricultural landscape bypassing farm settlements, villages and town settlement

Figure 5: The powerline will cut through agriculture fields. Note the irrigation pivots in the background

The proposed powerline traverse approximately 80km with the first tower at Silimela in a commercial agricultural landscape South of Mable Hall traversing to the southeast passing between Groblerdal to the east and Aquaville to the west.

The line starts from 25°5'10.31"S; 29°17'55.02"E on cultivated and disturbed land.

The line will proceed through agricultural and game farming landscapes crossing the Olifants River valley. The proposed servitude will cross from Limpopo into Mpumalanga Province just east of Kranspoort Vakansiedor.

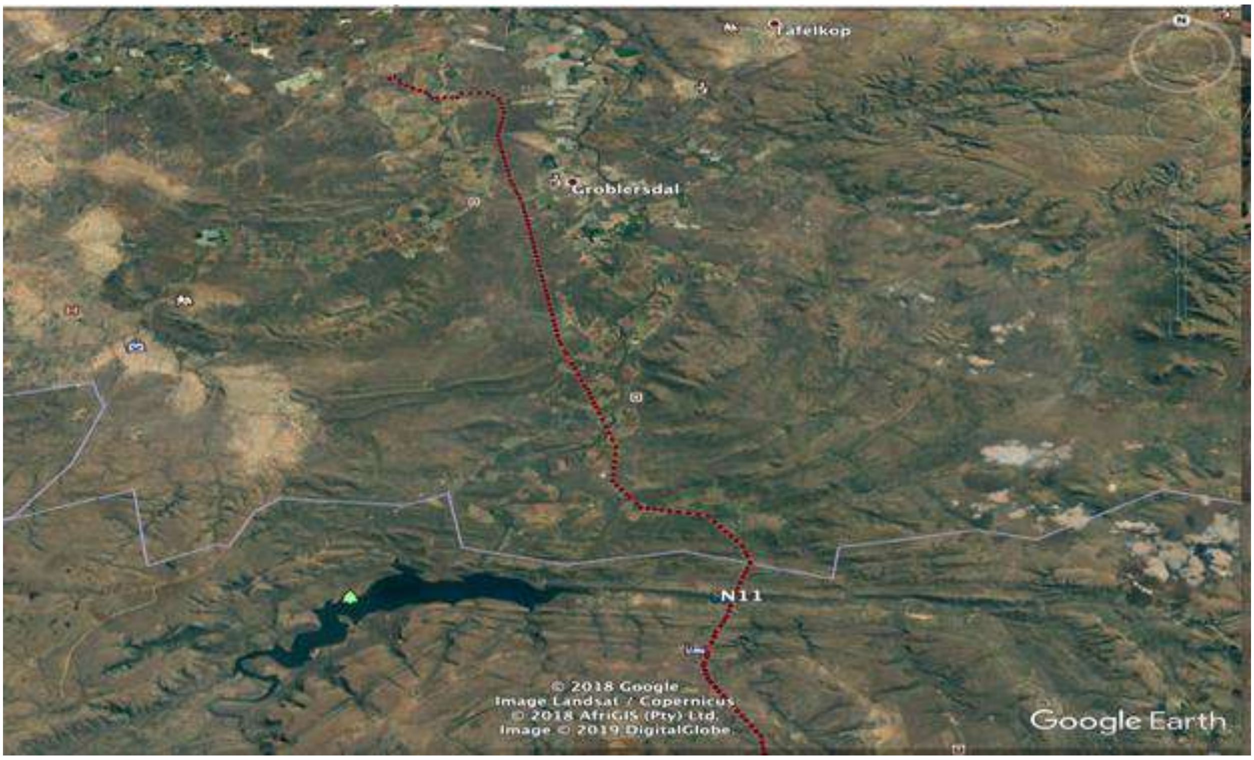


Figure 6: The location of the proposed transmission line running from Silimela through the agricultural landscape southwards past Groblersdal town and across the Olifants River Valley east of the Loskop Dam.

From here the line maintains a southwards trajectory rough along the N11 heading to Middleburg. The line will run on the periphery of Middleburg town on the western boundary of Mhlizi Township navigating between the township and the coal mining complexes of Uitkyk. It will snake through a servitude crossing the R575 from east to west then cross the N4 Highway before crossing the R575 rod eastward and terminating southwards on agricultural landscapes at Emkhiweni just on eastern side of the R575.

Figure 7: The location of the proposed transmission line running past Middleburg urban region through disturbed peri-urban and mining areas terminating in agricultural landscape south the Middleburg town, Mpumalanga Province.

The power line terminates at 25°52'22.73"S; 29°24'2.89"E

8 RESULTS OF THE ARCHAEOLOGICAL/HERITAGE ASSESSMENT STUDY - DESCRIPTION OF PROJECT AREA

The previous Phase 1 AIA and HIA studies conducted in 2013 (Murimbika, 2013) highlighted the potential for the affected landscape specifically areas around Silimela Substation site where the proposed line would start to yield archaeological and cultural heritage resources. The study also identified contemporary cultural sites such as the remains of historic farmsteads that were associated with different sections of the route that was presented.

Figure 8 and 9: The proposed powerline will cut through agriculture fields.

Figure 8 and 9 shows portions of previously degraded and disturbed land portions where existing minor reticulation powerlines already traverses across the farm marked with irrigation infrastructure, farm roads, boundary fence lines. Inspection of the disturbed sections did not yield archaeological materials or possible sites on direct path of the powerline.

The area is significantly disturbed from previous and current agricultural land use activities (Figure 10 & 11). The proposed powerline servitude runs parallel to Groblersdal –Wolwekraal 88 kv powerline.

Figure 10 & 11: Thickly vegetated grazing areas. Note the thick grass cover and leaf cover which compromised visibility of possible surface remains.

The area between Groblersdal and the Olifants River Valley is characterised by existing high and medium voltage powerlines, irrigation infrastructure, farm settlements, farm tracks, farm processing sites, farm labourer's dwellings, boundary fence lines. There is an existing 88kv powerline that runs parallel to the proposed powerline. As such, the development will be an in situ addition to an already altered cultural landscape.

Figure 12: From Groblersdal toward the Olifants river valley, the proposed powerline will run along existing 88kv powerline servitude.

8. 1. Locations Structure 1 to Structure 22

Structures 1 to 22 shown in Figure 13 are all situated on portion of previously degraded and disturbed land portions where existing minor reticulation powerlines already traverses across the farm marked with irrigation infrastructure, farm roads, boundary fence lines and an 88kv powerline. The survey of Pylon Structures positions 1 to 22 did not yield archaeological materials or possible sites on direct path of the powerline development.

Impact	Impact Significance	Heritage Significance	Certainty	Duration
None	Low	None	Unsure	Short term

Mitigation

None required. All towers are positioned within currently and previously cultivated land which left no trace for surficial visible archaeological material (Plate 1). However, in the unlikely event that chance archaeological materials are disturbed at any of the tower position, salvage and chance finds procedures should be implemented.

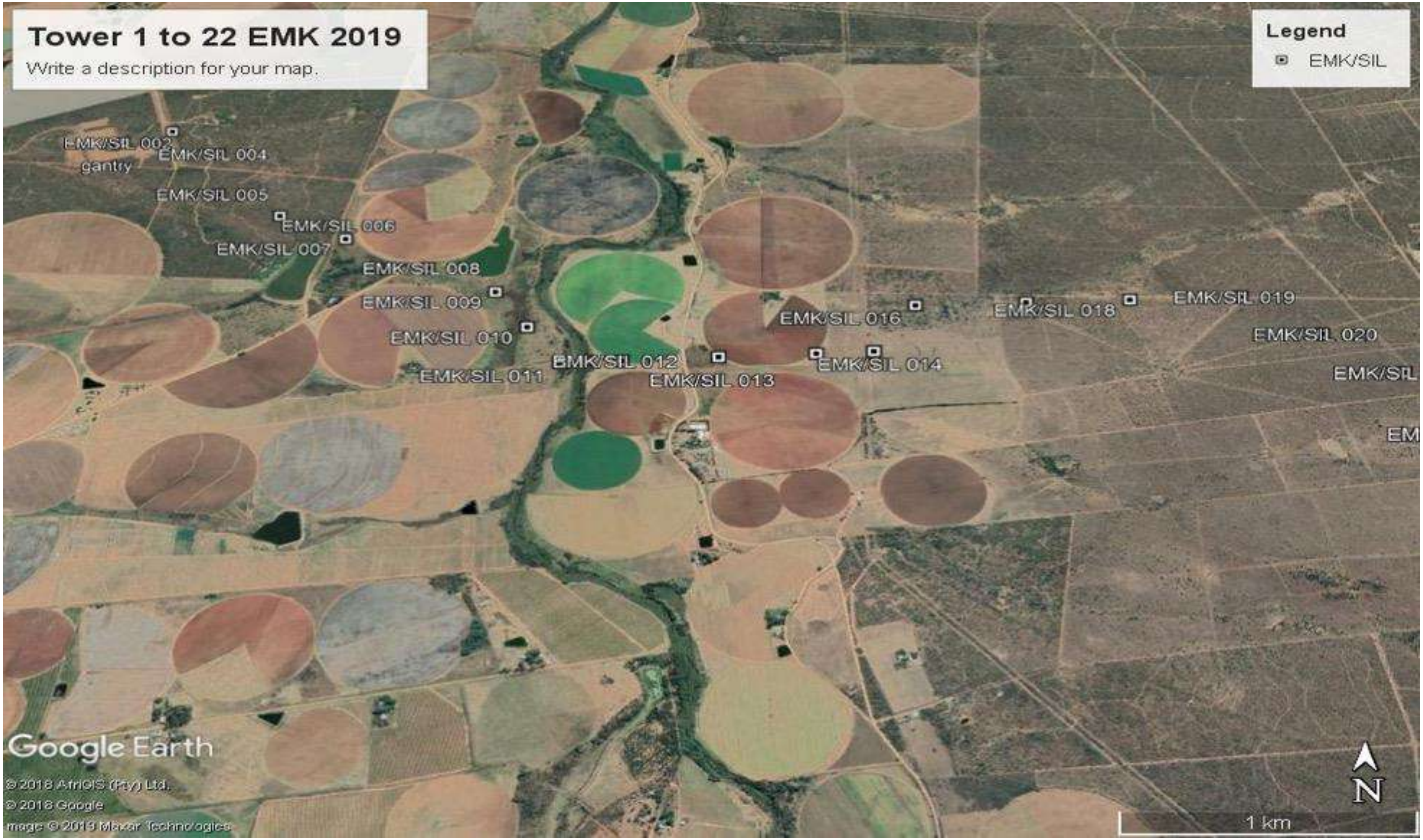


Figure 13: The powerline pylon positions follow the servitude that cuts across commercial farming area characterised by agriculture fields, irrigation infrastructure settlements, along main roads and across open lands with existing powerlines and other developments.

Figure 14: Pylon Structures 1 to 22 are located in predominantly commercial agriculture area characterised by commercial farming infrastructure

8.2 LOCATIONS STRUCTURE 21 TO STRUCTURE 44

Towers 22 to 44 are located within Portion 6 Vaalfontein 14, Portion 996 Loskop Noord 12 JS, Portion 39, 47 & 54 Klipbank 26 JS. The area is significantly disturbed from previous and current agricultural land use activities (see Figure 14). The proposed powerline servitude runs parallel to Groblersdal – Wolwekraal 88 kv powerline.

Figure 15: Some pylons from tower 22 to 44 will cut through thickly vegetated grazing areas. Note the thick grass cover and leaf cover which compromised visibility of possible surface remains.

Impact	Impact Significance	Heritage Significance	Certainty	Duration
Low	Low	None to Undetermined	Unsure	Short term

Mitigation

No further mitigation is required prior to construction phase. However, in the unlikely event that chance archaeological materials are disturbed at any of the remaining tower positions in this section, salvage and chance finds procedures should be implemented.

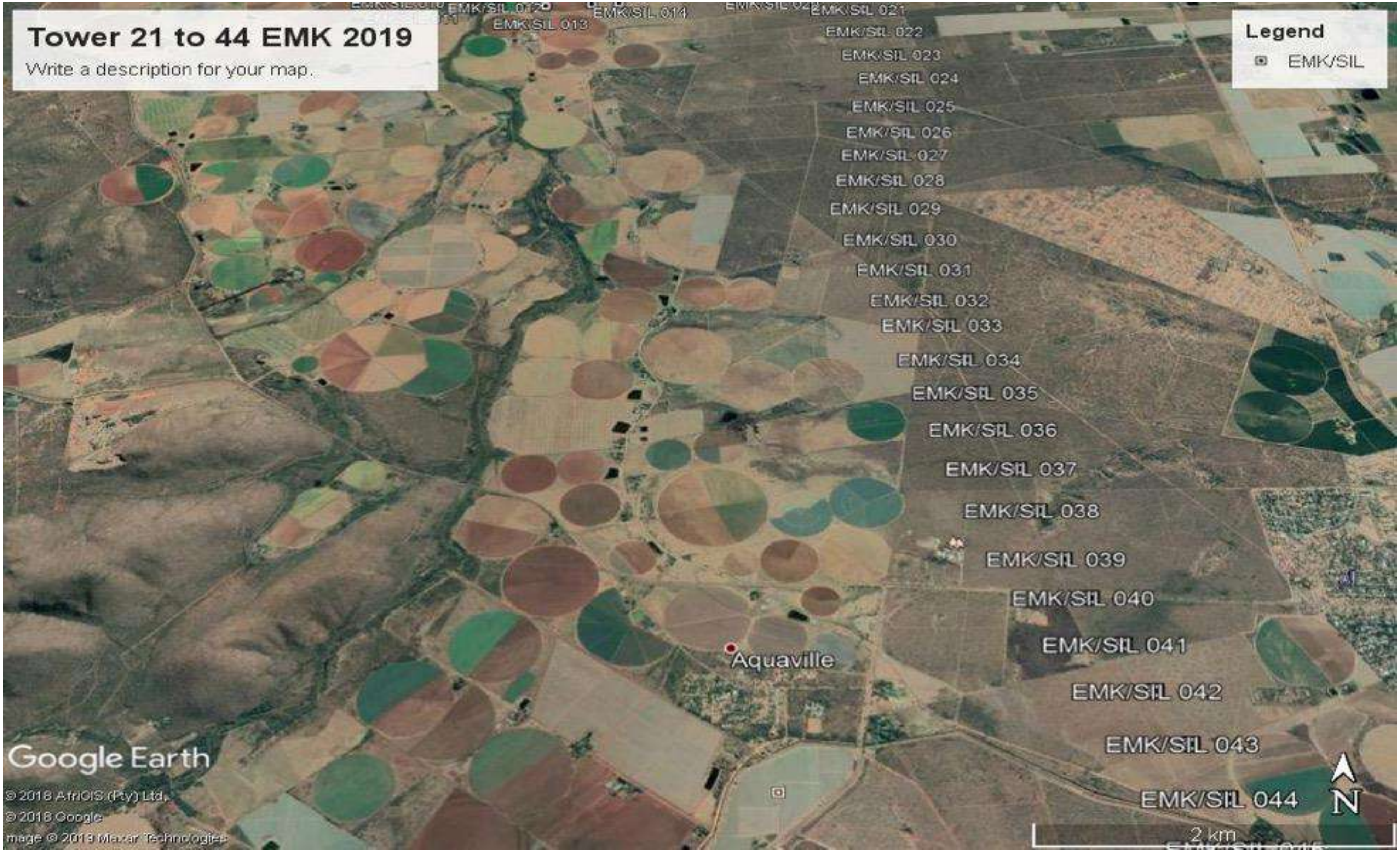


Figure 16: Powerline Pylon Structures 21 to 44 are also located in commercial agriculture lands characterised by cultivated land and irrigation infrastructure.

8.3 Locations Structure 44 to Structure 80

Structures 44 to 80 are located in an area characterised by existing high and medium voltage powerlines, irrigation infrastructure, farm settlements, farm tracks, farm processing sites, farm labourer's dwellings, and boundary fence lines.

Impact	Impact Significance	Heritage Significance	Certainty	Duration
None	Medium-low	None to Undetermined	Unsure	Short term

Mitigation

No further mitigation is required prior to construction phase. However, in the unlikely event that chance archaeological materials are disturbed at any of the remaining tower position s in this section, salvage and chance finds procedures should be implemented.

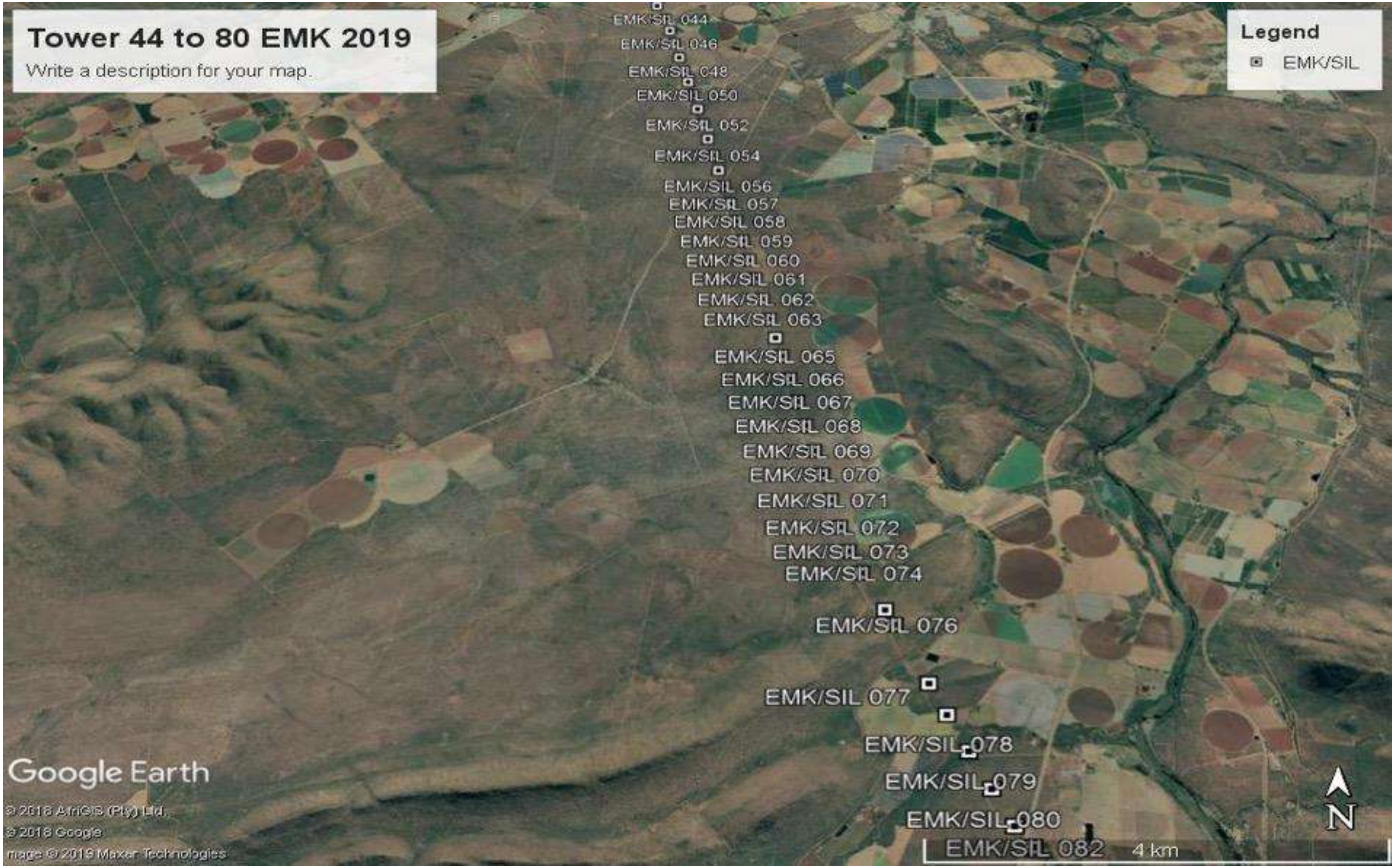


Figure 17: Structures 44 to 80 are situated along commercial grazing and agriculture area. Note some farm dwellings in the vicinity of tower 41 to tower 45

8.4 Locations Structure 80 to Structure 90

The survey of Pylon Structures positions 80 to 90 archaeological small pieces of potsherd materials on between specifically tower 83 and 84 within the servitude path of the development. Where the servitude crosses the N11 after Groblersdal, inspection of the farm road on agricultural land yielded archaeological potsherds and small grinding stone (Fig. 18).

Figure18: small pieces of potsherds and grinding stone recovered on farm road cut. These finds did not yield a clear provenance but they indicate the presence of Iron Age site in this vicinity.

The survey of area close to the N11 after Groblersdal yield archaeological materials or possible sites on direct path of the powerline development (Fig 18). These archaeological materials were identified at at **Lat.** 29°24' 31.09" E**Long.** 25°18'51.60" S on cultivated and disturbed land.

Impact	Impact Significance	Heritage Significance	Certainty	Duration
Potential disturbance of previously unknown archaeological sites	Low	unknown	Unsure	Short term

Mitigation

The artefacts indicate the presence of archaeological sites in the project foot print. (Fig. 19). CEO should closely monitor the area. In the event that chance archaeological materials are disturbed at any of the tower positions in this area, salvage and chance finds procedures should be implemented as would be directed by the SAHRA.

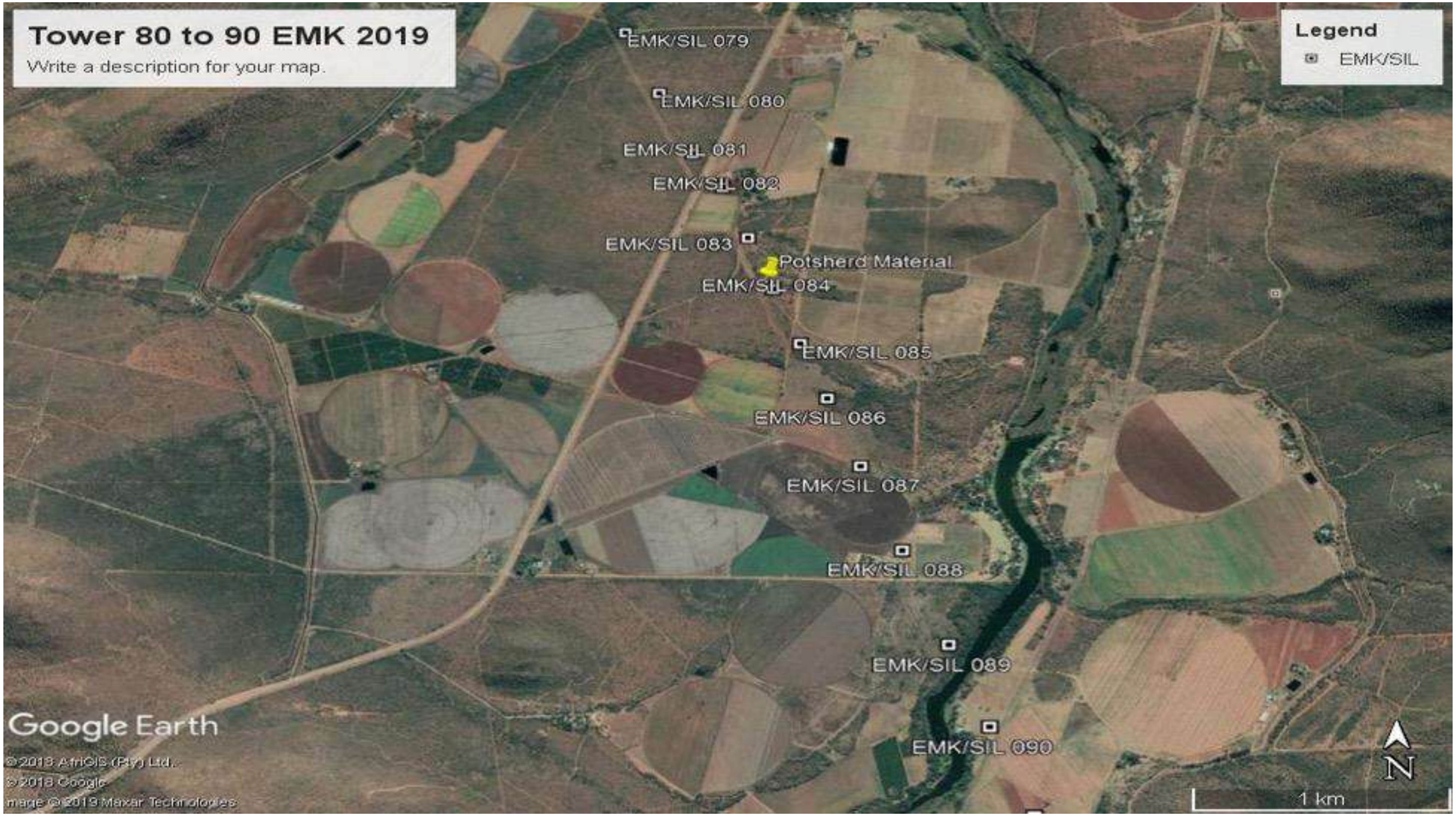


Figure 19: TWR 80 to 90 located along the meandering Olifants River valley within a mixture of disturbed agricultural land, river valley and ravines. Prehistoric potshed materials were identified in the vicinity of towers 82 and 88. The powerline will cross the Olifants River between tower 89 and tower 90.

8.5 LOCATIONS STRUCTURE 91 TO STRUCTURE 106

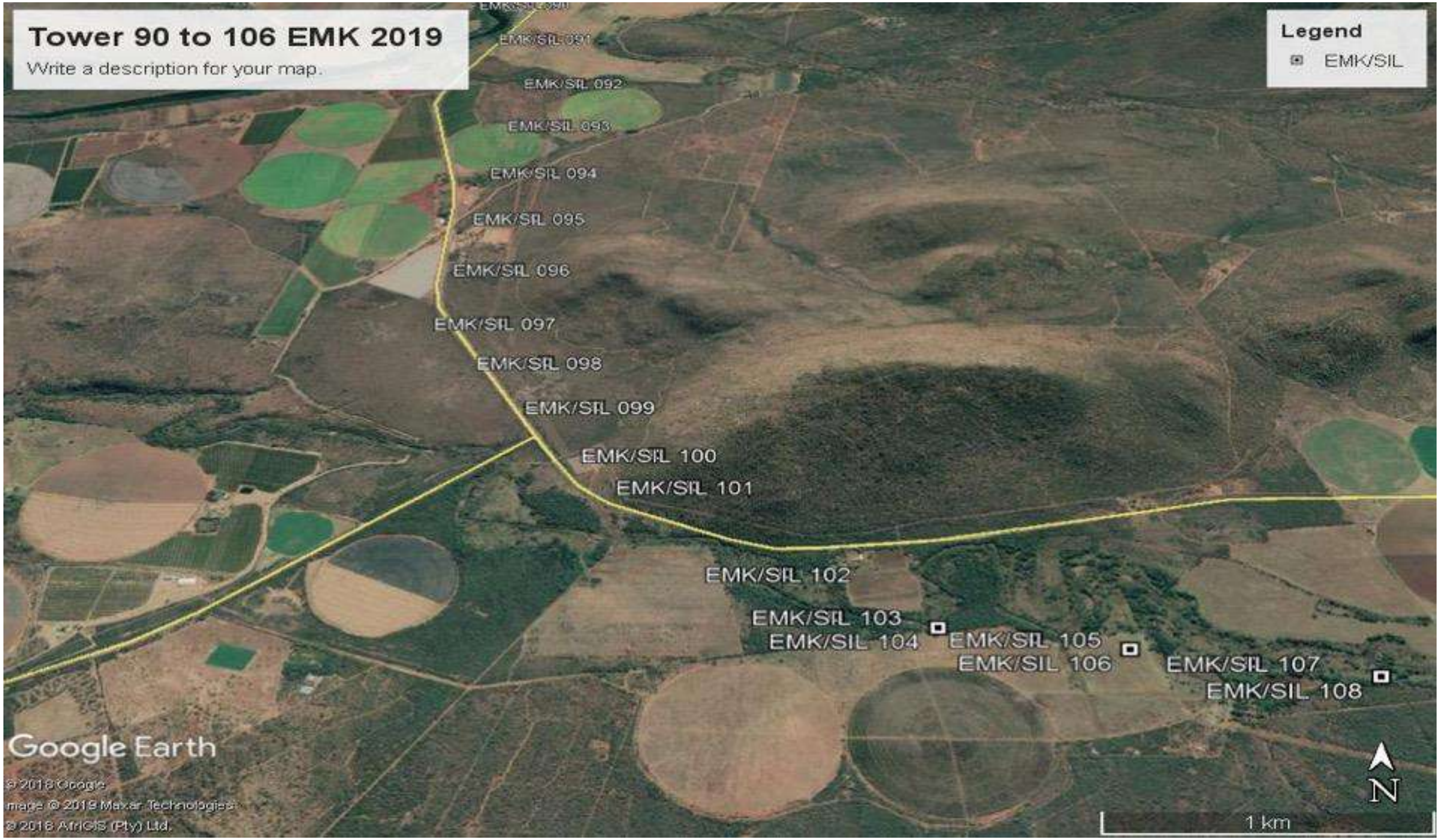
Most of the receiving land portions were previously degraded and disturbed with existing powerline, access roads, farm dwellings and agricultural fields (Fig. 20). The survey of Pylon Structures positions 91 to 106 did not yield classified archaeological sites on direct path of the development. However, portions of the section have potential to yield archaeological site as evidence by such sites recorded in previous studies in the vicinity of the servitude.

Impact	Impact Significance	Heritage Significance	Certainty	Duration
None	Low	Low	Unsure	Short term

Mitigation

None required. However, in the unlikely event that chance archaeological materials are disturbed at any of the tower position, salvage and change finds procedures should be implemented. No further mitigation is required prior to construction phase. However, should chance archaeological materials are disturbed at any of the remaining tower positions in this section, salvage and chance finds procedures should be implemented.

Figure 20: Powerline will cut across cultivated land and patches of grazing land.



8.6 Locations Structure 107 to Structure 150

Structures 107 to 150 shown in Figure 21 are all situated on portions of land consisting of access and N11 main road servitude, farm dwellings, high and low voltage powerlines, irrigation agricultural land, irrigation infrastructure, streams and grazing lands. Most of the receiving land portions were previously degraded and disturbed with existing powerline, access roads, rural homesteads and agricultural fields. A gravel road also cuts across the powerline servitude. No archaeological sites were recorded on direct path of the development.

Impact	**Impact Significance**	**Heritage Significance**	**Certainty**	**Duration**
None	Low	None	Unsure	Short term

Mitigation

None required. However, in the unlikely event that chance archaeological materials are disturbed at any of the tower position, salvage and change finds procedures should be implemented. No further mitigation is required prior to construction phase. However, should chance archaeological materials are disturbed at any of the remaining tower positions in this section, salvage and chance finds procedures should be implemented.

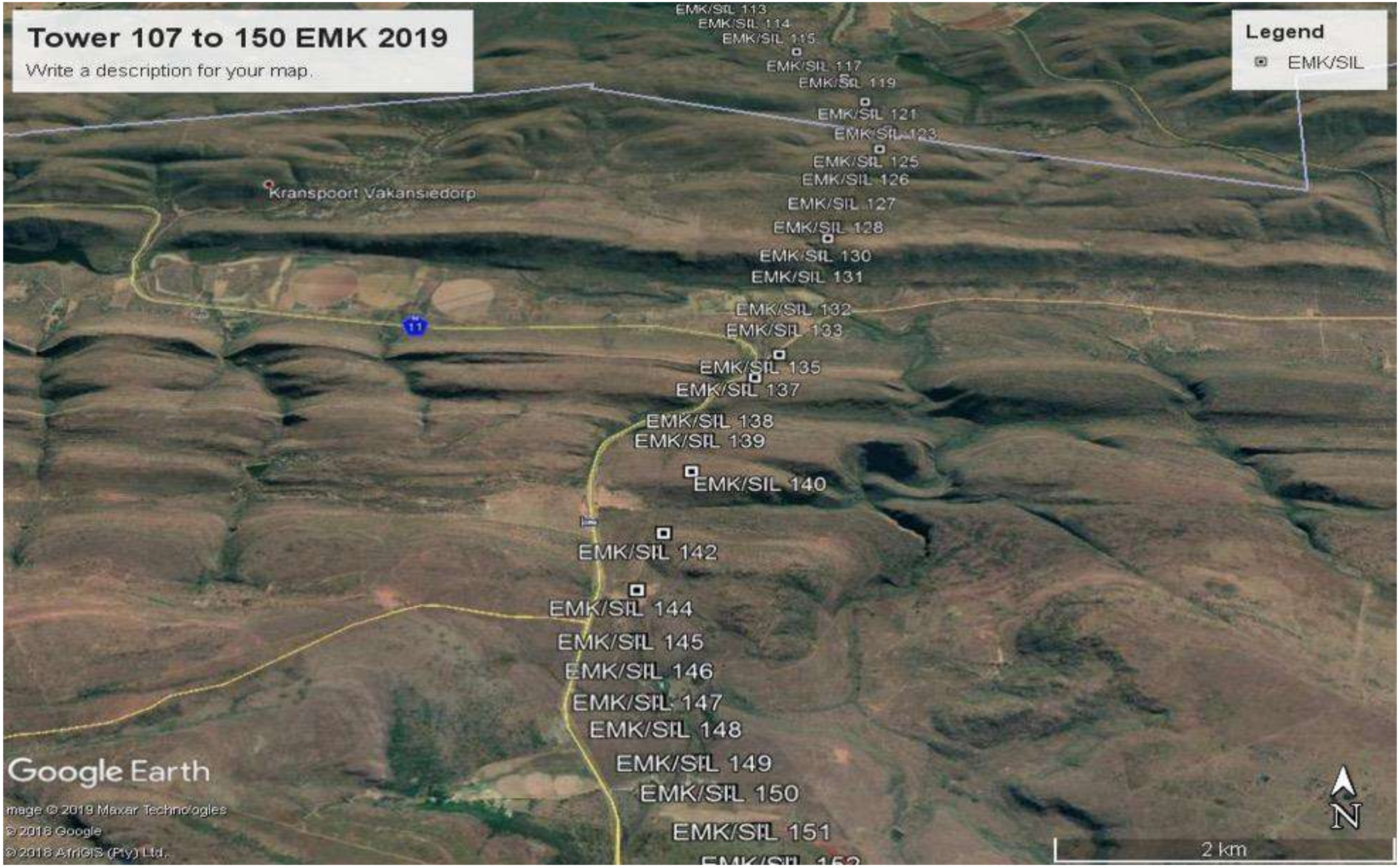


Figure 21: Powerline will cut through sloppy mountainous area.

8.7 Locations Structure 151 to Structure 181

Structures 151 to 181 shown in Figure 22 are all situated on portions of land consisting of main road servitude, farm dwellings, high and low voltage powerlines, irrigation agricultural land and infrastructure, and grazing lands. Most of the receiving land portions were previously degraded and disturbed with existing powerline, access roads, rural homesteads and agricultural fields.

Impact	**Impact Significance**	**Heritage Significance**	**Certainty**	**Duration**
None	Low	None	Unsure	Short term

Mitigation

No further mitigation is required prior to construction phase. However, should chance archaeological materials are disturbed at any of the remaining tower positions in this section, salvage and chance finds procedures should be implemented. Abandoned historic homesteads should not be interfered with without a clearance of Destruction Permit from SAHRA since some of the building remains may be 60 years of. Such old structures enjoy automatic legal protection from the NHRA. Such site may also yield previously unknown burial sites.

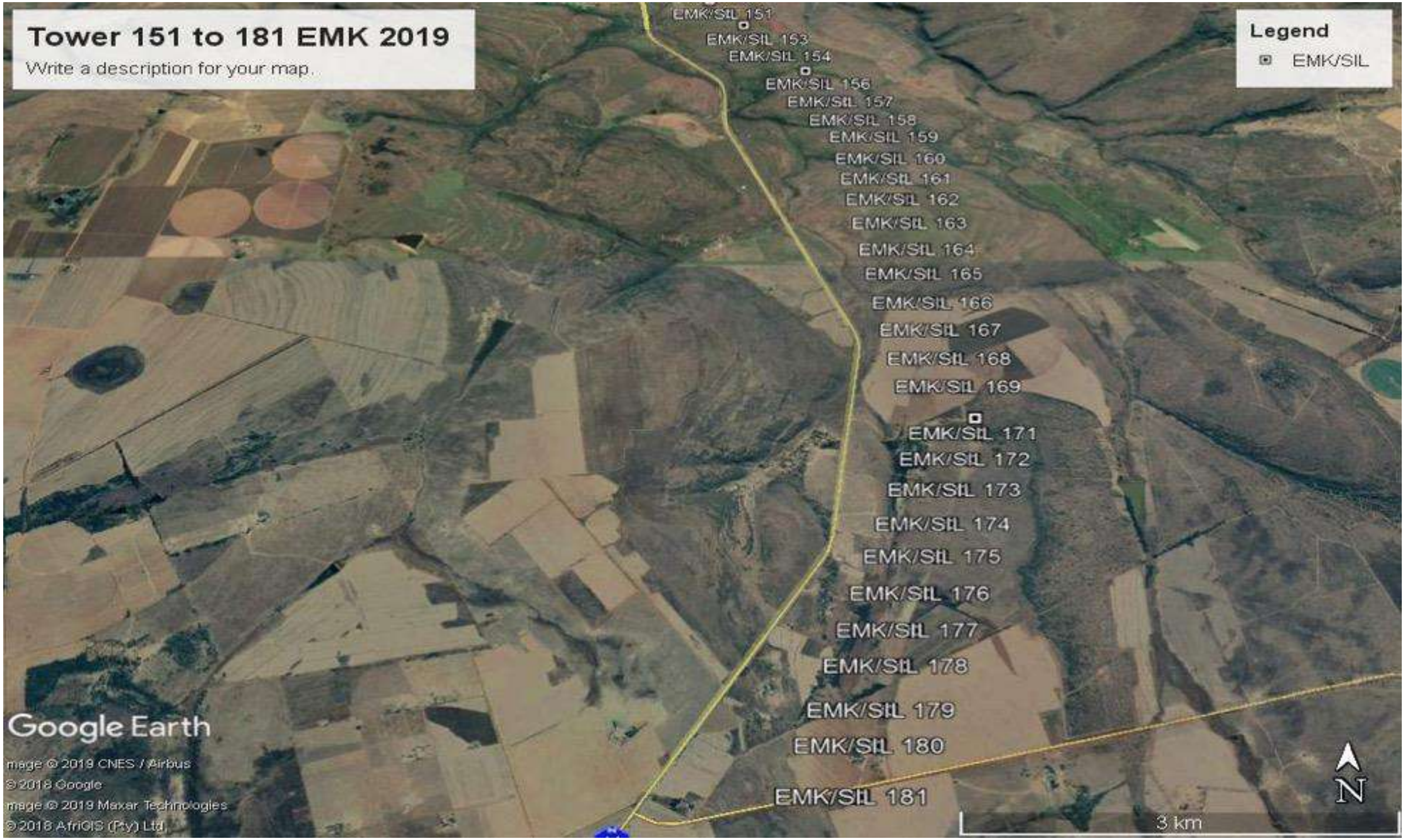


Figure 22: Power line towers from 151 to 181

8.8 LOCATIONS STRUCTURE 181 TO STRUCTURE 200

The powerline route traverses deeper into Mpumalanga Province descending into the Olifants River valley (Fig. 23 & 24). The area is hilly with some steep sided hills. From here on, the route cross the river and run long the N11 national road.

Figure23& 24: View of section of the Olifants River whose banks were surveyed for potential archaeological materials being washed into the river bed.

Structures 181 to 200 shown in Figure 25 are all situated on portions of land consisting of main road servitude, farm dwellings, high and low voltage powerlines, substation, irrigation agricultural land, irrigation infrastructure, streams and grazing lands. Most of the receiving land portions were previously degraded and disturbed with existing powerline, access roads, rural homesteads and agricultural fields. Two 88kv powerlines run parallel to the proposed powerline servitude. The survey of Pylon Structures positions 181 to 200 yielded prehistoric potsherd material between tower 197 and 198 directly on the path of the development (Fig 26). Several isolated potsherd were identified highlighting the existence of possible archaeological sites on direct path of the powerline development (Fig 25). A fair density of archaeological potsherd materials were identified at **Lat.** 29°27' 32.38" E **Long.** 25°37'51.94" S on previously cultivated and disturbed land (Fig. 25). The potsherd scatter could not be confirmed as part of a distinct archaeological site.

Impact	**Impact Significance**	**Heritage Significance**	**Certainty**	**Duration**
Low	Low-medium	Unknown	Unsure	Short term

Mitigation

ECO should closely monitor the foundation excavations and installation construction work for Towers 190 to 200 where potsherd materials were identified. By association, these towers locations have high potential to yield subsurface discernable archaeological remains that may require to be recorded during construction work. No further mitigation is required prior to construction phase. However, should chance archaeological materials be disturbed at any of the unmonitored tower positions in this section, salvage and chance finds procedures should be implemented. Abandoned historic homesteads should not be interfered with without a clearance of destruction Permit from SAHRA since some of the building remains may be 60 years of. Such old structures enjoy automatic legal protection from the NHRA.

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Figure 25: Powerline is located in a heavily disturbed area and built up residential area.

8.9 Locations Structure 201 to Structure 220

The survey of Pylon Structures positions 201 to 220 did not yield archaeological sites on direct path of the development. However, there are a number or contemporary abandoned homesteads near Tower 220. The ruins are more than 60m from the tower position. Although such sites are not significant from a heritage classification, they potentially have burial grounds associated with them.

Impact	**Impact Significance**	**Heritage Significance**	**Certainty**	**Duration**
None to Low	Low	Low	Unsure	Short term

Mitigation

None required. However, in the unlikely event that chance archaeological materials are disturbed at any of the tower position, salvage and change finds procedures should be implemented. Abandoned homesteads should be avoided since they may yield burial sites. No further mitigation is required prior to construction phase. However, should chance archaeological materials are disturbed at any of the remaining tower positions in this section, salvage and chance finds procedures should be implemented. Abandoned historic homesteads should not be interfered with without a clearance of Destruction Permit from SAHRA since some of the building remains may be 60 years of. Such old structure enjoy automatic legal protection from the NHRA. Such site may also yield previously unknown burial sites.

Figure 26: This section of the powerline is located near Middleburg; the area is heavily disturbed by urban development, farming and mining activities that are characteristic of the area.

8.10 LOCATIONS STRUCTURE 222 TO STRUCTURE 240

Structures 222 to 240 shown in Figure 27 are all situated on portions of land consisting of N11 main road servitude, farm tracks, telephone lines, farm dwellings, built up residential areas, high and low voltage powerlines, eroded sections, irrigation agricultural land, irrigation infrastructure, streams and grazing lands. Most of the receiving land portions were previously degraded and disturbed with existing powerline, access roads, rural homesteads and agricultural fields. Two 88kv powerlines run parallel to the proposed powerline servitude. The survey of Pylon Structures positions 221 to 240 identified archaeological potshed material between tower 228 and 229 directly path of the development.

This area is south west of Dennesig Township northern area of Middleburg. The survey of tower positions yielded several areas with a mixture of historic settlement or farm residence areas. In the vicinity of the powerline route, multiple location with identifiable archaeological (preliminary classified as LIA) were recorded in situ (Fig. 27). Scatter of archaeological potsherd materials were identified at Lat**.** 29°26' 43.98" E **Long.** 25°43'02.29" S on previously cultivated and disturbed land (Fig. 27).

Impact	**Impact Significance**	**Heritage Significance**	**Certainty**	**Duration**
None	Low	Unknown	Unsure	Short term

Mitigation

Sub surface construction work for tower 220 to 240 should be closely monitored by ECO during construction work. In the event that chance archaeological materials are disturbed at any of the tower positions during construction, salvage and change finds procedures should be implemented in line with SAHRA regulations and NHRA requirements. No further mitigation is required prior to construction phase. Abandoned historic homesteads should not be interfered with without a clearance of destruction Permit from SAHRA since some of the building remains may be 60 years of. Such old structures enjoy automatic legal protection from the NHRA.

The area north of Middleburg has a long history of rural and peri urban settlements. Such areas have potential to yield previously unknown recent historic human burial and grave sites usually associated with some abandoned human settlements which are common in this region. As such, excavation of tower foundations between tower 220 and 2240 should be monitored by a professional archaeologist during the construction works.

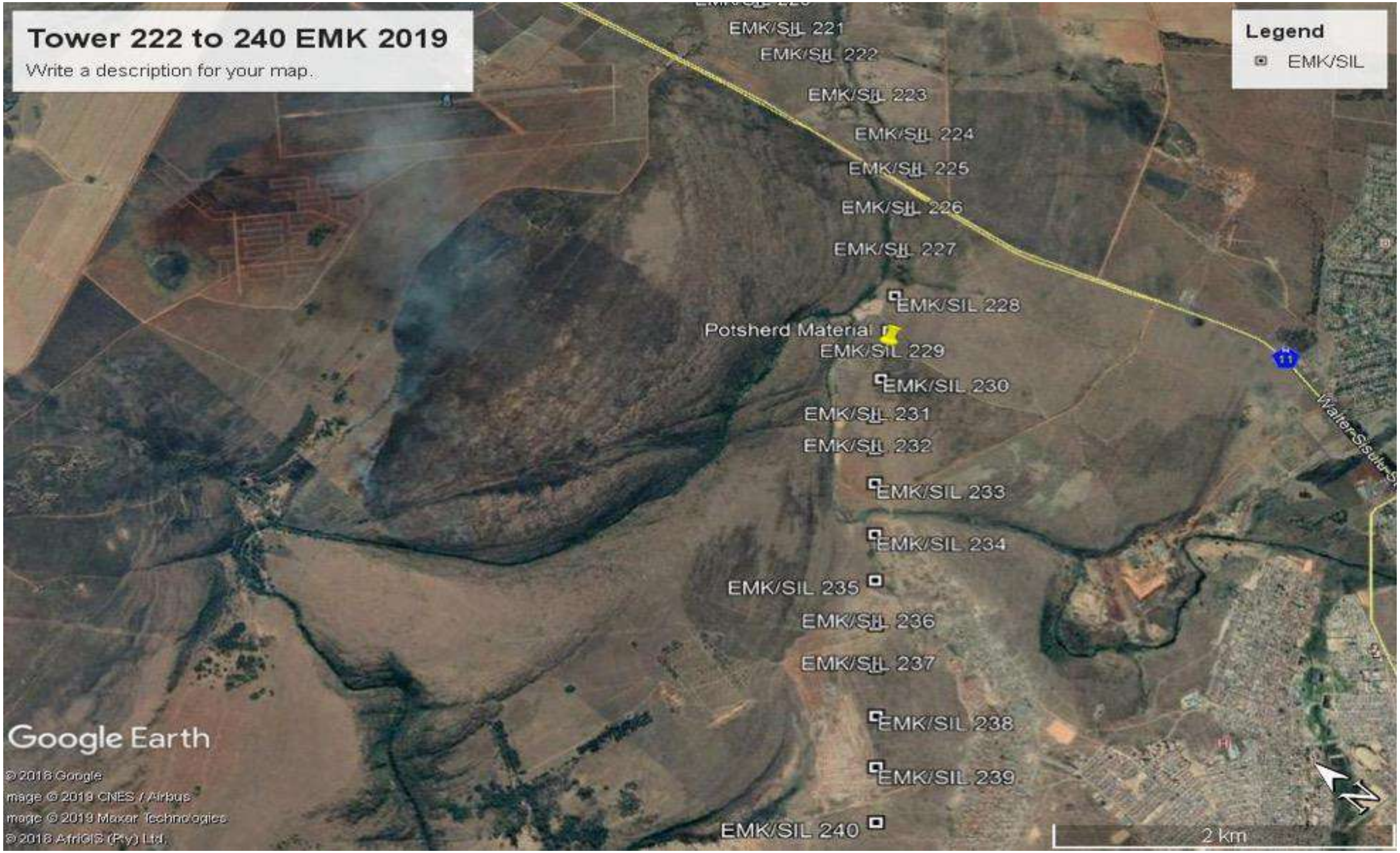

Figure 27: Powerline cuts through disturbed and built up area.

8.11 LOCATIONS STRUCTURE 240 TO STRUCTURE 280

Most of the receiving land portions are heavily degraded and disturbed with existing powerline, access roads, settlements and industrial infrastructure. The survey of Pylon Structures positions 240 to 280 did not yield archaeological sites on direct path of the development.

Impact	**Impact Significance**	**Heritage Significance**	**Certainty**	**Duration**
None	Low	None	Unsure	Short term

Mitigation

None required. However, in the unlikely event that chance archaeological materials are disturbed at any of the tower position, salvage and change finds procedures should be implemented. No further mitigation is required prior to construction phase. However, should chance archaeological materials are disturbed at any of the remaining tower positions in this section, salvage and chance finds procedures should be implemented. Abandoned historic homesteads should not be interfered with without a clearance of Destruction Permit from SAHRA since some of the building remains may be 60 years of. Such old structures enjoy automatic legal protection from the NHRA. Such site may also yield previously unknown burial sites.

Figure 28: Powerline cuts through disturbed and built up area, all cutting through main roads R575 and R555

8.12 LOCATIONS STRUCTURE 281 TO STRUCTURE 302

Structures 281 to 302 shown in Figure 29 are all located on portions of land consisting of urban infrastructure that include main road servitudes, high and low voltage powerlines, substation, streams, mining and industrial infrastructure. Most of the receiving land portions were previously degraded and disturbed with existing powerline, access roads, rural homesteads and agricultural fields. Two 88kv powerlines run parallel to the proposed powerline servitude. The survey of Pylon Structures positions 281 to 302 identified potshed material directly on path of the development.

The area south of Middleburg where the line will terminate has rural commercial agriculture and peri urban settlements. The area yielded archaeological remains marked with potsherds. (Fig. 29 archaeological potsherd materials were identified at **Lat.** 29°24' 07.85" E **Long.** 25°51'34.05" S on previously cultivated and disturbed land (Fig. 29).

Impact	Impact Significance	Heritage Significance	Certainty	Duration
Low	Low	Unkown	Unsure	Short term

Mitigation

ECO should closely monitor installation of Towers 292 to 298 during foundation excavations. By association, these towers locations have high potential to yield subsurface discernable archaeological remains. No further mitigation is required prior to construction phase. However, should chance archaeological materials be disturbed at any of the unmonitored tower positions in this section, salvage and chance finds procedures should be implemented.

The proposed termination point for the powerline is the proposed site for the EmKhiweni substation on farmland at Lat**.** 29°24' 02.90" E **Long.** 25°52'22.86" S.

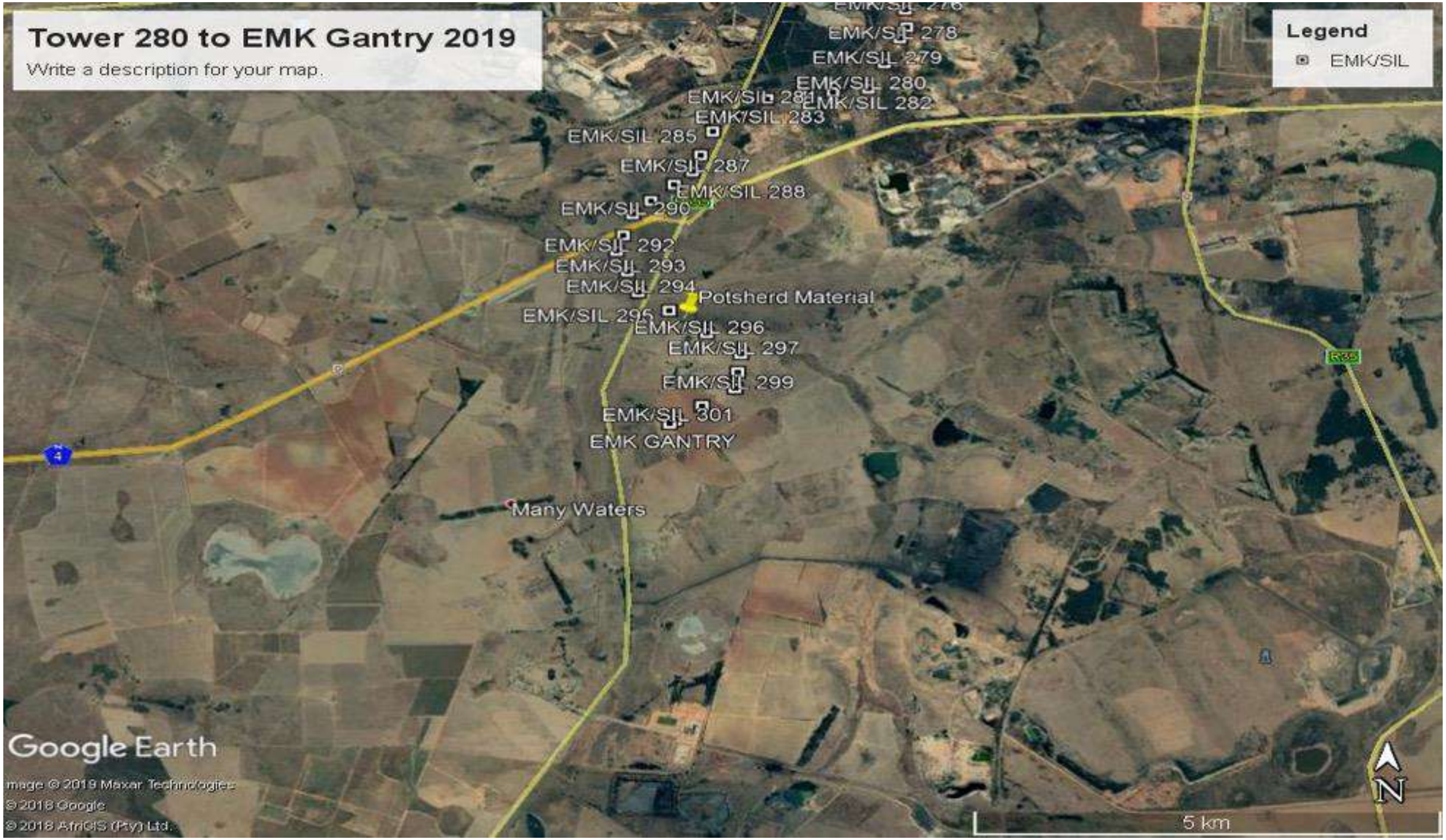

Figure 29: Powerline will terminate EMK gantry.

9. ASSUMPTIONS AND LIMITATIONS

The heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources potentially present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover in some areas. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time as the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development the procedures and requirements pertaining to graves and burials will apply as set out below.

The assessment excludes the evaluation of ancillary infrastructure such as additional access roads; borrow pits, construction camps and other components that may be situated outside the 55m servitude surveyed in this study. These need to be assessed as they are identified during the construction phase of the project. These sites should be inspected by the ECO prior to establishment and should any heritage features or objects be found a heritage specialist should be contacted or SAHRA should be notified

10. DISCUSSION

The proposed powerline runs from the north in the vicinity of Silimela traversing west of Groblersdal town, crosses the Olifants River valley and continue along the N11 to the western periphery of Middleburg. The lone terminates across the N4 south of Middleburg on proposed site of the Emkhiweni substation. All 302 approved powerline structure locations (refer to Table 1 for Coordinates of locations) were surveyed along the approved servitude. None of these locations fell directly on any high significant cultural property or Grade 1, 2 or 3 archaeological or historical sites. However, archaeological materials were recorded on some portions within the vicinity of different selections of tower positions along the 108km servitude. Affected tower positions with potential to yield archaeological materials were flagged and recommended for monitoring during construction phase. This means, when the construction teams begin work on the flagged locations, ECO should be on site inspecting all subsurface construction work to ensure that no chance finds materials are destroyed.

Overall, it is very highly unlikely that any high significant (Grade 1 or 2) archaeological or cultural physical resource will negatively be impact by the 302-powerline structures to be installed as part of the Emkhiweni substation and 400 kv line from Emkhiweni substation to Silimela.

10.1 CULTURAL HERITAGE ASSESSMENT OF SIGNIFICANCE

The appropriate management of cultural heritage resources is usually determined on the basis of their assessed significance as well as the likely impacts of any proposed developments. Cultural significance is defined in the Burra Charter as meaning *aesthetic, historic, scientific or social value for past, present or future generations* (Article 1.2). Social, religious, cultural and public significance are currently identified as baseline elements of this assessment, and it is through the combination of these elements that the overall cultural heritage values of the site of interest, associated place or area are resolved.

10.2 ASSESSMENT CRITERIA

The Guidelines to the SAHRA Guidelines and the Burra Charter define the following criterion for the assessment of cultural significance:

Aesthetic Value

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and material of the fabric; sense of place, the smells and sounds associated with the place and its use.

Historic Value

Historic value encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out in this section. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of subsequent treatment.

Scientific value

The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information. Scientific value is also enshrined in natural resources that have significant social value. For example, pockets of forests and bushvelds have high ethnobotany value.

Social Value

Social value embraces the qualities for which a place has become a focus of spiritual, religious, political, local, national or other cultural sentiment to a majority or minority group. Social value also extend to natural resources such as bushes, trees and herbs that are collected and harvested from nature for herbal and medicinal purposes.

In case of this specific AIA and HIA study, no listed Grade 1-3 heritage sites were associated with the development area, However, archaeological signatures of potsherds and historical burial sites across old farm lands were identified and rated to be of low – medium heritage significance under archaeological resources and historical remains. These cultural materials are not part of clearly defined archaeological or historic sites but are signature and indicators of existence of such site in within the powerline servitude. It is on this basis that the study recommended ECO monitoring during the construction of the affected tower positions. The monitoring program should also cover chance finds procedures for previously unknown archaeological or cultural materials that may accidentally be discovered during the proposed powerline construction work.

Be that as it may, this walkdown survey did not identify any permanently prohibitive or significant archaeological or cultural sites to block the proposed construction.

11 CONSTRUCTION HERITAGE MANAGEMENT PLAN

The heritage management principles in Table below apply during construction and operational phases of the project.

Table 3: Construction Heritage Management Plan.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Objective	• Protection of chance archaeological sites and land considered to be of cultural value; • Protection of chance physical cultural property sites against vandalism, destruction and theft; and • The preservation and appropriate management of new archaeological finds should these be discovered during construction.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase – Phase 1 HIA Study of Alternative routes & Walk-down Survey of Final Approved Route								

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
1	Planning	Ensure all known sites of cultural, archaeological, and historical significance are demarcated on the site layout plan, and marked as no-go areas. **No known or protected sites were recorded in the HIA and AIA studies**	Throughout Project	Weekly Inspection	Contractor [C] CECO	SM	ECO	EA EM PM
Construction Phase								
1	Emergency Response	Should any archaeological or physical cultural property heritage resources be exposed during excavation for the purpose of construction, construction in the vicinity of the finding must be stopped until heritage authority has cleared the development to continue.	N/A	Throughout	C CECO	SM	ECO	EA EM PM
		Should any archaeological, cultural property heritage resources be exposed during excavation or be found on development site, a registered heritage specialist or SAHRA official must be called to site for inspection.		Throughout	C CECO	SM	ECO	EA EM PM
		Under no circumstances may any archaeological, historical or any physical cultural property heritage material be destroyed or removed form site;		Throughout	C CECO	SM	ECO	EA EM PM
		Should remains and/or artefacts be discovered on the development site during earthworks, all work will cease in		When necessary	C CECO	SM	ECO	EA EM PM

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
		the area affected and the Contractor will immediately inform the Construction Manager who in turn will inform SAHRA.						
		Should any remains be found on site that is potentially human remains, the SAHRA and South African Police Service should be contacted.		When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
		Same as construction phase.						
Operational Phase								
		Same as construction phase.						

Table 4: Roles and responsibilities of archaeological and heritage management.

ROLE	RESPONSIBILITY	IMPLEMENTATION
A responsible specialist needs to be allocated and should sit in at all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Environmental consultancy (ECO)
If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted in due course for evaluation.	The client	Archaeologist and a competent archaeology supportive team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage. (i.e. integrate the archaeological components into employee induction course).	The client	Environmental Consultancy and the Archaeologist,
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites.	The client	Environmental Consultancy and the Archaeologist
After the specialist/archaeologist has been appointed, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

12 IMPACT MANAGEMENT

12.1 PRE-CONSTRUCTION PHASE

Based on the findings of the AWD, all stakeholders and key personnel should undergo an archaeological induction course during this phase. Induction courses generally form part of the employees' overall training and the archaeological component can easily be integrated into these training sessions aimed more at managers and supervisors, highlighting the value of this exercise and the appropriate communication channels that should be followed after chance finds, and the second targeting the actual workers and getting them to recognize artefacts, features and significant sites. This ECO should use report for training as well as the mitigation measures stated on this report.

12.2 CONSTRUCTION PHASE

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area and small-scale infrastructure development associated with the project.

It is possible that cultural material will be exposed during construction operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to the subsequent history of the project. In general, these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

ECO should monitor all tower positions flagged as possible sites for chance finds by location or association during construction. During the construction phase, it is important to recognize any significant chance material being unearthed, making the correct judgment on which actions should be taken. ECO to inspect the flagged site and any development recurrently, with more frequent visits to the actual workface and operational areas.

Should an archaeological site or cultural material be discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to decide on what is required and if it is necessary to carry out emergency recovery. SAHRA/LIHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered.

13 CONCLUSIONS & RECOMMENDATIONS

None of the surveyed 302 powerline structure locations fell directly on high significance graded cultural heritage or archaeological sites (Grade 1, 2 or 3 as classified by the NHRA). The study did not find any unmitigatable barrier to powerline construction within the approved servitude. Therefore, subject to recommendations herein made, no direct conflicts between archaeological and physical cultural heritage properties including burial grounds and the proposed development are anticipated when construction begins.

The following general mitigation measures are recommended:

- If during construction any possible finds are made, the operations must be stopped and the qualified archaeologist be contacted for an assessment of the find.
- As precautionary measure and in line with applicable best heritage management principles, the following holds:

- *The Heritage management plan (HMP) issued in this report is applicable especially in chance finds context once construction begins.*
- *The foot print impact of each Powerline Structure and associated construction activities should be kept to minimal and within the approved servitude to limit the possibility of encountering additional or chance finds within the powerline servitude.*
- *In situations where unpredicted impacts occur (such as accidentally disturbing a previously unknown grave during subsurface construction work), construction activities should be stopped and the heritage authority notified immediately.*
- *In the unlikely event of chance archaeological material or previously unknown human remains being disturbed during subsurface construction, the finds should be left in situ subject to further instruction from the heritage authorities (refer to Appendix 1 for additional details).*
- *The overriding objective, in the unlikely event of chance findings, where remedial action is warranted, is to minimize disruption in construction scheduling while recovering archaeological and any affected cultural heritage data as stipulated by the LIHRA and SAHRA regulations.*

It is the author's final and considered recommendation that there being no heritage barriers on the path of the powerline development; the proposed powerline and related infrastructure development may proceed, subject to recommendations, as planned and within the approved powerline servitude and structure locations.

14 BIBLIOGRAPHY

AUSTRALIA ICOMOS (1999) *The Burra Charter: The Australia ICOMOS charter for places of cultural significance*. Burwood.

BICKFORD, A AND SULLIVAN, S. 1977. *"Assessing the research significance of historic sites"* in S Sullivan and S Bowdler (eds) Site Surveys and Significance assessment in Australian Archaeology. Canberra: ANU.

BURKE, H. And SMITH, C. 2004. *The archaeologist's field handbook.* Australia. Allen and Unwin.

COOPER,M. A.,FIRTH,A.,CARMAN,J. & WHEATLEY,D. (eds.)1995: Managing Archaeology. London: Routledge.

GLAZEWSKI, J., 2000: Environmental Law in South Africa. Durban: Butterworths.

MURIMBIKA, M. 2012. PROPOSED NAGLE DAM 132/11KV SUBSTATION ESTABLISHEMENT AND ASSOCIATED 132KV POWERLINE, KWAZULU NATAL PROVINCE: PHASE 1 ARCHAEOLOGICAL AND HERITAGE IMPACT ASSESSESSMENT STUDY REPORT.

SOUTH AFRICA,1983. *Human Tissue Act.* Government Gazette.

SOUTH AFRICA 1999. *NATIONAL HERITAGE RESOURCES ACT (No 25 of 1999),* Government Gazette. Cape Town.

SAHRA APMHOB. 2004. *Policy for the management of Archaeology, Palaeontology, Meteorites and Heritage Object.* . SAHRA: Cape Town.

SAHRA APM. 2006. *Guidelines: Minimum standards for the archaeological and palaeontological Component of Impact Assessment Reports.* . SAHRA: Cape Town.

SAHRA APMHOB 2002. General Introduction to surveys, impact assessments and management plans. . SAHRA: CT.

SAHRA. 2002. General guidelines to Archaeological Permitting Policy. SAHRA: Cape Town.

SAHRA. 2002. General Introduction to surveys, impact assessments and management plans.

SAHRA. What to do when Graves are uncovered accidentally.

WHITELAW, G. 1991. Precolonial iron production around Durban and in southern Natal. *Natal Museum Journal of Humanities* **3**: 29–39. *ARCHAEOLOGICAL & HERITAGE IMPACT ASSESSMENT STUDY FOR PROPOSED NAGLE DAM SUBSTATION AND POWERLINE DEVELOPMENT, 2ND EDITION VERSION. 3.0*

Heritage Impact Assessment Specialist Study by M. Murimbika (Ph.D.) 2012

WHITELAW, G. 1993. Customs and settlement patterns in the first millennium AD: evidence from Nanda, an Early Iron Age site in the Mngeni Valley, Natal. *Natal Museum Journal of Humanities* **5**: 47–81.

WHITELAW, G. 1994. KwaGandaganda: settlement patterns in the Natal Early Iron Age. *Natal Museum Journalof Humanities* **6**: 1–64.

WHITELAW, G. 1997. What Da Gama missed on his way to Sofala. *Natalia* **27**: 30–41.

WILSON, M. 1969. Changes in social structure in southern Africa: the relevance of kinship studies to the historian. In: L. Thompson, ed., *African societies in southern Africa*. London: Heinemann, pp. 71–85.

WRIGHT, J. 2009. The Thuli

15 SAHRA HIA RECORD OF DECISION

Copy of ROD not available during the compilation of this report. This report will be submitted to the local Heritage Resource Agencies (Mpumalanga and Limpopo) and SAHRA during the Draft EIA review

16 APPENDIX 1: HUMAN REMAINS AND BURIALS IN DEVELOPMENT CONTEXT

BY Dr Murimbika M. [2012]

Developers, land use planners and professional specialist service providers often encounter difficult situations with regards to burial grounds, cemeteries and graves that may be encountered in development contexts. This may be before or during a development project. There are different procedures that need to be followed when a development is considered on an area that will impact upon or destroy existing burial grounds, cemeteries or individual graves. In contexts where human remains are accidentally found during development work such as road construction or building construction, there are different sets of intervention regulations that should be instigated. This brief is an attempt to highlight the relevant regulations with emphasis on procedures to be followed when burial grounds, cemeteries and graves are found in development planning and development work contexts. The applicable regulations operate within the national heritage and local government legislations and ordinances passed in this regard. These guidelines assist you to follow the legal pathway.

1. First, establish the context of the burial:
A. Are the remains less than 60 years old? If so, they may be subject to provisions of the Human Tissue Act, Cemeteries Ordinance(s) and to local, regional, or municipal regulations, which vary from place to place. The finding of such remains must be reported to the police but are not automatically protected by the National Heritage Resources Act (Act 25 of 1999).
B. Is this the grave of a victim of conflict? If so, it is protected by the National Heritage Resources Act (Section 36(3a)). (Relevant extracts from the Act and Regulations are included below).
C. Is it a grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority? If so, it is protected by the National Heritage Resources Act (Section 36(3b)).
D. Are the human or hominid remains older than 100 years? If so, they are protected by the National Heritage Resources Act (Section 35(4), see also definition of "archaeological" in Section 2).
2. Second, refer to the terms of the National Heritage Resources Act most appropriate to the situation, or to other Acts and Ordinances:
A. Human remains that are NOT protected in terms of the National Heritage Resources Act (i.e. less than 60 years old and not a grave of a victim of conflict or of cultural significance) are subject to provisions of the Human Tissue Act and to local and regional regulations, for example Cemeteries Ordinances applicable in different Provincial and local Authorities.
B). All finds of human remains must be reported to the nearest police station to ascertain whether or not a crime has been committed.
C). If there is no evidence for a crime having been committed, and if the person cannot be identified so that their relatives can be contacted, the remains may be kept in an institution where certain conditions are fulfilled. These conditions are laid down in the Human Tissue Act (Act No. 65 of 1983). In contexts where the local traditional authorities given their consent to the unknown remains to be re-buried in their area, such re-interment may be conducted under the same regulations as would apply for known human remains.

3. In the event that a graveyard is to be moved or developed for another purpose, it is incumbent on the local authority to publish a list of the names of all the persons buried in the graveyard if there are gravestones or simply a notification that graves in the relevant graveyard are to be disturbed. Such a list would have to be compiled from the names on the gravestones or from parish or other records. The published list would call on the relatives of the deceased to react within a certain period to claim the remains for re-interment. If the relatives do not react to the advertisement, the remains may be re-interred at the discretion of the local authority.

A. However, it is the responsibility of the developer to ensure that none of the affected graves within the cemetery are burials of victims of conflict. The applicant is also required in line with the heritage legislation to verify that the graves have no social significance to the local communities.
B. It is illegal in terms of the Human Tissue Act for individuals to keep human remains, even if they have a permit, and even if the material was found on their own land.

4. The Exhumations Ordinance (Ordinance No. 12 of 1980 and as amended) is also relevant. Its purpose is "To prohibit the desecration, destruction and damaging of graves in cemeteries and receptacles containing bodies; to regulate the exhumation, disturbance, removal and re-interment of bodies, and to provide for matters incidental thereto". This ordinance is supplemented and support by local authorities regulations, municipality by-laws and ordinances.

DEFINITIONS AND APPLICABLE REGULATIONS
1). A "Cemetery" is defined as any land, whether public or private, containing one or more graves.
2). A "grave" includes "(a) any place, whether wholly or partly above or below the level of ground and whether public or private, in which a body is permanently interred or intended to be permanently interred, whether in a coffin or other receptacle or not, and (b) any monument, tombstone, cross, inscription, rail, fence, chain, erection or other structure of whatsoever nature forming part of or appurtenant to a grave.
3). No person shall desecrate, destroy or damage any grave in a cemetery, or any coffin or urn without written approval of the Administrator.
4). No person shall exhume, disturb, remove or re-inter anybody in a cemetery, or any coffin or urn without written approval of the Administrator.
5). Application must be made for such approval in writing, together with:
a). A statement of where the body is to be re-interred.
b). Why it is to be exhumed.
c). The methods proposed for exhumation.
d). Written permission from local authorities, nearest available relatives and their religious body owning or managing the cemetery, and where all such permission cannot be obtained, the application must give reasons why not.

6). The Administrator has the power to vary any conditions and to impose additional conditions.
7). Anyone found guilty and convicted is liable for a maximum fine of R200 and maximum prison sentence of six months.
5. Human remains from the graves of victims of conflict, or any burial ground or part thereof which contains such graves and any other graves that are deemed to be of cultural significance may not be destroyed, damaged, altered, exhumed or removed from their original positions without a permit from the National Heritage Resources Agency. They are administered by the Graves of Conflict Division at the SAHRA offices in Johannesburg.
"Victims of Conflict" are:
a). Those who died in this country as a result of any war or conflict but excluding those covered by the Commonwealth War Graves Act, 1992 (Act No. 8 of 1992).
b). Members of the forces of Great Britain and the former British Empire who died in active service before 4 August 1914.
c). Those who, during the Anglo Boer War (1899-1902) were removed from South Africa as prisoners and died outside South Africa, and,
d). Those people, as defined in the regulations, who died in the "liberation struggle" both within and outside South Africa.
6. Any burial that is older than 60 years, which is outside a formal cemetery administered by a local authority, is protected in terms of Section 36(3b) of the National Heritage Resources Act. No person shall destroy damage, alter, exhume or remove from its original position, remove from its original site or export from the Republic any such grave without a permit from the SAHRA.
There are some important new considerations applicable to B & C (above).
SAHRA may, for various reasons, issue a permit to disturb a burial that is known to be a grave of conflict or older than 65 years, or to use, at a burial ground, equipment for excavation or the detection or the recovery of metals.
(Permit applications must be made on the official form Application for Permit: Burial Grounds and Graves available from SAHRA or provincial heritage resources authorities.) Before doing so, however, SAHRA must be satisfied that the applicant:
a). Has made satisfactory arrangements for the exhumation and re- interment of the contents of such a grave at the cost of the applicant.
b). Has made a concerted effort to contact and consult communities and individuals who by tradition have an interest in such a grave and,
c). Has reached an agreement with these communities and individuals regarding the future of such a grave or burial ground.

PROCEDURE FOR CONSULTATION

The regulations in the schedule describe the procedure of consultation regarding the burial grounds and graves. These apply to anyone who intends to apply for a permit to destroy damage, alter, remove from its original position or otherwise disturb any grave or burial ground older than 60 years that is situated outside a formal cemetery administered by a local authority. The applicant must make a concerted effort to identify the descendants and family members of the persons buried in and/or any other person or community by tradition concerned with such grave or burial ground by:
1). Archival and documentary research regarding the origin of the grave or burial ground;
2). Direct consultation with local community organizations and/or members;
3). The erection for at least 60 days of a notice at the grave or burial ground, displaying in all the official languages of the province concerned, information about the proposals affecting the site, the telephone number and address at which the applicant can be contacted by any interested person and the date by which contact must be made, which must be at least 7 days after the end of the period of erection of the notice; and
4). Advertising in the local press.
The applicant must keep records of the actions undertaken, including the names and contact details of all persons and organizations contacted and their response, and a copy of such records must be submitted to the provincial heritage resources authority with the application.
Unless otherwise agreed by the interested parties, the applicant is responsible for the cost of any remedial action required.
If the consultation fails to research in agreement, the applicant must submit records of the consultation and the comments of all interested parties as part of the application to the provincial heritage resources authority.
In the case of a burial discovered by accident, the regulations state that when a grave is discovered accidentally in the course of development or other activity:
a). SAHRA or the provincial heritage resources authority (or delegated representative) must, in co-operation with the Police, inspect the grave and decide whether it is likely to be older than 60 years or otherwise protected in terms of the Act; and whether any further graves exist in the vicinity.
b). If the grave is likely to be so protected, no activity may be resumed in the immediate vicinity of the grave, without due investigation approved by SAHRA or the provincial heritage resources authority; and
c). SAHRA or the provincial heritage resources authority may at its discretion modify these provisions in order to expedite the satisfactory resolution of the matter.
d. Archaeological material, which includes human and hominid remains that are older than 100 years (see definition in section 2 of the Act), is protected by the National Heritage Resources Act (Section 35(4)), which states that no person may, without a permit issued by the responsible heritage resources authority - destroy, damage, excavate, alter or remove from its original site any archaeological or palaeontological material.
The implications are that anyone who has removed human remains of this description from the original site must have a permit to do so. If they do not have a permit, and if they are convicted of an offence in terms of the National Heritage Resources Act as a result, they must be liable to a maximum fine of R100 000 or five years imprisonment, or both.

TREAT HUMAN REMAINS WITH RESPECT

a). Every attempt should be made to conserve graves in situ. Graves should not be moved unless this is the only means of ensuring their conservation.
b). The removal of any grave or graveyard or the exhumation of any remains should be preceded by an historical and archaeological report and a complete recording of original location, layout, appearance and inscriptions by means of measured drawings and photographs. The report and recording should be placed in a permanent archive.

c). Where the site is to be re-used, it is essential that all human and other remains be properly exhumed and the site left completely clear.
d). Exhumations should be done under the supervision of an archaeologist, who would assist with the identification, classification, recording and preservation of the remains.
e). No buried artifacts should be removed from any protected grave or graveyard without the prior approval of SAHRA. All artifacts should be re-buried with the remains with which they are associated. If this is not possible, proper arrangements should be made for the storage of such relics with the approval of SAHRA.
f). The remains from each grave should be placed in individual caskets or other suitable containers, permanently marked for identification.
g). The site, layout and design of the area for re-interment should take into account the history and culture associated with, and the design of, the original grave or graveyard.
h). Re-burials in mass graves and the use of common vaults are not recommended.
i). Remains from each grave should be re-buried individually and marked with the original grave markers and surrounds.
j). Grouping of graves, e.g. in families, should be retained in the new layout.
k). Material from the original grave or graveyard such as chains, kerbstones, railing and should be re-used at the new site wherever possible.
l). A plaque recording the origin of the graves should be erected at the site of re-burial.
m). Individuals or groups related to the deceased who claim the return of human remains in museums and other institutions should be assisted to obtain documentary proof of their ancestral linkages.

Appendix 6D: Agricultural Impact Assessment

REPORT

On contract research for
Nemai Consulting

SOILS AND AGRICULTURAL POTENTIAL FOR THE EMKHIWENI-SILIMELA PROJECT, MPUMALANGA PROVINCE

By

D.G. Paterson (*Pr. Nat. Sci.* 400463/04)

February 2019

Report No. GW/A/2019/02

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Declaration:

I declare that the author of this study is a qualified, registered natural scientist (soil science), is independent of any of the parties involved and has no other conflicting interests.

D.G. Paterson

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1 INTRODUCTION

The ARC-Institute for Soil, Climate and Water was requested by Nemai Consulting to carry out a study for the soils and agricultural potential for the proposed Emkhiweni Substation and Emkhiweni to Silimela transmission line, in the Mpumalanga and Limpopo Provinces. This report is a slightly updated version of a previous report (then called the Marble Hall-Rockdale transmission line, compiled in 2013), which covered essentially the same route.

2 STUDY AREA

The study extends from the Silimela substation near Marble Hall, in Limpopo Province, southward to the proposed Emkhiweni substation, near Middelburg, in Mpumalanga Province. The proposed route is shown by the blue line in Figure 1.

For the soil maps (Appendix), a 1 km buffer on each side of the transmission line was identified. While the servitude width is only 55 m, due largely to the scale of the available soil information (1:250 000), it is easier to show the soil patterns on a map (see Appendix) within a wider corridor.

2.1 Terrain

The terrain of the study area is gently undulating, and lies at an altitude of around 1 100 to 1 600 m above sea level, becoming higher to the south. In general, slopes of around 2-12% occur, although steeper areas are found to the east of the Loskop Dam, as well as to the north of Middelburg. The route is crossed by the Olifants River, north of the Loskop Dam, as well as several other smaller streams, most of which are non-perennial.

Figure 1 Locality map

2.2 Climate

Climate data was obtained from the national Land Type Survey (Koch, 1987).

The climate of the greater part of the route has warm, moist summers with cool, dry winters. On average, 85% of the annual average rainfall of 680.2 mm falls in the growing season (October to March). Frost, often severe, occurs in winter. The extreme maximum temperature is 38.9ºC and the extreme minimum –13.3ºC. However, the area closer to Groblersdal will be drier and warmer than the rest of the route, due to the drop in altitude.

The climatic data is given in Table 1 below.

Table 1 Climate Data for Middelburg area

Month	Rainfall (mm)	Min. Temp (ºC)	Max. Temp (ºC)	Average frost dates
Jan	118.8	13.8	27.0	Start date: 13/05
Feb	93.3	13.1	26.3	End date: 13/09
Mar	79.3	11.6	24.9	Days with frost: ±57
Apr	39.8	7.6	23.0	
May	19.7	3.0	20.3	
Jun	6.8	-0.7	17.7	
Jul	8.8	-0.8	17.5	**Heat units (hrs > 10ºC)**
Aug	8.4	1.8	20.6	Summer (Oct-Mar): 1670
Sep	22.1	6.1	23.6	
Oct	64.1	10.4	26.0	Winter (Apr-Sept): 390
Nov	109.1	11.9	25.9	
Dec	110.2	13.2	26.8	
Year	**680.2**	**(Average) 15.4ºC**		

2.3 Land use

There is a variety of land use patterns encountered along the proposed route. Near Silimela, the is an area of irrigated cultivation, while from there southward, the route traverses mostly areas of natural grazing and or bush. Close to the crossing of the N11, near Loskop Dam, more irrigation is encountered, while areas of dryland cultivation are found south of Loskop Dam, almost to Middelburg. In and around Middelburg, the land use is mainly mixed peri-urban and industrial/mining.

2.4 Geology

The area is underlain by sandstone and conglomerate of the Wilgerivier Formation, Waterberg Group with lava and tuff of the Transvaal Sequence to the north (Geological Survey, 1992).

3 METHODOLOGY

The soil information that was used to compile this study, forms part of the map sheet 2528 Pretoria of the national 1:250 000 land type survey (Schoeman *et al.*, 1985). Each land type is a unique combination of soil pattern, terrain and macroclimate.

The information contained in the land type survey is of a reconnaissance nature (scale of 1:250 000) and, as such can only represent the dominant soils within a specific land type. It is to be expected that areas of different soils will occur, but due to the nature and scale of the survey, they can not be delineated in detail.

Within the immediate vicinity of the study area, a total of 15 land types occur, namely:

- **Ba4, Ba15, Ba37** (Red, highly weathered, structureless soils, some with plinthic subsoils)
- **Bb16 (**Non-red, highly weathered, structureless soils, some with plinthic subsoils)
- **Bc1, Bc2, Bc3 (**Red, slightly weathered, structureless soils, some with plinthic subsoils)
- **Bd4 (**Red, slightly weathered, structureless soils, some with plinthic subsoils)
- **Ea4** (Red and dark clay soils)
- **Fb3** (Shallow soils, sometimes calcareous)

- **Ib10, Ib15, Ib16, Ib21, Ib22** (shallow soils with rock)

The distribution of these land types is shown in the map in Appendix 1.

4 SOILS

The main characteristics of each of the land types are given in Table 2 below (the colours correspond to those used in the map in the Appendix). The soils were classified according to MacVicar *et al*, 1977), with the dominant agricultural potential class within each land type highlighted in **bold type**.

Note:

The column in Table 2 that refers to “Agricultural Potential” refers to the **dryland** potential only: that is the soil characteristics without any climatic parameters.

Table 2 Soil properties per land type

Land type	Dominant soils	Sub-dominant soils	Dominant Slopes	Agricultural Potential (%)
Ba4	Hutton 14/15/16; 500-1200 mm; SaLm-SaClLm 45%	Avalon + Glencoe 14/15; 600-1200 mm; LmSa-SaLm 9%	1-3%	**H: 55.5** M: 24.9 L: 19.6
Ba15	Hutton/Clovelly 15; 300-600 mm; LmcoSa 29%	Hutton 26/27; 450-1200 mm; SaClLm-SaCl 19%	3-20%	H: 24.0 M: 12.8 **L: 63.2**
Ba37	Hutton 14/15/16; 900-1200 mm; SaLm-SaClLm 36%	Avalon 14/15; 800-1200 mm; LmSa-SaLm 9%	1-8%	H: 39.2 **M: 45.5** L: 15.3
Bb16	Soil/Rock Complex; <400 mm LmSa-SaLm 44%	Hutton/Clovelly 14/15; 350-750 mm LmSa-SaLm 26%	1-15%	H: 5.0 M: 43.3 **L: 51.7**
Bc1	Soil/Rock Complex; <400 mm LmSa-SaLm 29%	Hutton 24/26/34/36; 450-1200 mm SaLm-SaClLm 28%	2-8%	H: 6.0 **M: 48.0** L: 46.0
Bc2	Hutton 33/34/35/36; 900-1200 mm SaLm-SaClLm 51%	Avalon/Glencoe 36; 800-1200 mm SaLm-SaClLm 24%	1-3%	**H: 94.0** M: 6.0 **L: 0.0**
Bc3	Hutton 33/34/35/36; 900-1200 mm SaLm-SaClLm 58%	Oakleaf 33/36; >1200 mm Sa-SaLm 23%	1-3%	**H: 88.0** M: 12.0 **L: 0.0**

Table 2 Soil properties per land type

Land type	Dominant soils	Sub-dominant soils	Dominant Slopes	Agricultural Potential (%)
Bd4	Soil/Rock Complex; <400 mm LmSa-SaLm 68%	Avalon + Glencoe 35/36; 450-750 mm; Sa-SaLm 17%	1-3%	H: 1.6 M: 24.8 **L: 73.6**
Ea4	Shortlands 21/22; 500-1200 mm; SaCl-Cl 32%	Hutton 27/36/37; 500-1200 mm; SaClLm-SaCl 27%	0-6%	**H: 58.5** M: 41.5 **L: 0.0**
Fb3	Soil/Rock Complex; <400 mm LmSa-SaLm 90%	Hutton 36; 450-900 mm; SaLm-SaClLm 10%	0-6%	H: 0.0 M: 10.0 **L: 90.0**
Ib10	Rock 58%	Mispah 10; 100-300 mm SaClLm 8%	15-100%	H: 2.0 M: 2.8 **L: 95.2**
Ib15	Rock 61%	Mispah 10; 100-300 mm Sa-LmSa 15%	6-100%	H: 0.0 M: 15.9 **L: 84.1**
Ib16	Rock 60%	Mispah 10; 100-300 mm Sa-LmSa 7%	12-100%	H: 3.0 M: 4.0 **L: 93.0**
Ib21	Rock 61%	Soil/Rock Complex; <450 mm LmSa-SaClLm 31%	6-60%	H: 1.4 M: 6.7 **L: 91.9**
Ib22	Rock 57%	Soil/Rock Complex; <450 mm LmSa-SaClLm 31%	8-100%	H: 0.0 M: 5.8 **L: 94.2**

5 AGRICULTURAL POTENTIAL

From the map in Appendix 1, and the information in Table 2, it can be seen that the **proposed transmission line route** crosses land types with a significant variation in agricultural potential. To indicate this, the percentage of high potential soils in each land type has been indicated, as follows:

Table 3 High potential soils occurrence

<20% High potential soils	
20-40% High potential soils	
40-60% High potential soils	
60-80% High potential soils	
>80% High potential soils	

The land types where high potential soils predominate include **Ba4** (in the south), **Bc2, Bc3** (in the north) and **Ea4** (next to the N11 and Olifants River). Areas where moderate potential soils occur are **Ba37** (in the south) and **Bc1** (close to Loskop Dam). The rest of the land types contain, to a greater or lesser degree, mostly low potential soils or rock.

The **proposed site of the substation**, to the south of Middelburg, is within a zone of generally high potential soils.

The land types and associated potential are highlighted on the maps that are included in the Appendix, as follows:

1. Power line route – land type boundaries
2. Power line route – agricultural potential
3. Proposed substation and loop-in lines – land type boundaries
4. Proposed substation and loop-in lines - agricultural potential

6 IMPACTS AND RECOMMENDATIONS

With the construction of a **transmission line**, the main impact will be the loss of agricultural soil. However, due to the small area of footprint of each tower, and the fact that cultivation can, in most cases, proceed under a transmission line, this impact is generally not major.

For the **planned substation**, although it is a relatively small footprint, it will be a permanent construction, so that any loss of agricultural productivity due to the construction will be long-term if not permanent.

The other potential impact associated with the construction of a transmission line is the possibility of soil erosion, due mainly to the removal of surface vegetation, coupled with excavation of the soil mantle. While wind erosion cannot be completely discounted, in the study area, by far the most likely type of erosion would be caused by water, especially in times of heavy or prolonged rainfall.

By using the available soil information, topo-cadastral coverage and the photo information shown on Google Earth, a reasonable prediction can be made of the impacts at each tower.

Impacts have been assessed in terms of the following criteria (Nemai Consulting methodology):

» The **nature (N)**, which includes a description of what causes the effect, what will be affected and how it will be affected, either positively, neutrally or negatively.
» The **extent (E)**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 4 will be assigned as appropriate (with 1 being low and 5 being high):
» The **duration (D)**, wherein it is indicated whether:

- * the lifetime of the impact will be of a short duration (0–5 years) – assigned a score of 1;
  * the lifetime of the impact will be of a medium duration (5-11 years) - assigned a score of 2;
  * long term (> 11 years) - assigned a score of 3; or
  * permanent - assigned a score of 4;
- » The **magnitude (M)**, quantified on a scale from 1 to 3, where 1 is low and will have little or no effect on the environment, 2 is medium and will cause a slight impact on processes, 3 is high (processes are altered to the extent that they may temporarily cease).
- » The **probability (P)** of occurrence, which describes the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is rare/remote (probably will not happen), 2 is unlikely (some possibility, but low likelihood), 3 is probable (moderate possibility), 4 is likely and 5 is almost certain (impact will occur regardless of any prevention measures).
- » the **significance (S)**, which is an overall impression of an impact's importance and can be assessed as no impact (0), no impact after mitigation (1), residual impact after mitigation (2) or (3) impact cannot be mitigated; and
- » the degree to which the impact can be reversed.
- » the degree to which the impact may cause irreplaceable loss of resources.
- » the *degree* to which the impact can be *mitigated.*

Overall Score = (N x M x S) x (E + D + P)

The **significance weightings** for each potential impact are as follows:

- » < 30 points: Low/Acceptable (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- » 31-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),

- 61-90 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).
- >90 points: Very High (i.e. where the impact would probably prevent the development from proceeding.

Two impacts have been identified to be associated with the development of the Emkhiweni Substation and Emkhiweni-Silimela 400kV Line from a soil perspective; these impacts include:

***Impact 1* (Table 2)**: In most environmental investigations, the major impact on the natural resources of the site would be the loss of potential agricultural land due to the tower, substation, and associated infrastructure construction. However, in this instance, this impact would be of extremely limited significance and would be local in extent, if at all.

***Impact 2* (Table 3)**: In this area, the sandy soils, coupled with the dry climate, means that a possible impact would be the increased risk of wind erosion of the topsoil when vegetation cover is removed or disturbed. This would be especially relevant for the construction of access roads and other associated infrastructure.

The significance of the impacts can be summarised as follows:

Table 2 Loss of agricultural land

***Nature: Loss of potentially productive agricultural land** (both construction and operation phase)*		
	Without mitigation	**With mitigation**
Nature (N)	Negative (-1)	Neutral (0)
Extent (E)	Local (1)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Medium (2)	Low (1)
Probability (P)	Moderate (3)	Unlikely (2)
Significance (S)	Residual (2)	Low (1)
Overall Score (N x M x S) x (E + D + P)	**-4 x 8 = -32 (Medium)**	**1 x 6 = 6 (Low)**
Reversibility	Low	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: The main mitigation measures would be: • To minimise the footprint of construction as much as possible. • Avoid highly productive and/or irrigated areas (see Figure 2)		
Residual Risks: likely to be low, since the implementation of the appropriate mitigation measures will enable more or less complete rehabilitation during and after the life of the project.		

Table 3: Soil erosion

Nature: Loss of soil through erosion due to action of water		
	Without mitigation	**With mitigation**
Nature (N)	Negative (-1)	Neutral (0)
Extent (E)	Local (1)	Local (1)
Duration (D)	Long-term (4)	Short-term (1)
Magnitude (M)	Medium (2)	Low (1)
Probability (P)	Moderate (3)	Unlikely (2)
Significance (S)	Residual (2)	Low (1)
Overall Score (N x M x S) x (E + D + P)	**-4 x 8 = -32 (Medium)**	**1 x 4 = 4 (Low)**
Reversibility	Low	High
Irreplaceable loss of resources?	Possibly	No
Can impacts be mitigated?	Yes	
Mitigation: The main mitigation measures would be: • To minimise the footprint of construction as much as possible. • Identify potentially highly erodible soils and avoid such areas • Avoid disturbance of watercourses, steep slopes • Re-vegetate bare areas as soon as possible • Practice sustainable soil conservation measures where necessary (contours, geotextiles, soil stabilization)		
Residual Risks: likely to be low, since the implementation of the appropriate mitigation measures will enable more or less complete rehabilitation during and after the life of the project.		

Regarding irrigated areas, the areas where permanent irrigation occur, as identified by the national land cover database. The potential impacts will be highest in the areas shown in blue on the map (Figure 2 below), where great care will be needed to avoid siting the towers in irrigated lands, as well as to try and route the line away from such areas.

For this reason, a separate impact table has been prepared for the possible effects on irrigated agricultural production.

Table 3 Loss of irrigated land

Nature: Loss of potentially productive irrigated areas *(both construction and operation phase)*		
	Without mitigation	**With mitigation**
Nature (N)	Negative (-1)	Neutral (0)
Extent (E)	Local (1)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	High (3)	Low (1)
Probability (P)	Moderate (3)	Unlikely (2)
Significance (S)	Residual (2)	Low (1)
Overall Score (N x M x S) x (E + D + P)	**-6 x 8 = -48 (Medium)**	**1 x 6 = 6 (Low)**
Reversibility	Low	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: The main mitigation measures would be: • To minimise the footprint of construction as much as possible. • Avoid active irrigated areas (see Figure 2), since irrigation cannot be carried out adjacent to transmission lines or under the route.		
Residual Risks: likely to be low, since the implementation of the appropriate mitigation measures will enable more or less complete rehabilitation.		

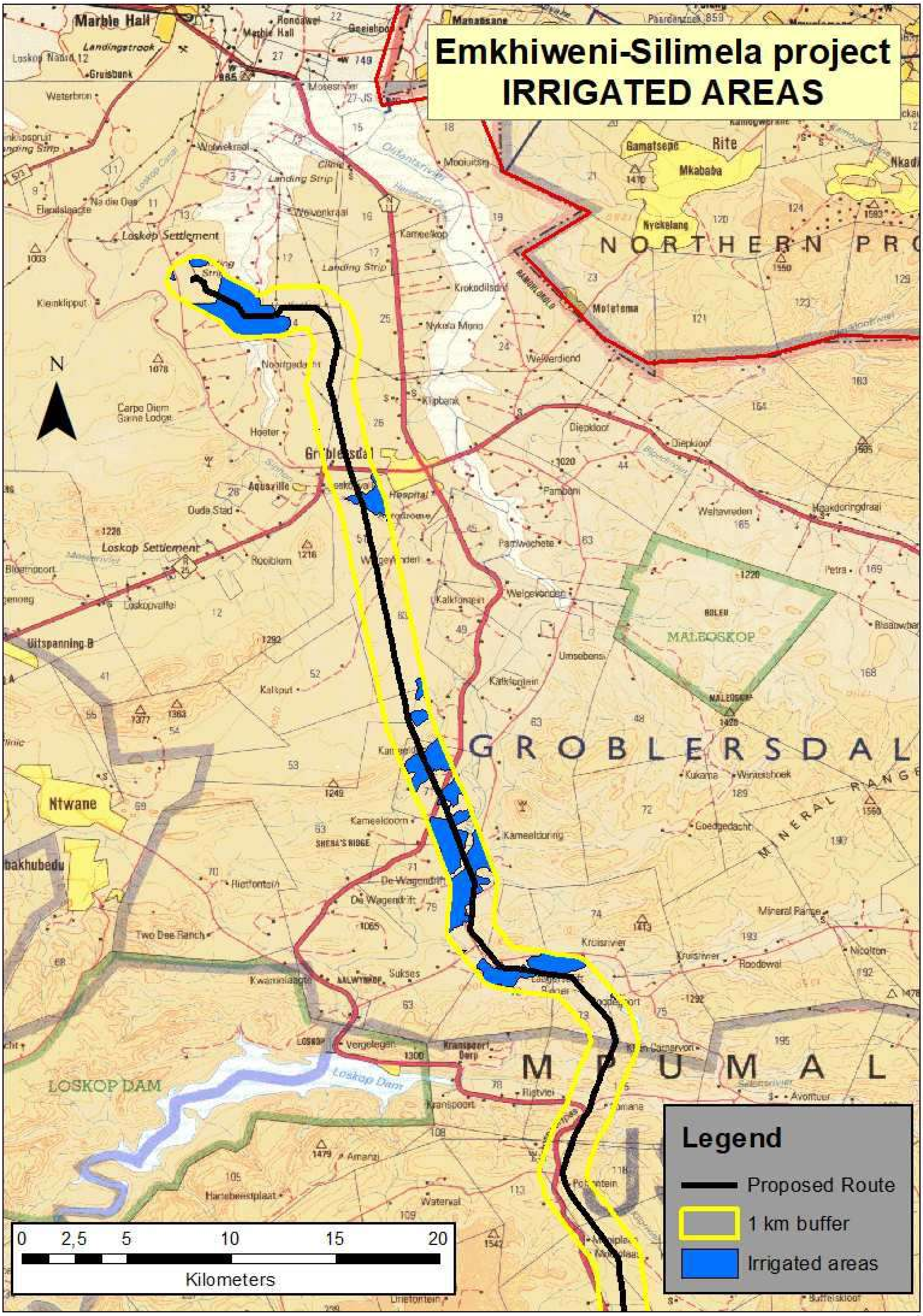


Figure 2 Irrigated areas

6.2 Fatal Flaws and Sensitivity Screening

There are **no fatal flaws** regarding the study area. The impacts to the sensitive areas identified through the study, namely the irrigated soils in the northern sections of the power line, can be mitigated sufficiently.

REFERENCES

Geological Survey, 1992. 1:250 000 scale geological map 2528 Pretoria. Council for Geoscience, Pretoria.

Koch, F.G.L., 1987. Climate data. In: *Land types of the maps 2426 Rustenburg and 2528 Pretoria. Mem. Agric. Nat. Res. S. Afr.* No 8. Dept. Agric & Water Supply, Pretoria.

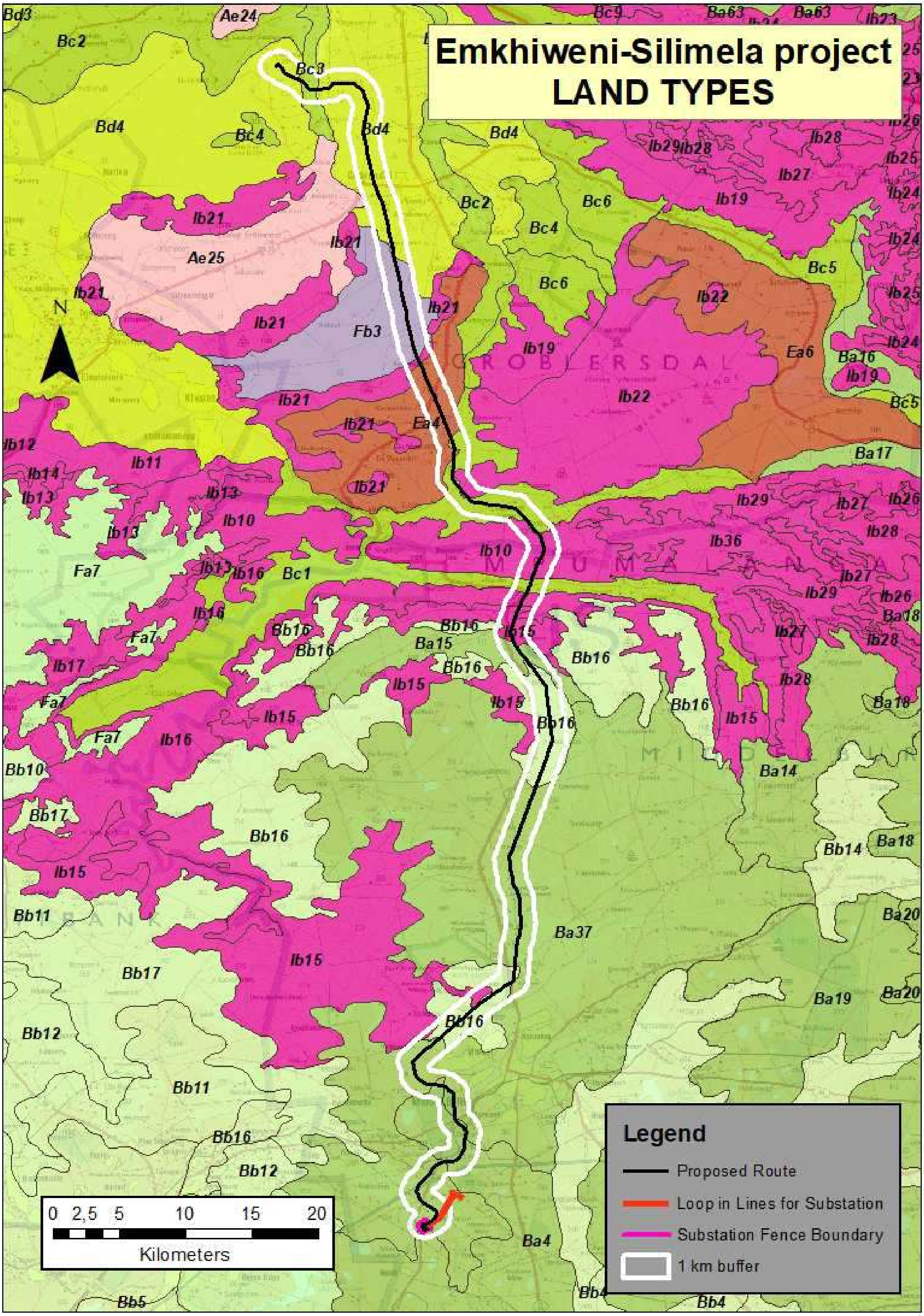
MacVicar, C.N., de Villiers, J.M., Loxton, R.F, Verster, E., Lambrechts, J.J.N., Merryweather, F.R., le Roux, J., van Rooyen, T.H. & Harmse, H.J. von M., 1977. Soil classification. A binomial system for South Africa. ARC-Institute for Soil, Climate & Water, Pretoria.

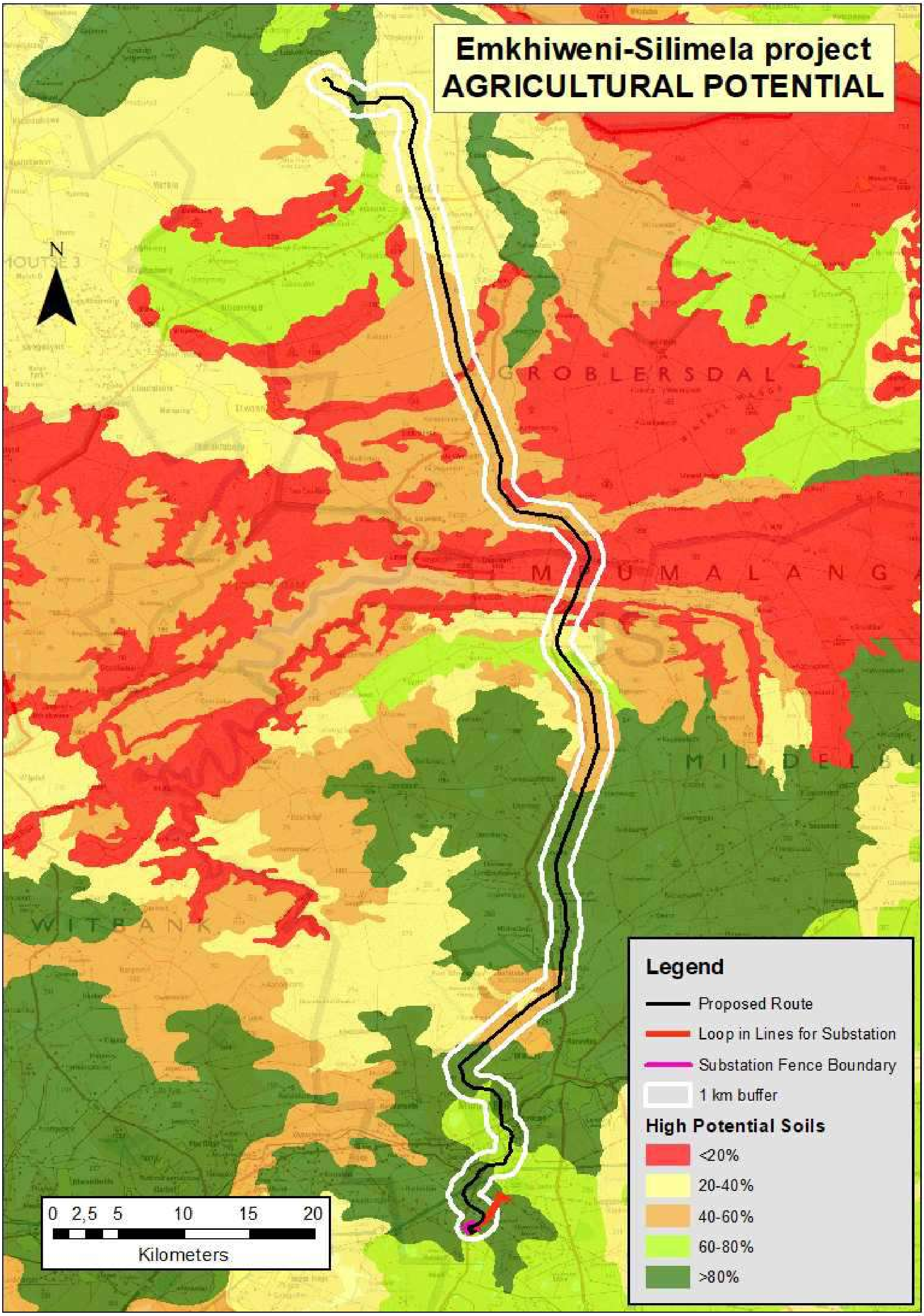
Schoeman, J.L., Meldal-Johnson, A., Fitzpatrick, R.W. & Verster, E., 1985. Land type map 2528 Pretoria. Agricultural Research Council, Pretoria.

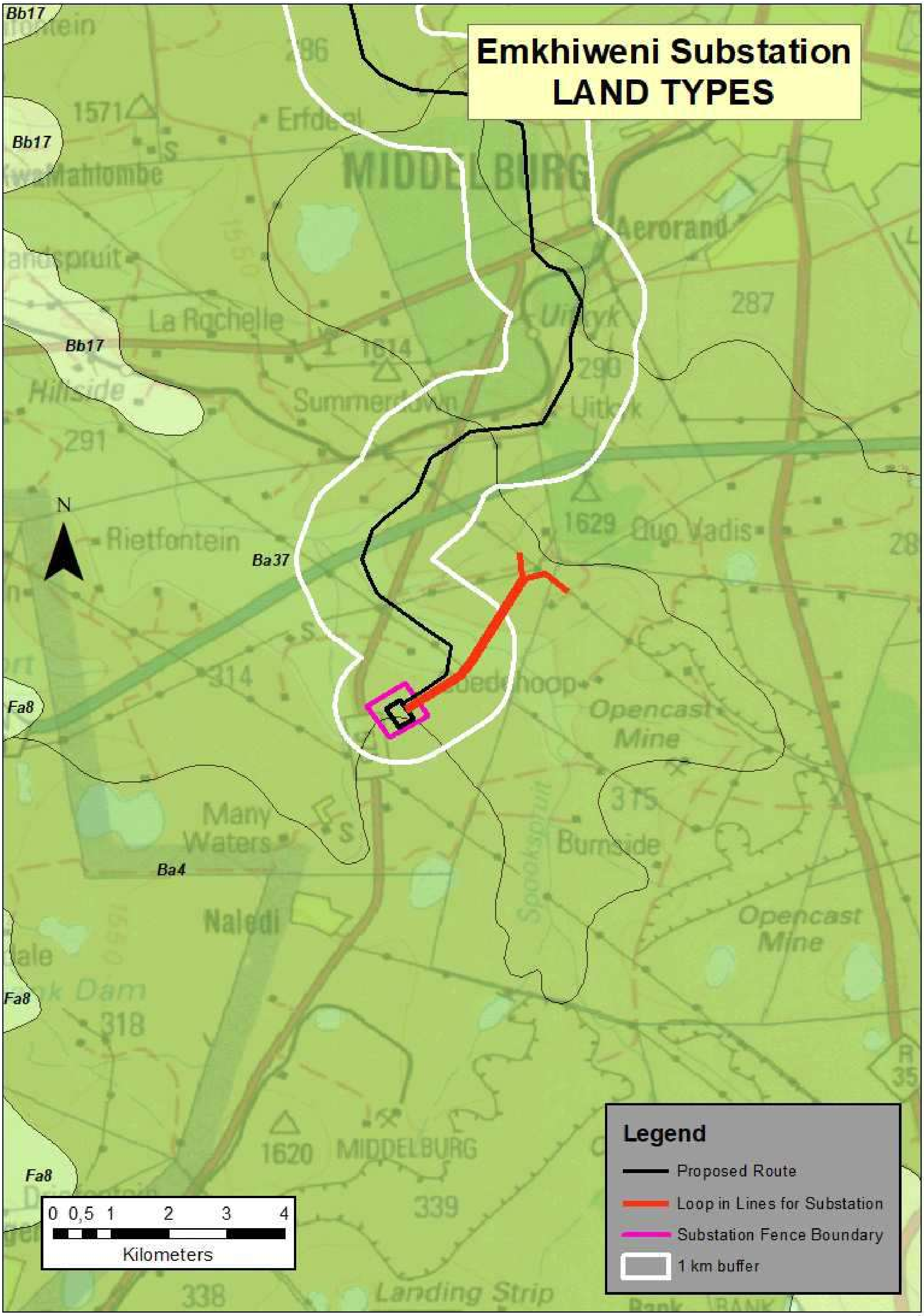
APPENDIX:

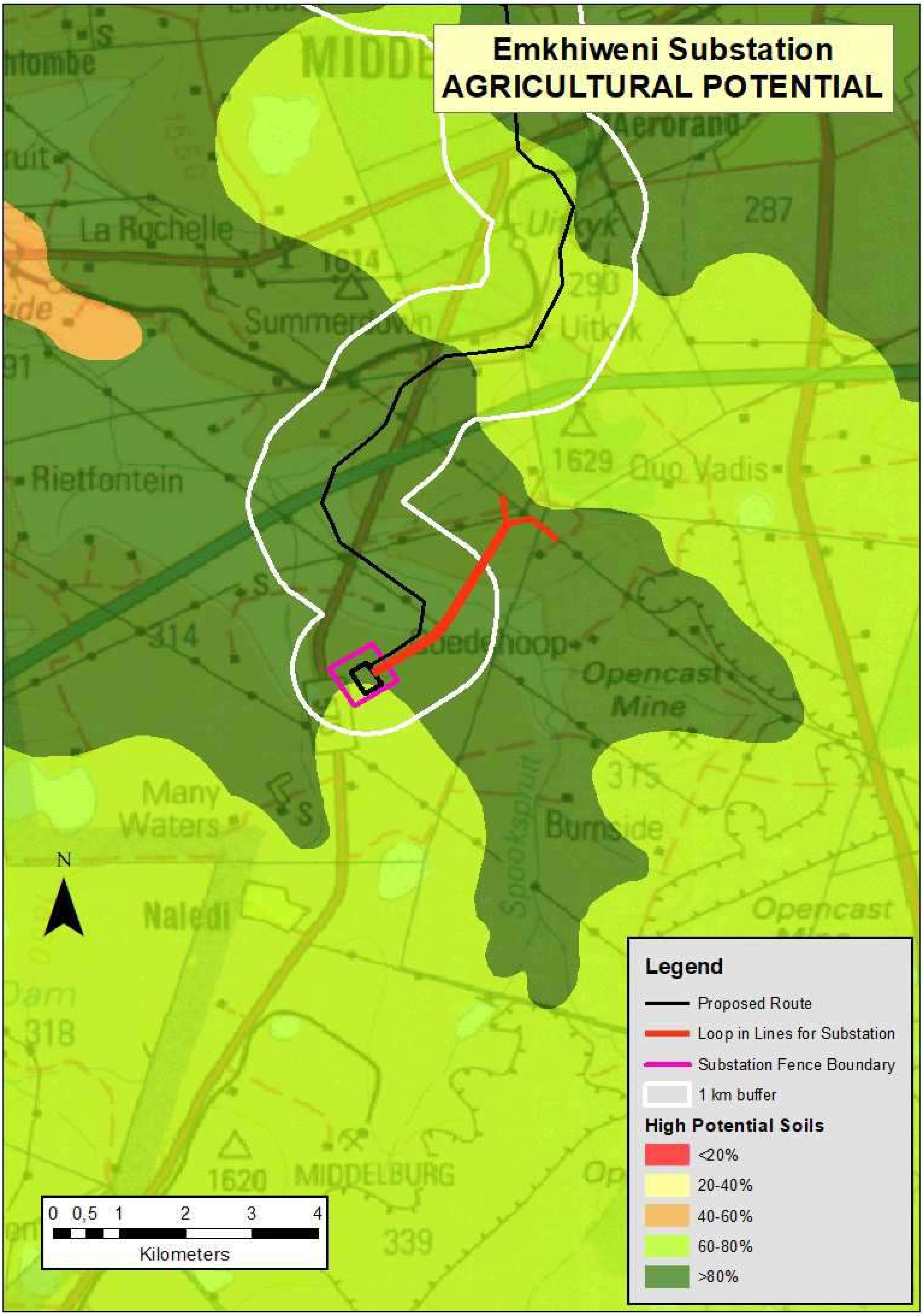
Land Types and

Agricultural Potential


Emkhiweni-Silimela project
LAND TYPES
Legend
Proposed Route
Loop in Lines for Substation
Substation Fence Boundary
1 km buffer
0 2,5 5 10 15 20
Kilometers
N


Emkhiweni-Silimela project
AGRICULTURAL POTENTIAL
N
GROBLERSDAL
MPUMALANGA
MIDDELB
WITBANK
Legend
Proposed Route
Loop in Lines for Substation
Substation Fence Boundary
1 km buffer
High Potential Soils
<20%
20-40%
40-60%
60-80%
>80%
0 2,5 5 10 15 20
Kilometers


Emkhiweni Substation
LAND TYPES
Legend
Proposed Route
Loop in Lines for Substation
Substation Fence Boundary
1 km buffer
0 0,5 1 2 3 4
Kilometers
N
Bb17
Bb17
Bb17
Ba37
Ba4
Fa8
Fa8
Fa8
MIDDELBURG
Aerorand
La Rochelle
Summerdown
Rietfontein
Quo Vadis
Opencast Mine
Many Waters
Naledi
Burnside
Opencast Mine
Landing Strip
MIDDELBURG



Emkhiweni Substation
AGRICULTURAL POTENTIAL
Legend
Proposed Route
Loop in Lines for Substation
Substation Fence Boundary
1 km buffer
High Potential Soils
<20%
20-40%
40-60%
60-80%
>80%
N
0 0,5 1 2 3 4
Kilometers
La Rochelle
Summerdown
Riettfontein
Many Waters
Naledi
Uitkyk
Uitkyk
Quo Vadis
Opencast Mine
Burnside
Spookspruit
MIDDELBURG

Appendix 6E: Visual Impact Assessment

ENVIRONMENTAL & ENGINEERING

REPORT

ESKOM (PTY) LTD

VISUAL IMPACT ASSESSMENT (VIA)

REPORT REF: 19-732-SPS (EIA PHASE)

(VARIOUS PROPERTIES FROM EMKHIWENI SUBSTATION TO SILIMELA, NORTHWEST PROVINCES, SOUTH AFRICA)

VERSION 0.0

Updated- 22/8/2019

Document and Quality Control:

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AA – draft	2019-06-25	Neel Breitenbach		First draft for review / comments
BB – draft	2019-06-26	Vernon Siemelink		Technical Review
CC– draft	2019-06-25	Leoni le Roux		Quality review
DD– draft	2019-08-19	Jacqui Davis		Client review
EE - draft	2019-08-21	Neel Breitenbach		Final Review
Approved for Distribution:				
0.0	2019-08-22	Vernon Siemelink		Final report

Quality Control BY:

Nature of Signoff:	Responsible Person:	Role / Responsibility	Qualification
Author	Neel Breitenbach	Visual Impact and Air Quality specialist	Senior Environmental Consultant B.Sc. Geography
Quality Reviewer	Leoni le Roux	Administrator	Professional Secretary and Personal Assistant
Reviewer	Vernon Siemelink	Senior Environmental Consultant ISO 14001:2004 Auditor	M(EnvMan) Environmental Management UP
Client			

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I, Vernon Siemelink, declare that;

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing:
    - any decision to be taken with respect to the application by the competent authority; and
    - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

	2019-06-26
Signature	**Date**

Mr. Vernon Siemelink
BSSc Honn GeoScience (UP)
M (EnvMan) Environmental Management
ISO 14001:2004 Lead Auditor

EXECUTIVE SUMMARY

Nemai Consulting was appointed by Eskom in 2009 to undertake the EIA as part of the 2006 EIA Regulations for the following projects:

1. Construction of the Rockdale B Substation (now referred to as Emkhiweni Substation), with 2 x 500 MVA 400 / 132 kV transformers; and
2. Construction of the Rockdale B to Wolwekraal 400 kV line (now referred to as the Emkhiweni Substation to Silimela 400 kV line).

The projects were authorised in May 2011 (Emkhiweni Substation) and July 2011 (Emkhiweni-Silimela 400 kV line). Eskom has decided to proceed with the construction of Emkhiweni-Silimela 400 kV line (which is approximately 80 kms) however the previous Record of Decision (RoD) has lapsed. Therefore Nemai Consulting are undertaking a new application for Environmental Authorisation (EA) as part of the 2014 EIA Regulations, as amended (07 April 2017). Eskom was not able to proceed with construction within the ROD timeframes as a result of the lack of funding for the project.

The proposed project is associated with the transmission network and its associated substations in the Mpumalanga and Limpopo Provinces.

EMKHIWENI SUBSTATION TO SILIMELA 400 KV LINE

The distribution network in the Marble Hall area is supplied from the Simplon substation, this network is currently experiencing low voltage problems. In future the Simplon and Rockdale substations will supply additional power to the network, however this additional power cannot be supported by the existing network without violating its operational limits.

The Emkhiweni Substation to Silimela 400 kV line provides the means to support the additional power supply within operational limits.

EMKHIWENI SUBSTATION

Rockdale is an existing substation located to the southwest of Middleburg near the N11. The transmission lines that feed into it are the two Arnot – Rockdale 275 kV lines. The firm capacity at the Rockdale substation is 500 MVA and was exceeded in 2007. The new loads at the substation cannot be accommodated without violating the loading conditions of the transformers, which are 45 years old. The existing Rockdale substation also does not have the correct busbar arrangement. If a single transformer is lost, load shedding would be necessary. If a transformer needs to be maintained then this would also result in load shedding. Additional power demands are expected for the Rockdale substation, however due to the abovementioned problems these cannot be accommodated.

The proposed solution is the construction of a new substation near to the existing Rockdale substation. This proposed new substation would be known as Emkhiweni and it would serve the following purpose:

- De-load the Rockdale and Vulcan substations;
- Create capacity at the existing substations;
- Cater for new loads; and
- Improve the reliability in the Middleburg area.

The scope of work for this Visual Impact Assessment will include:

1. Describe the existing visual characteristics of the proposed sites and its environs;
2. Viewshed and viewing distance using GIS analysis up to 3 km from the proposed structures (5 km for the Substation);
3. Visual Exposure Analysis;
4. Viewer Sensitivity analysis;
5. Overall Visual Impact; and
6. Determine Visual Impact Significance ranking of project.

GIS VISUAL IMPACT RATINGS

Table 1: GIS Calculated Visual Impact.

Alternative	Sum of GIS Pixel Values	Max of GIS Pixel Values	Mean of GIS Pixel Values	Visual Impact Rating
400 kv Line	2 521 338	20.886	4.414	Low
Emkhiweni Substation	258 977	18.953	3.846	Low

Categorizing the values into 5 categories from Very Low to Very High, the mean quantitative impact of the project can be categorised as Low. This however is the mean value for the full 3 km and 5 km buffer of the project. Specific locations along the proposed 400 kV line may be ranked higher.

The visual impact generated in GIS cannot be guaranteed as 100% accurate. Some viewpoints, which are indicated on the viewshed as being inside of the viewshed, can be outside of the viewshed. This is due to the change of the natural environment by surrounding activities as well as natural vegetation that play a significant role and can have a positive or negative influence on the visual impact.

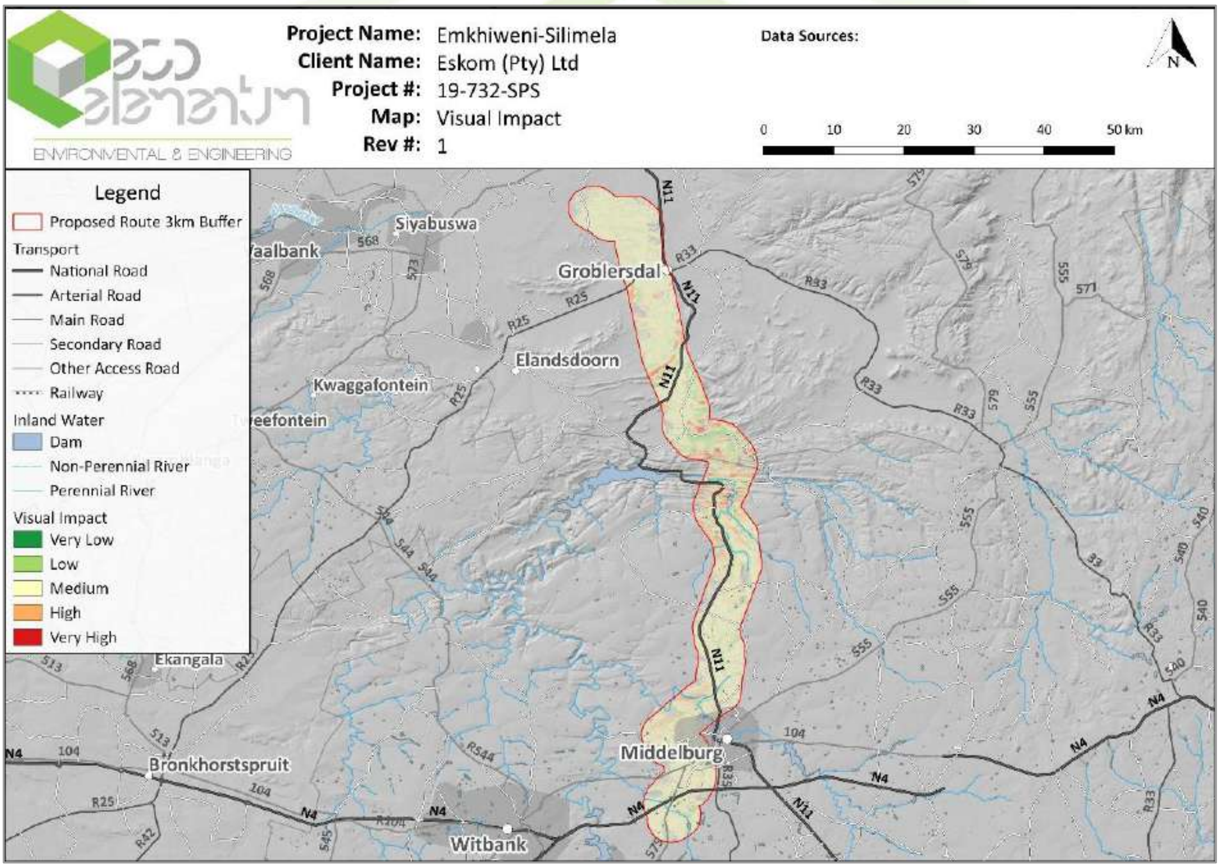

Figure 1: GIS Visual Impact of the proposed Emkhiweni-Silimela 400 kV Line

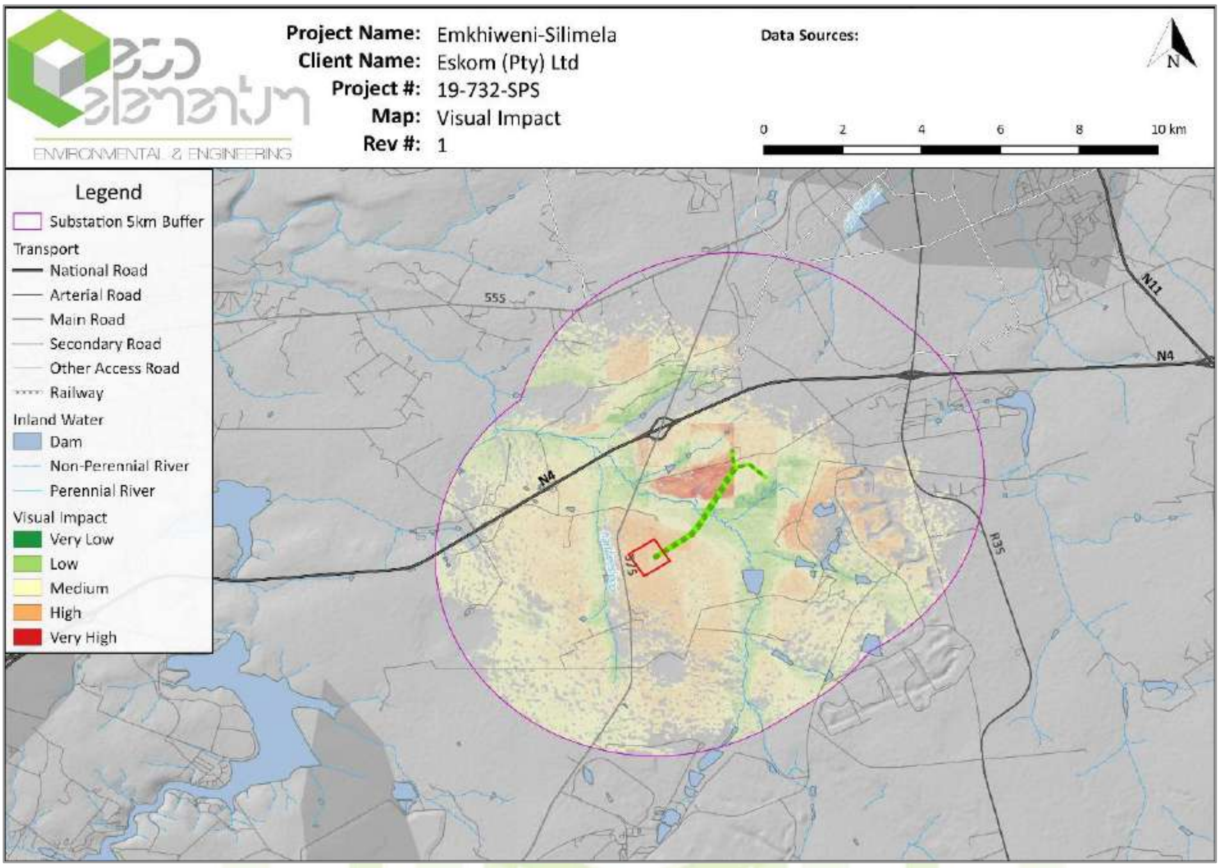

Figure 2: GIS Visual Impact of the proposed Emkhiweni Substation

SIGNIFICANCE IMPACT RATINGS

The construction and operation phase of the proposed Emkhiweni-Silimela related activities and its associated infrastructure will have a MEDIUM visual impact on the natural scenic resources and the topography. However, with the correct mitigation measures the impact might decrease to a point where the visual impact can be seen as less significant although still MEDIUM. The moderating factors of the visual impact of the proposed infrastructure in close range are as follows:

- Number of human inhabitants located in the area;
- Natural topography and vegetation;
- Mitigation measures that will be implemented such as the establishment of barriers or screens;
- Paint colour of the Pylons;
- The size of the operation; and
- Absorption capacity of the landscape.

In light of the above-mentioned factors that reduce the impact of the facility, the visual impact is assessed as MEDIUM VISUAL IMPACT after mitigation measures have been implemented.

Table 2: The overall Assessment of the Visual Impact

Nature of impact: The overall Assessment of the Visual Impact of the area.		
	No Mitigation	**With Mitigation**
	Proposed	**Proposed**
Extent	3	2.25
Duration	3.75	3.5
Magnitude	6.5	5
Probability	4	3.5
Significance Rating (SR)	Medium (55)	Medium (38.25)
Status (positive, neutral or negative)	Negative	
Reversibility	No	
Irreplaceable loss of resources	Yes	
Can impact be mitigated	Yes	
Mitigation:	All mitigation as discussed in each individual project element.	
Cumulative Impact:	Cumulative of each individual project element.	

The Visual Impact due to the construction activities and associated project infrastructure can be seen as having a MEDIUM impact on the surrounding environment and inhabitants before mitigation measures are implemented. After mitigation, the visual impact can be seen as lowered although still classified as MEDIUM. Thus, mitigation measures are very important and two of the most significant mitigation measures are the rehabilitation of the area after construction has been concluded and reducing the visibility of the powerlines as much as possible. If the mitigation of the impact is not done correctly then the visual impact will become a concern. However, with the correct mitigation, the impact will be of minimal visual intrusion for the type of proposed structures.

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Definition of Terms

Assessment	A systematic, independent and documented review of operations and practises to ensure that relevant requirements are met.
Construction	The time period that corresponds to any event, process, or activity that occurs during the Construction phase (e.g., building of site, buildings, and processing units) of the proposed project. This phase terminates when the project goes into full operation or use.
Critical viewpoints	Important points from where viewers will be able to view the proposed or actual development and from where the development may be significant.
Cumulative Impacts	The summation of the effects that result from changes caused by a development in conjunction with the other past, present or reasonably foreseen actions (The landscape Institute, Institute of Environmental Management & Assessment. 2002)
Decommissioning	to remove or retire (a mine, etc.) from active service.
Environmental Component	An attribute or constituent of the environment (i.e., air quality; marine water; waste management; geology, seismicity, soil, and groundwater; marine ecology; terrestrial ecology, noise, traffic, socio-economic) that may be impacted by the proposed project.
Environmental Impact	A positive or negative condition that occurs to an environmental component as a result of the activity of a project or facility. This impact can be directly or indirectly caused by the project's different phases (i.e., Construction, Operation, and Decommissioning).
Field of view:	The field of view is the angular extent of the observable world that is seen at any given moment. Humans have an almost 180º forward-facing field of view. Note that human stereoscopic (binocular) vision only covers 140º of the field of view in humans; the remaining peripheral 40º have no binocular vision due to the lack of overlap of the images of the eyes. The lower the focal length of a lens (see below), the wider the field of view.
Landscape Integrity	Landscape integrity is visual qualities represented by the following qualities, which enhance the visual and aesthetic experience of the area.
Mitigation (in the context of Visual Impact Assessment):	Any action taken or not taken in order to avoid, minimise, rectify, reduce, eliminate, or compensate for actual or potential adverse visual impacts.
Operation	The time period that corresponds to any event, process, or activity that occurs during the Operation (i.e., fully functioning) phase of the proposed project or development. (The Operation phase follows the Construction phase, and then terminates when the project or development goes into the Decommissioning phase.)
Record of Decision	Is an environmental authorisation issued by a state department.
Scenic value	Degree of visual quality resulting from the level of variety, harmony and contrast among the basic visual elements.
Sense of place	The character of a place, whether natural, rural or urban, it is allocated to a place or area through cognitive experience by the user.
Visual absorption capacity (VAC):	The ability of elements of the landscape to "absorb" or mitigate the visibility of an element in the landscape. Visual absorption capacity is based on factors such as vegetation height (the greater the height of vegetation, the higher the absorption capacity), structures (the larger and higher the intervening structures, the higher the absorption capacity) and topographical variation (rolling topography presents opportunities to hide an element in the landscape and therefore increases the absorption capacity).
Visual character	The overall impression of a landscape created by the order of the patterns composing it; the visual elements of these patterns are the form, line, colour and texture of the landscape's components. Their interrelationships are described in terms of dominance, scale, diversity and continuity. This characteristic is also associated with land use.
Visual Exposure	Visual exposure is based on distance from the project to selected viewpoints. Visual exposure or visual impact tends to diminish exponentially with distance. The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed mine activities and associated infrastructure were not visible, no visual impact would occur. Visual exposure is determined by the viewshed or the view catchment being the area within which the proposed development will be visible.
Visual Integrity	Visual sensitivity can be determined by a number of factors in combination, such as prominent topographic or other scenic features, including high points, steep slopes and axial vistas.
Visually sensitive	Areas in the landscape from where the visual impact is readily or excessively encountered.

Abbreviations

CA:	Competent Authority
DEA:	Department of Environmental Affairs (The former Department of Environmental Affairs and Tourism)
DMR:	The Department of Mineral Resources (The former Department of Minerals and Energy)
DWA:	Department of Water Affairs (Is now referred to the Department of Water and Sanitation – DWS)
EIA:	Environmental Impact Assessment
EMP:	Environmental Management Plan
EMPr:	Environmental Management Programme
I&AP's:	Interested and Affected Parties
IWUL:	Integrated Water Use License
IWWMP:	Integrated Water and Water Management Plan
MPRDA:	Mineral and Petroleum Resources Development Act, 28 of 2002
NAAQS:	National Ambient Air Quality Standards
NEMA:	National Environmental Management Act, 107 of 1998
NEMAQA:	National Environmental Management: Air Quality Act, 39 of 2004
NEMBA:	National Environmental Management: Biodiversity Act, 10 of 2004
NEMWA:	National Environmental Management: Waste Act, 59 of 2008
NHRA:	National Heritage Resources Act, 25 of 1999
NWA:	National Water Act, 36 of 1998
ROD:	Record of Decision
VAC:	Visual Absorption Capability
VIA:	Visual Impact Assessment
WSA:	Water Services Act, 108 of 1997
WUL*:*	Water Use Licence

PROJECT INFORMATION

Table 3: Applicant Details

Name of Applicant:	Eskom (PTY) Ltd
Contact Person:	
Contact Number:	
Email:	
Postal Address:	
Physical Address:	
File Reference Number DMR:	

Table 4: EAP Details

EAP Company:	NEMAI Consulting
Postal Address:	PO Box 1673 Sunninghill 2157
Contact Person:	Jaqui Davis
Contact Number:	011 781 1730
Email:	mailto:JacquiD@nemai.co.za
Website:	www.nemai.co.za

Table 5: Specialist Details

Specialist Company:	Eco Elementum (Pty) Ltd
Company Reg. No.:	2012/021578/07
Physical Address:	Office E2 The Willows Office Park Die Wilgers Pretoria 0184
Postal Address:	26 Greenwood Crescent Lynnwood Ridge 0040
Contact Person:	Vernon Siemelink
Contact Number:	072 196 9928
Email:	vernon@ecoelementum.co.za info@ecoelementum.co.za
Website:	www.ecoelementum.co.za

1. INTRODUCTION

Nemai Consulting was appointed by Eskom in 2009 to undertake the EIA as part of the 2006 EIA Regulations for the following projects:

1. Construction of the Rockdale B Substation (now referred to as Emkhiweni Substation), with 2 x 500 MVA 400 / 132 kV transformers; and
2. Construction of the Rockdale B to Wolwekraal 400 kV line (now referred to as the Emkhiweni Substation to Silimela 400 kV line).

The projects were authorised in May 2011 (Emkhiweni Substation) and July 2011 (Emkhiweni-Silimela 400 kV line). Eskom has decided to proceed with the construction of Emkhiweni-Silimela 400 kV line (which is approximately 80 kms) however the previous Record of Decision (RoD) has lapsed. Therefore Nemai Consulting are undertaking a new application for Environmental Authorisation (EA) as part of the 2014 EIA Regulations, as amended (07 April 2017). Eskom was not able to proceed with construction within the ROD timeframes as a result of the lack of funding for the project.

The proposed project is associated with the transmission network and its associated substations in the Mpumalanga and Limpopo Provinces.

1.1 Transmission Network Status in Mpumalanga and Limpopo Provinces

There are two transmission subsystems in the Mpumalanga and Limpopo Provinces, these are known as "Highveld North West" and "Lowveld North". These subsystems are interconnected and are currently experiencing several problems:

- The lines in the study area are heavily loaded, i.e. if maintenance is required or there is a fault on the line the remaining lines may exceed their thermal limits, as a result load shedding would become necessary;
- The transfer capacity is insufficient;
- An existing substation called Rockdale reached its firm capacity in 2007;
- The distribution network supplied by the Vulcan substations is passing through a burning ground and the network is failing, therefore these lines need to be diverted to other supply sources;
- The distribution network in the Marble Hall area is experiencing low voltage problems; and
- The Proposed Steelpoort (Tubatse) Pumped Storage Scheme requires Transmission network strengthening.

To combat these problems, several phased projects for which environmental assessments have been authorised, have been undertaken and include:

- Mokopane to Wolwekraal 400 kV power line and associated secondary infrastructure;
- Steelpoort to Wolwekraal 400 kV power line and associated secondary infrastructure; and
- Wolwekraal substation and associated secondary infrastructure.

Once these projects are implemented the following would have been achieved:

- The network security will be improved;
- Capacity for future load increases would be created; and
- Eskom's revenue would be increased.

1.2 Emkhiweni Substation to Silimela 400 kV Line

The distribution network in the Marble Hall area is supplied from the Simplon substation, this network is currently experiencing low voltage problems. In future the Simplon and Rockdale substations will supply additional power to the network, however this additional power cannot be supported by the existing network without violating its operational limits.

The Emkhiweni Substation to Silimela 400 kV line provides the means to support the additional power supply within operational limits.

1.3 Emkhiweni Substation

Rockdale is an existing substation located to the southwest of Middleburg near the N11. The transmission lines that feed into it are the two Arnot – Rockdale 275 kV lines. The firm capacity at the Rockdale substation is 500 MVA and was exceeded in 2007. The new loads at the substation cannot be accommodated without violating the loading conditions of the transformers, which are 45 years old. The existing Rockdale substation also does not have the correct busbar arrangement. If a single transformer is lost, load shedding would be necessary. If a transformer needs to be maintained then this would also result in load shedding. Additional power demands are expected for the Rockdale substation, however due to the abovementioned problems these cannot be accommodated.

The proposed solution is the construction of a new substation near to the existing Rockdale substation. This proposed new substation would be known as Emkhiweni and it would serve the following purpose:

- De-load the Rockdale and Vulcan substations;
- Create capacity at the existing substations;
- Cater for new loads; and
- Improve the reliability in the Middleburg area.

Table 6: Project Locality

Farm Name:	**Various**
Application Area:	~108 km
Magisterial District:	Various in Mpumalanga and Limpopo Provinces
Distance and direction from nearest town:	Various along the ~108 km route.

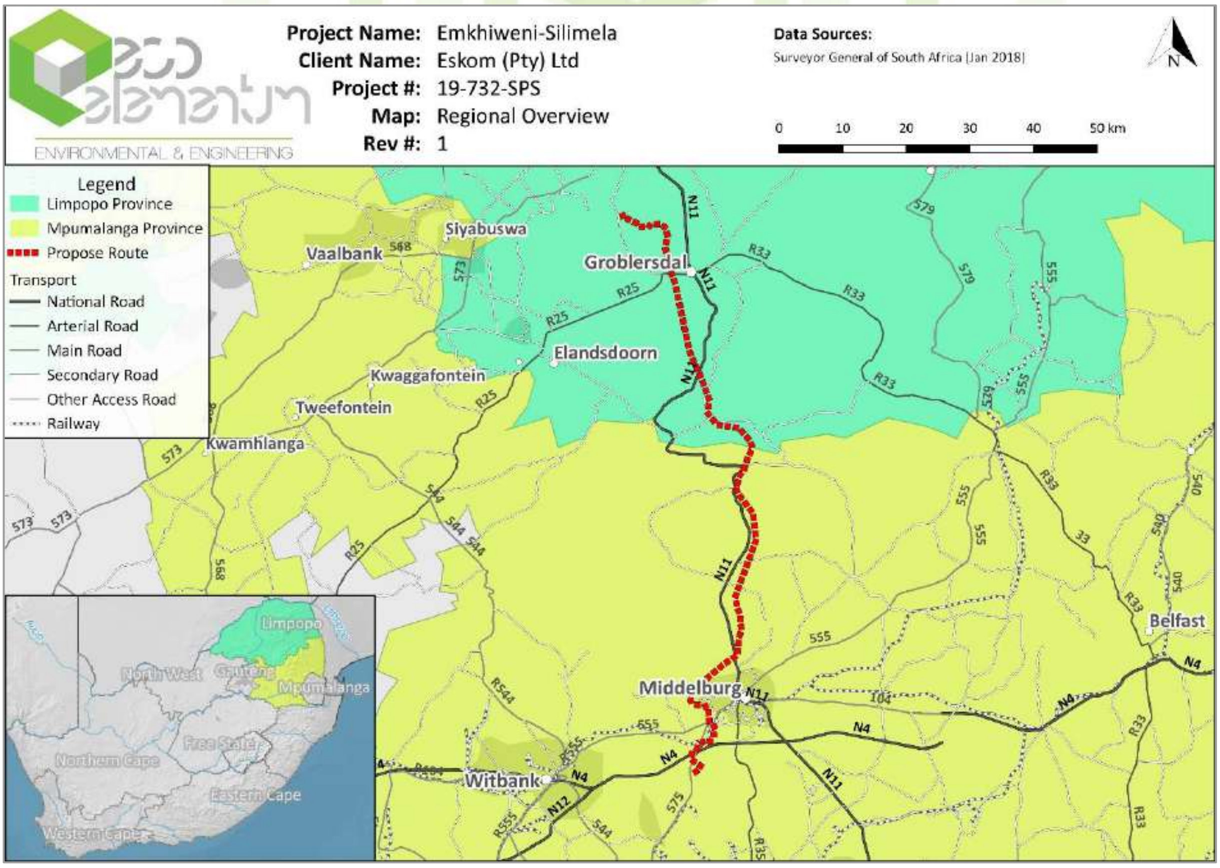

Figure 3: Locality map indicating the regional overview of the proposed Emkhiweni-Silimela project

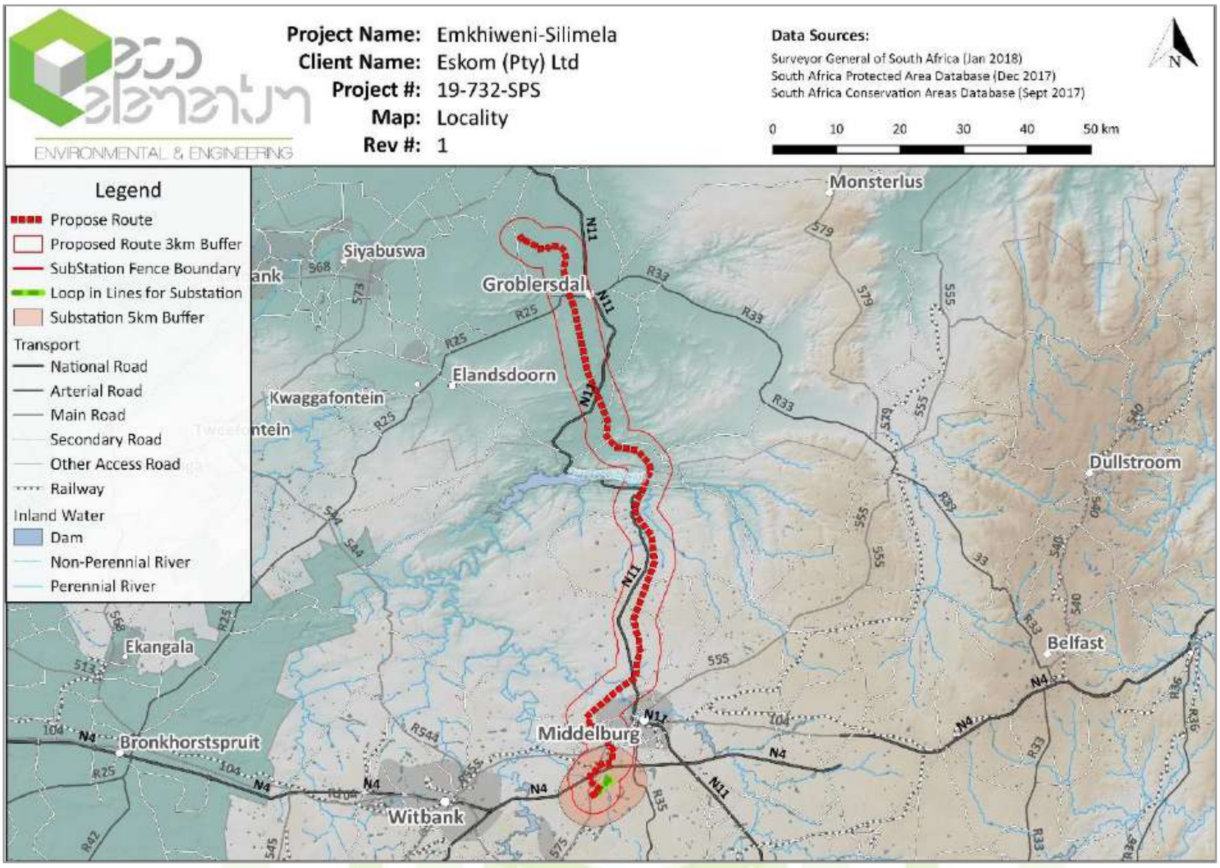

Figure 4: Locality map of the Emkhiweni-Silimela project.

2. SCOPE OF WORK

The scope of work for this Visual Impact Assessment will include:

1. Viewshed and viewing distance using GIS analysis up to 3 km from the proposed structures, 5km for the proposed Substation.
2. Visual Exposure Analysis comprising the following aspects:
    - Terrain Slope;
        - Slope angle is determined from the Digital Terrain Model (DTM) and the location of the proposed structures given a ranking depending on the steepness of the slope;
    - Aspect of structure location;
        - Aspect of the slope where the structures are to be built, are calculated from the DTM and given a ranking determined by the Sun angle.
    - Landforms;
        - Landform of the location of the proposed structures are determined from the DTM and ranked according to the type of landform. Structures built on certain landforms, e.g. ridges, will be more visible than structures built in valleys.
    - Slope Position of structure;
        - Using GIS analysis, the position of the proposed structure is determined and ranked according to the position on the slope the structure is to be built.
    - Relative elevation of structure;
        - Using the DEM the elevation of the proposed structure relative to the surrounding elevation is determined and ranked according to the difference in height of the surrounding areas.
    - Terrain Ruggedness;
        - The terrain ruggedness is determined from the DEM and given a ranking based on the homogeneousness of the terrain.
3. Viewer Sensitivity;
    - The Viewer sensitivity ranking of the surrounding areas is determined using various land cover and land use datasets and ranked according to the sensitivity of the related structures to the environment.
4. Overall Visual Impact;
    - Combing all the above dataset a final visual impact of the proposed structures is calculated.
5. Determine Visual Impact Significance ranking of project.

3. STUDY AREA

3.1 LOCATION

3.1.1 Topography

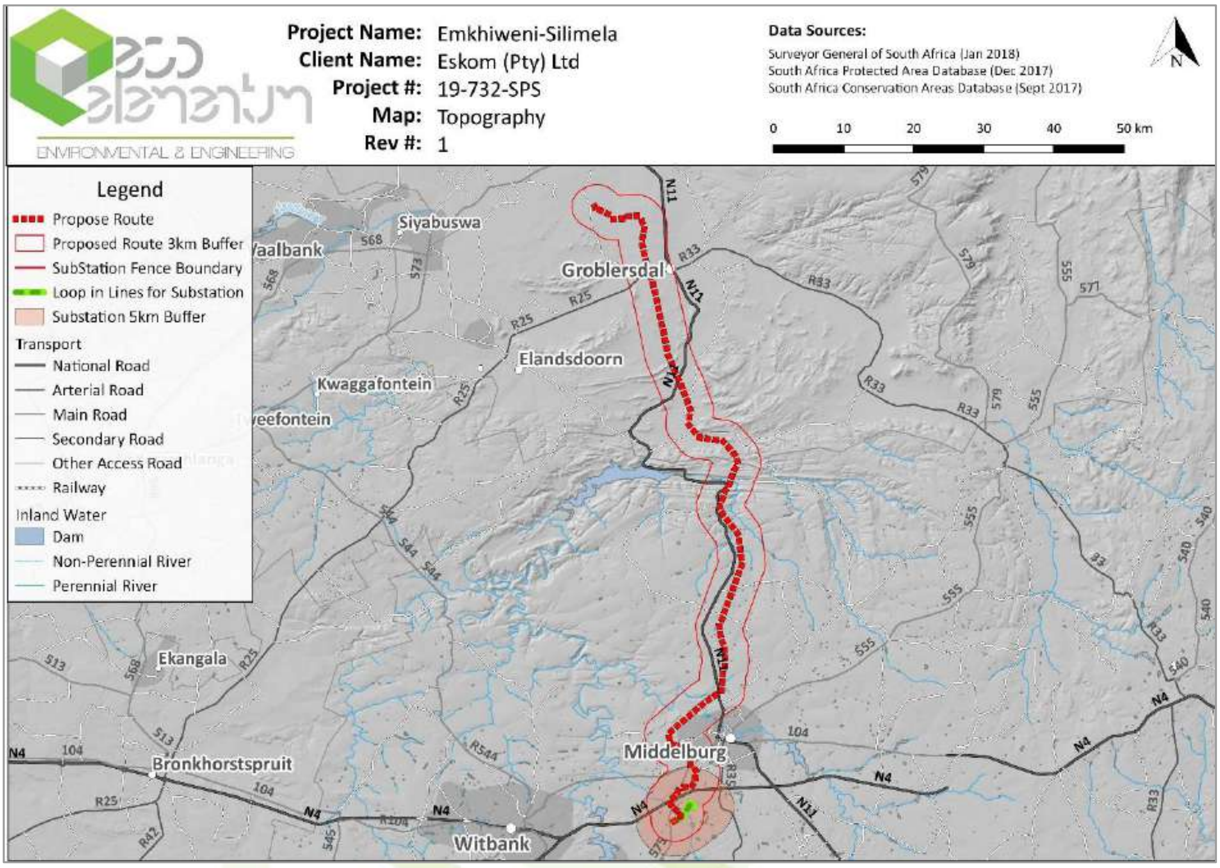

Figure 5: Map showing the Topography surrounding the Emkhiweni-Silimela project.

The proposed Emkhiweni-Silimela project area is situated in a predominant flat area. It does cross a deep valley at about the halfway mark of the proposed route.

3.2 NEW INFRASTRUCTURE

The proposed Emkhiweni Silimela project will comprise of newly built pylon structures. Three main tower types are typically used for 400 kV lines, Guyed-V, Cross-Rope, and Bend/Strain. The highest of these three are assumed to be used. A new substation at Emkhiweni will also be built with loop in lines.

Table 7 show the maximum height of the relevant proposed structures.

Table 7: Maximum Heights of Relevant Infrastructure.

Description	Height (m)
Pylon	30
Substation	20

4. METHODOLOGY

The following sequence was employed in this Visual Assessment Report:

4.1 GIS Assessment Of Visual Impact

1. Viewshed and viewing distance using GIS analysis up to 3 km from the proposed structures.
    - In order to model the decreasing visual impact of the structures, an Euclidean distance ranking was done from the centreline of the proposed Powerlines and superimposed on the viewshed to determine the level of visual exposure. The closest zone to the proposed structures indicates the area of most significant impact and the zone further than 3 km from the structures indicates the area of least impact.
2. A Visual Exposure Analysis was conducted that included the following parameters:
    - Terrain Slope:
        - Slope angle is determined from the Digital Terrain Model (DTM) and the location of the proposed structures given a ranking depending on the steepness of the slope; and
        - Structures built on steep slopes are assumed more visible and exposed than those on flat surfaces.
    - Aspect of structure location:
        - Aspect of the slope where the structures are to be built, are calculated from the DTM and given a ranking determined by the Sun angle.
        - Structures on flat surface are illuminated by the sun the whole day and thus visible from all directions. In the southern hemisphere structures on North facing slopes are less visible from the South, structures on East and West facing slopes are only illuminated during half of the day thus less visible where structures on the southern slopes are mostly in the shade.
    - Landforms:
        - Landform of the location of the proposed structures are determined from the DTM and ranked according to the type of landform. Structures built on certain landforms, e.g. ridges, will be more visible than structures built in valleys.
    - Slope Position of structure:
        - Using GIS analysis, the position of the proposed structure is determined and ranked according to the position on the slope the structure is to be built.
    - Relative elevation of structure:
        - Using the DEM the elevation of the proposed structure relative to the surrounding elevation is determined and ranked according to the difference in height of the surrounding areas. Structures built on higher ground are more visible than those built in low-lying areas.
    - Terrain Ruggedness:
        - The terrain ruggedness is determined from the DEM and given a ranking based on the homogeneousness of the terrain. Rugged terrain has a tendency to increase the visual absorption characteristics of the terrain.

3. Viewer Sensitivity:
    - The Viewer sensitivity ranking of the surrounding areas is determined using various land cover and land use datasets and ranked according to the sensitivity of the related structures to the environment.
4. Overall Visual Impact:
    - Combing all the above datasets, a final potential visual impact of the proposed structures is calculated. This is done by adding all the above values for the entire length of the proposed options.

4.2 Visual Impact Significance

- A visual impact significance rating is determined using the following criteria:
    - Extent of the site;
    - Duration of the project;
    - Magnitude of the project; and
    - Probability that it will have a visual impact.

4.3 Assumptions

- The core study area can be defined as an area with a radius of not more than 3 km from the structures. This is because the visual impact of Powerlines beyond a distance of 3 km would be so reduced that it can be considered negligible even if there is direct line of sight.
- The assessment was undertaken during the planning stage of the project and is based on the information available at that time.

4.4 Limitations

- Visual perception is by nature a subjective experience, as it is influenced largely by personal values. For instance, what one-viewer experiences as an intrusion in the landscape, another may regard as positive. Such differences in perception are greatly influenced by culture, education and socio-economic background. A degree of subjectivity is therefore bound to influence the rating of visual impacts. In order to limit such subjectivity, a combination of quantitative and qualitative assessment methods were used. A high degree of reliance has been placed on GIS-based analysis viewshed, visibility analysis, and on making transparent assumptions and value judgements, where such assumptions or judgements are necessary.
- The viewshed generated in GIS cannot be guaranteed as 100% accurate. Some viewpoints, which are indicated on the viewshed as being inside of the viewshed, can be outside of the viewshed. This is due to the change of the natural environment by surrounding activities as well as natural vegetation that play a significant role and can have a positive or negative influence on the viewshed.

4.5 Legal Requirements

There are no specific legal requirements for visual impact assessment in South Africa. Visual impacts are, however required to be assessed by implication when the provisions of relevant acts governing Environmental Impact Management are considered.

5. GIS, ASSESSMENT OF VISUAL IMPACTS

5.1 VISIBILITY

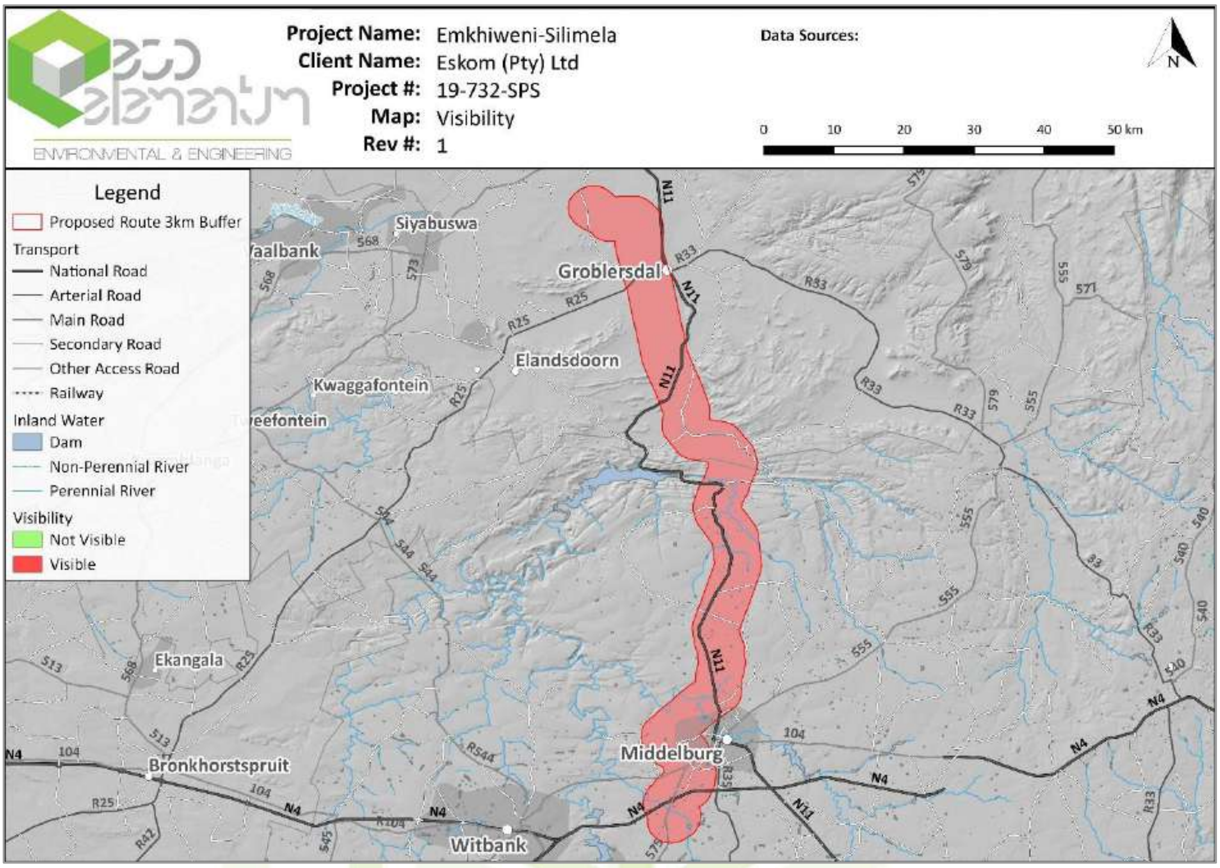

Figure 6: Visibility of the proposed Emkhiweni-Silimela 400 kv Line

A visibility analysis was run to determine the locations from which the proposed infrastructure would be visible within the 3 km buffer of the centre line of the Powerlines.

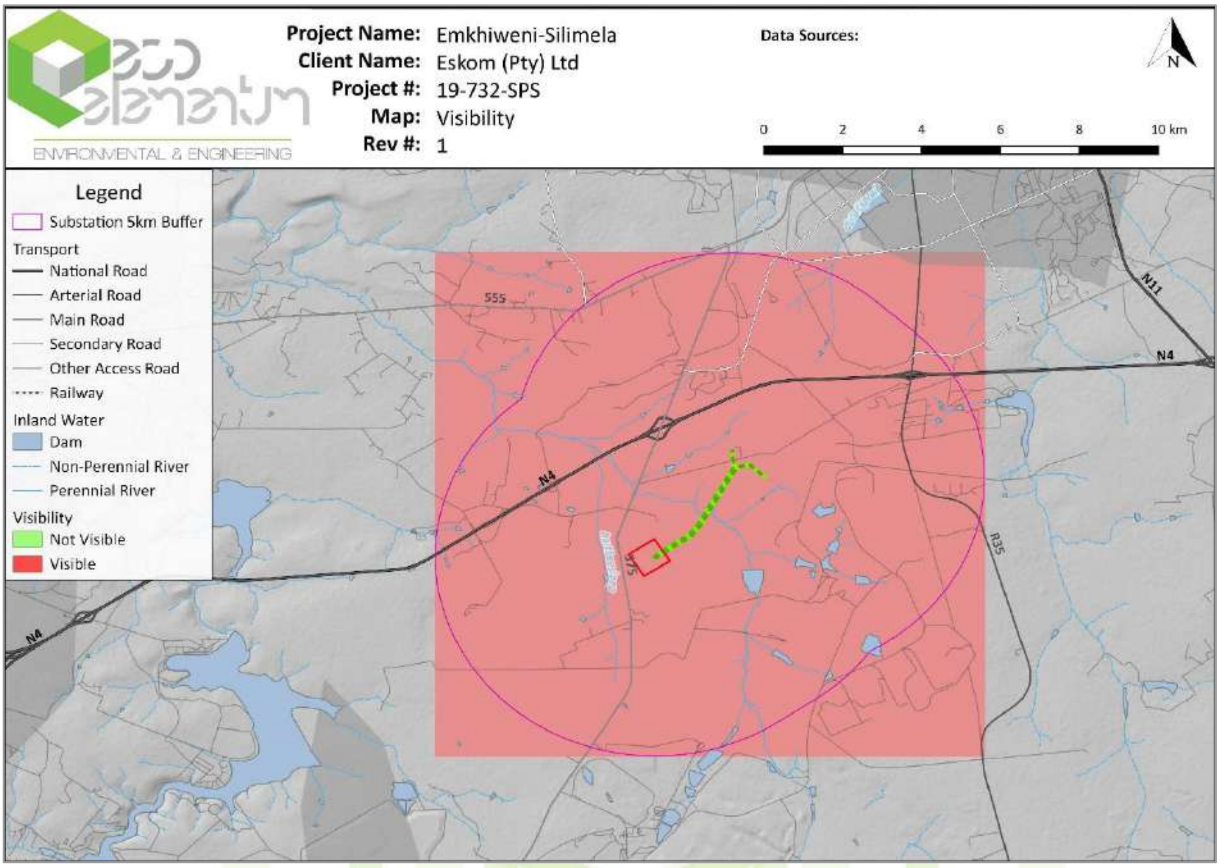

Figure 7: Visibility of the proposed Emkhiweni Substation

A visibility analysis was run to determine the locations from which the proposed infrastructure would be visible within the 5 km buffer of the proposed Emkhiweni substation.

5.2 Visual Exposure

Visual exposure is based on distance from the project within the 3 km buffer zone from the proposed centre line of the Powerlines. Visual exposure or visual impact tends to diminish exponentially with distance. The visibility or visual exposure of any structure or activity is the point of departure for the Visual Impact Assessment. It stands to reason that if the proposed structures were not visible, no visual impact would occur. Visual exposure is determined by the following variables:

- Slope angle;
- Aspect of slope;
- Landforms;
- Slope Position of structure;
- Relative Elevation of structure; and
- Terrain Ruggedness.

5.2.1 Slope

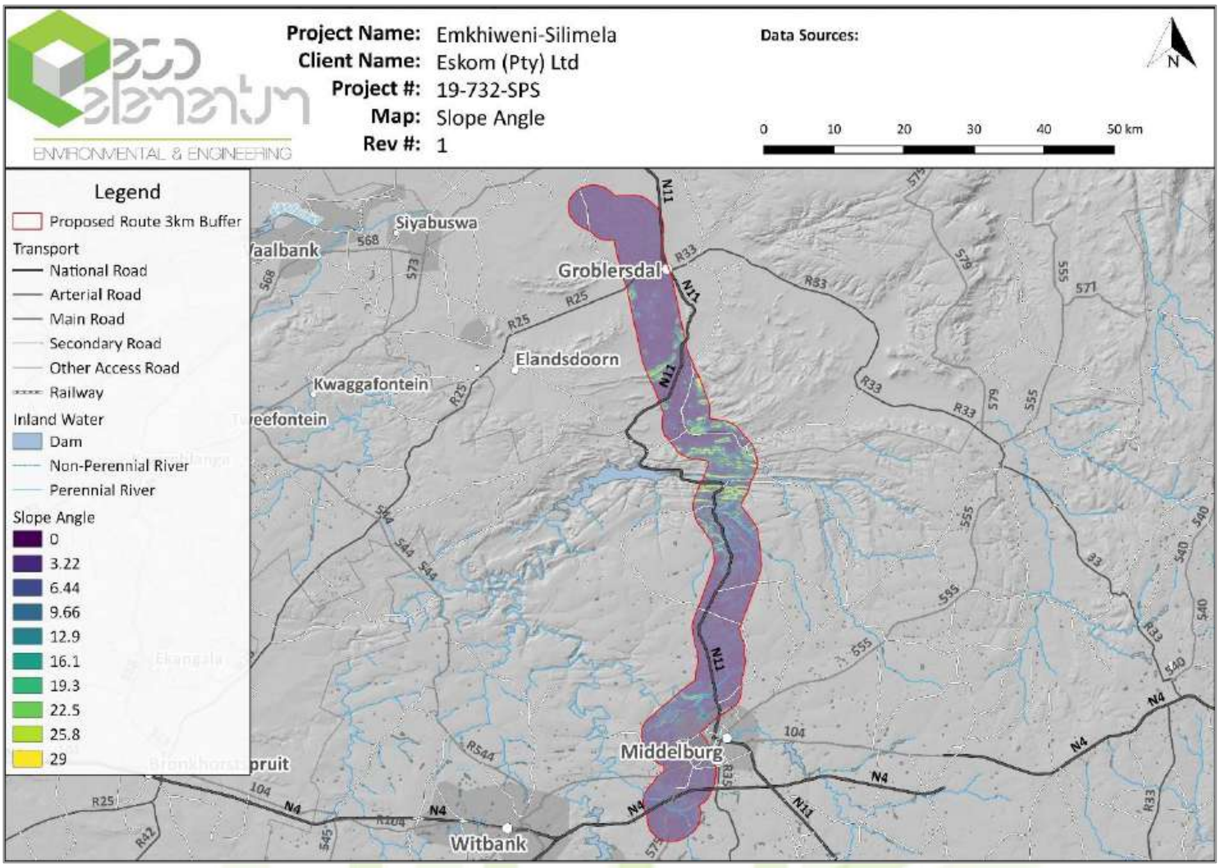

Figure 8: Slope angles of the terrain in the 3 km buffer area surrounding the proposed Emkhiweni-Silimela 400 kv Line

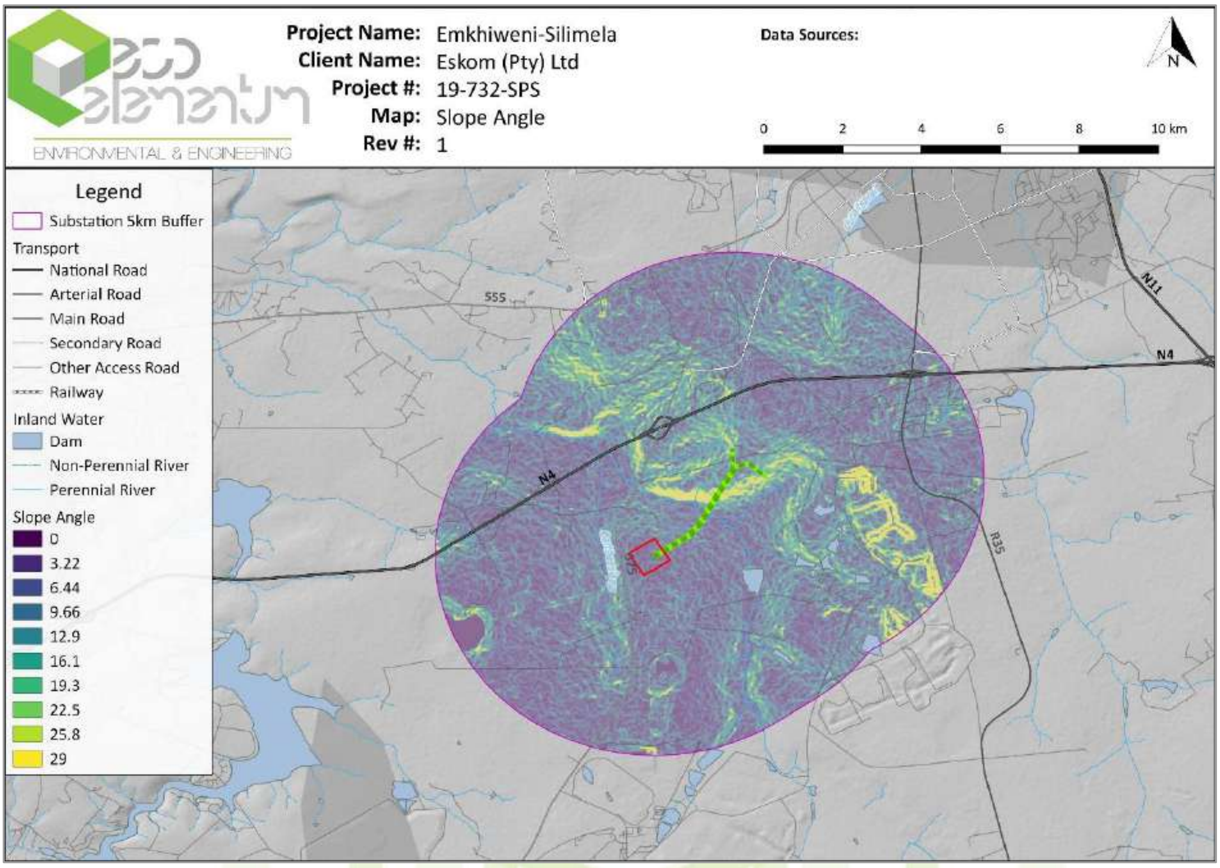

Figure 9: Slope angles of the terrain in the 5 km buffer area surrounding the proposed Emkhiweni Substation

5.2.2 Aspect

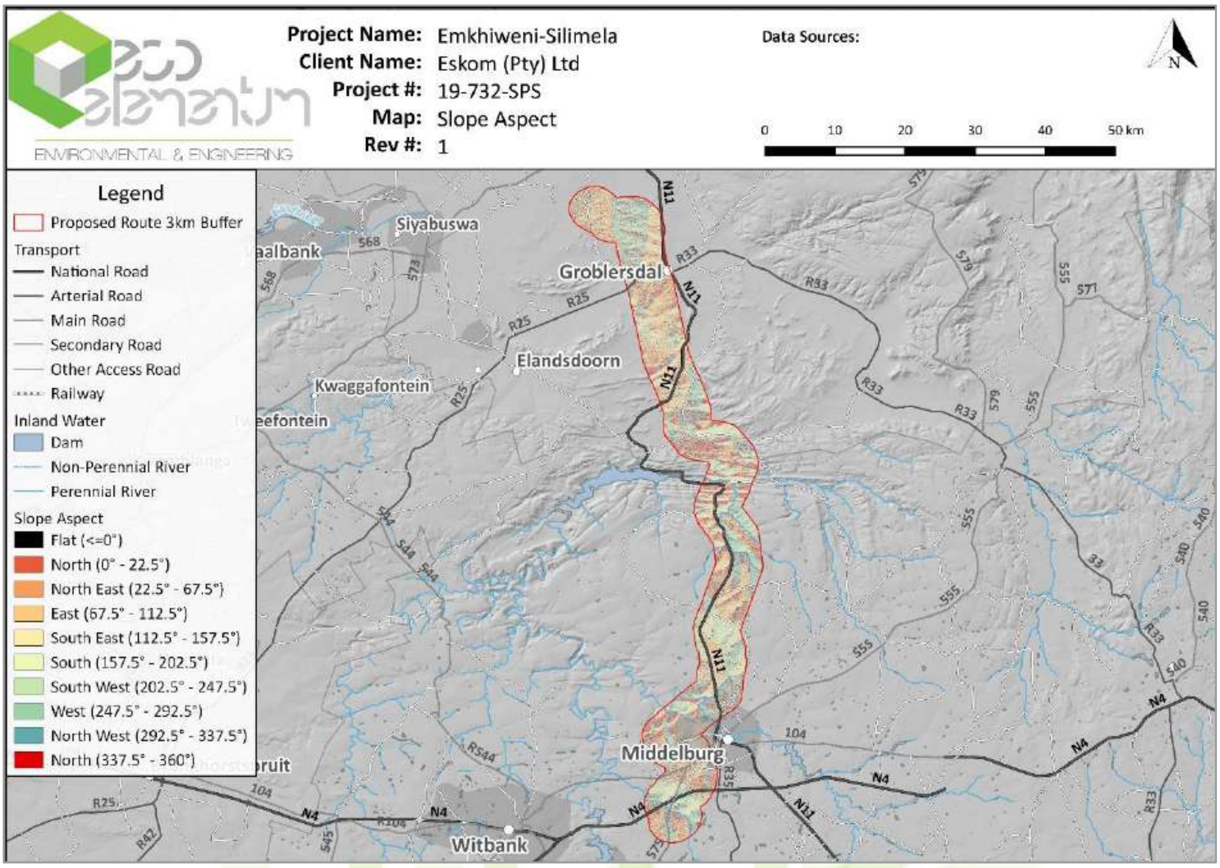

Figure 10: Slope Aspect direction of the terrain in the 3 km buffer area surrounding the proposed Emkhiweni-Silimela 400 kv Line

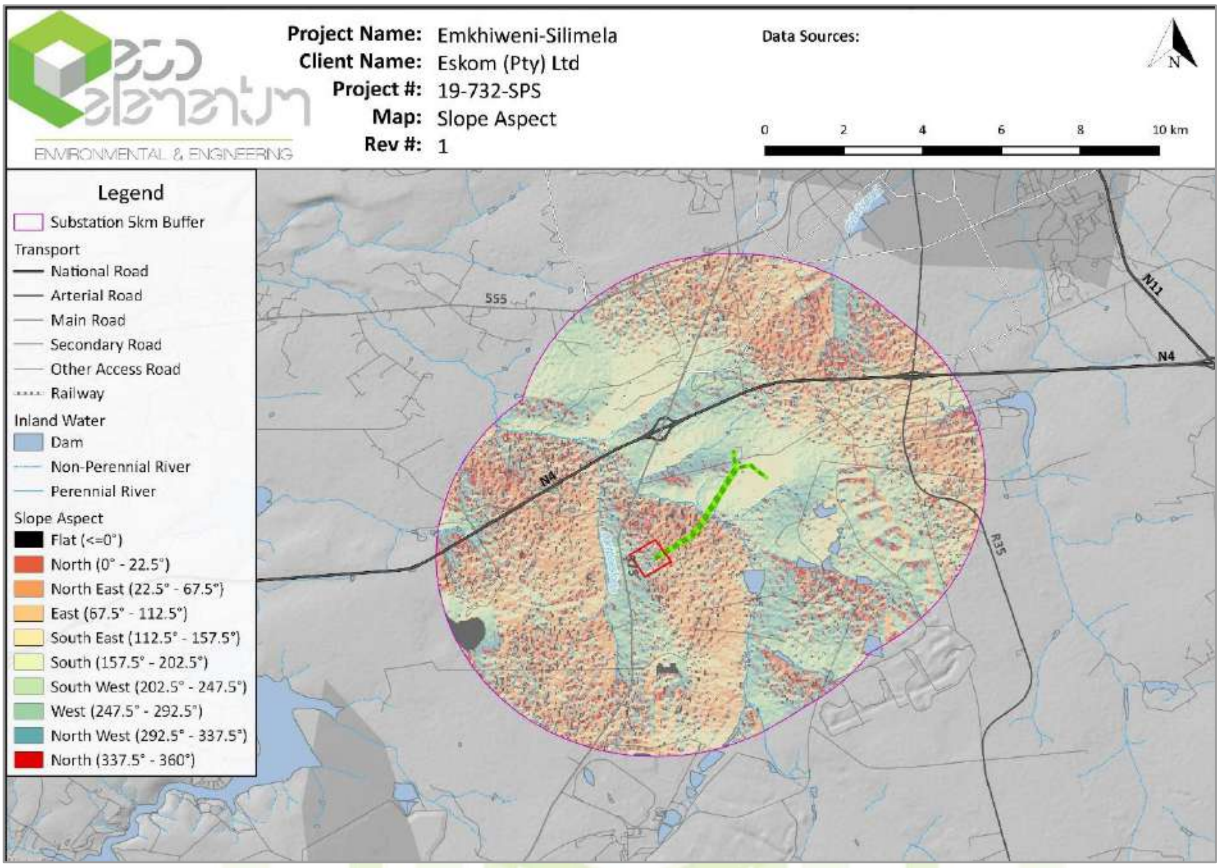

Figure 11: Slope Aspect direction of the terrain in the 5 km buffer area surrounding the proposed Emkhiweni Substation

5.2.3 Terrain Ruggedness

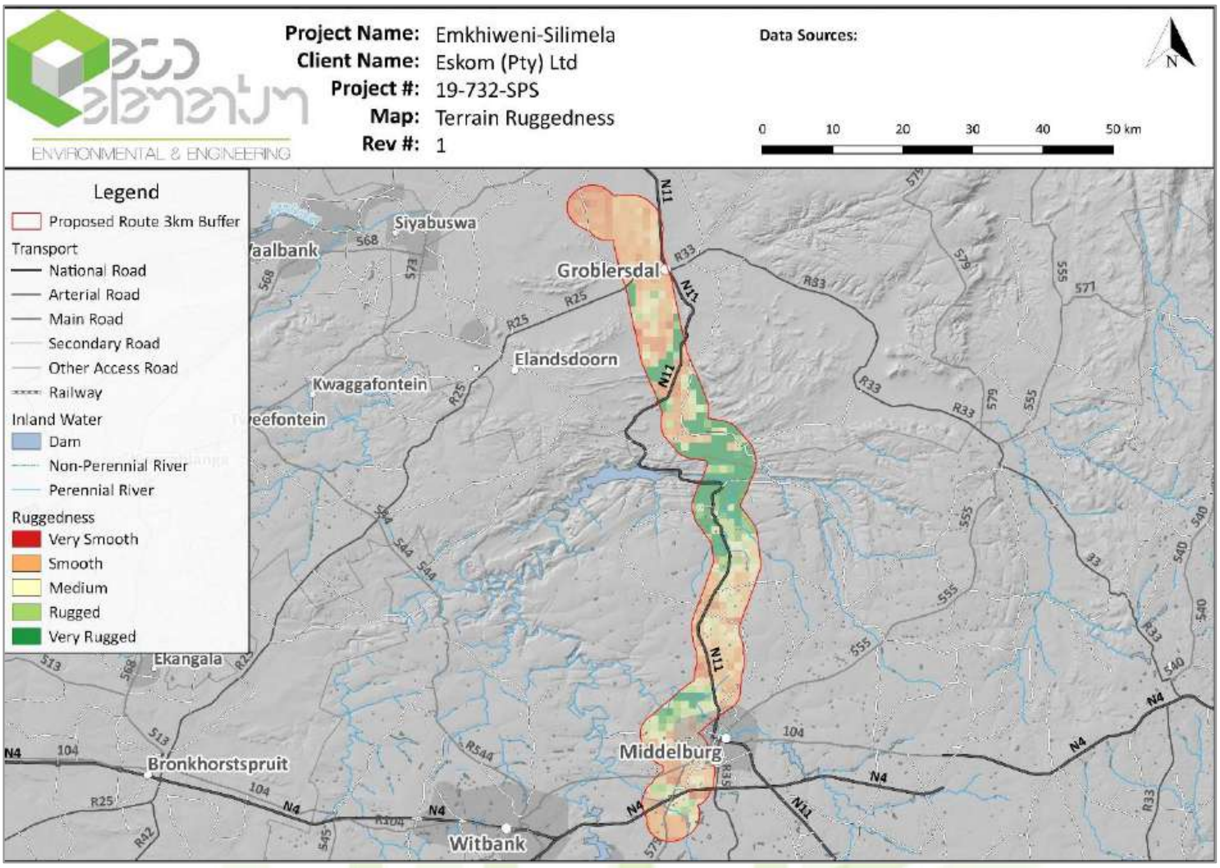

Figure 12: Terrain ruggedness in the 3 km buffer area surrounding the proposed Emkhiweni-Silimela Powerlines 400 kv Line

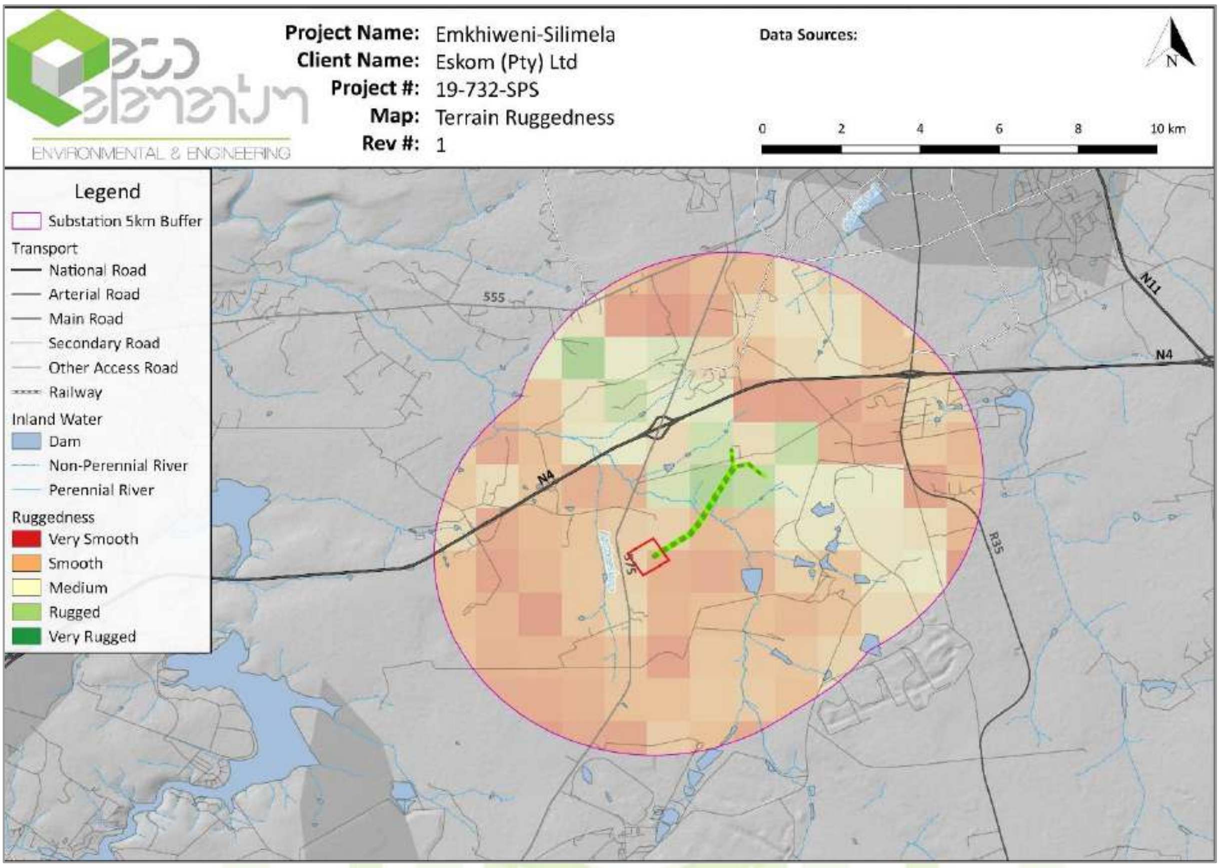

Figure 13: Terrain ruggedness in the 5 km buffer area surrounding the proposed Emkhiweni Substation

5.2.4 Relative Elevation

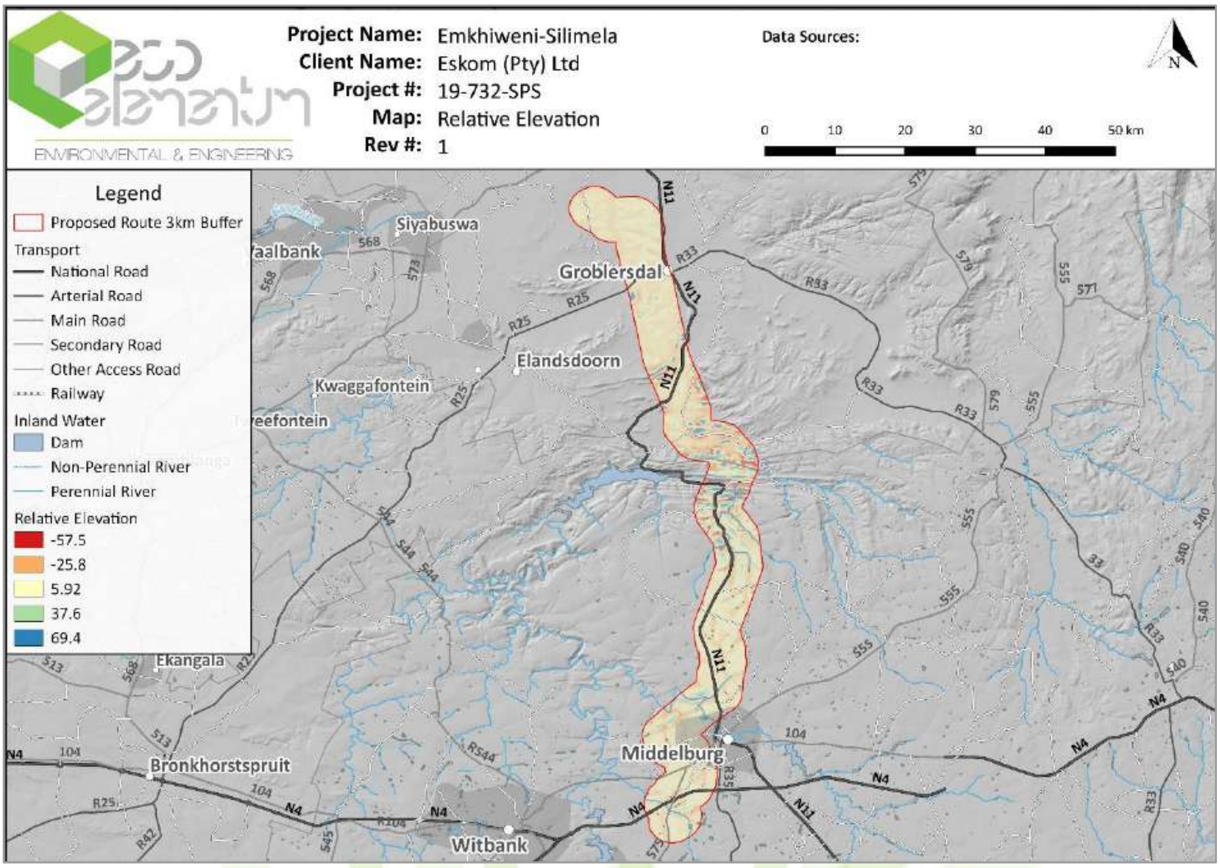

Figure 14: Relative Elevation of terrain in the 3 km buffer area surrounding the proposed Emkhiweni-Silimela 400 kv Line

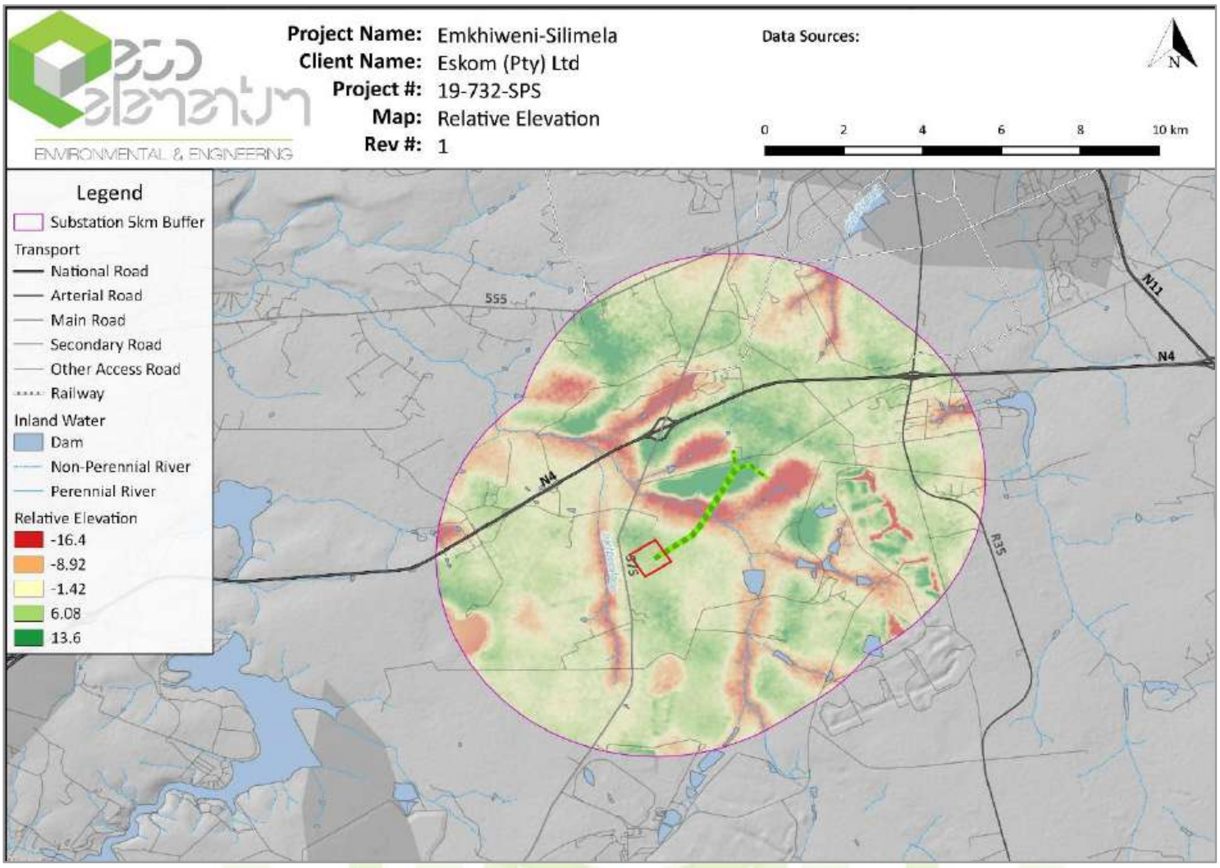

Figure 15: Relative Elevation of terrain in the 5 km buffer area surrounding the proposed Emkhiweni Substation

5.2.5 Landforms

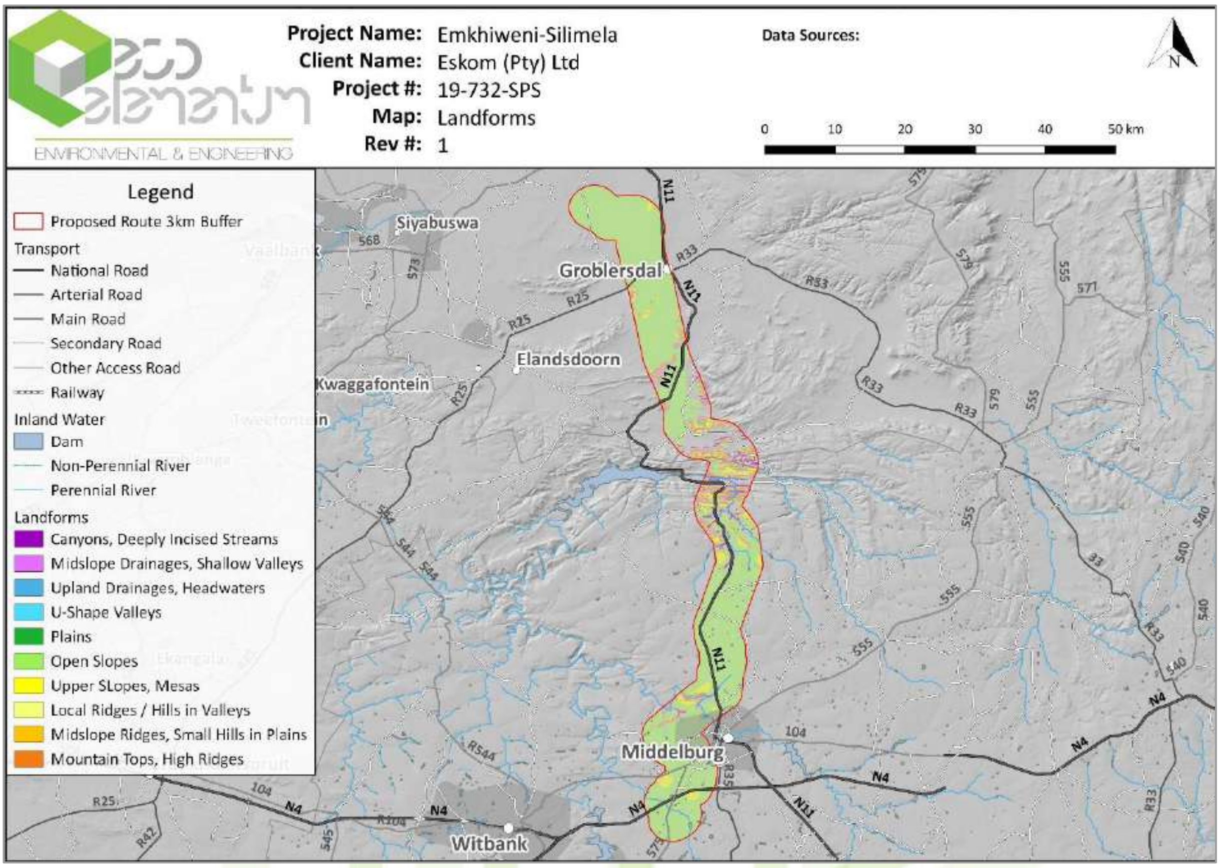

Figure 16: Landforms in a 3 km buffer area surrounding the proposed Emkhiweni-Silimela 400 kv Line

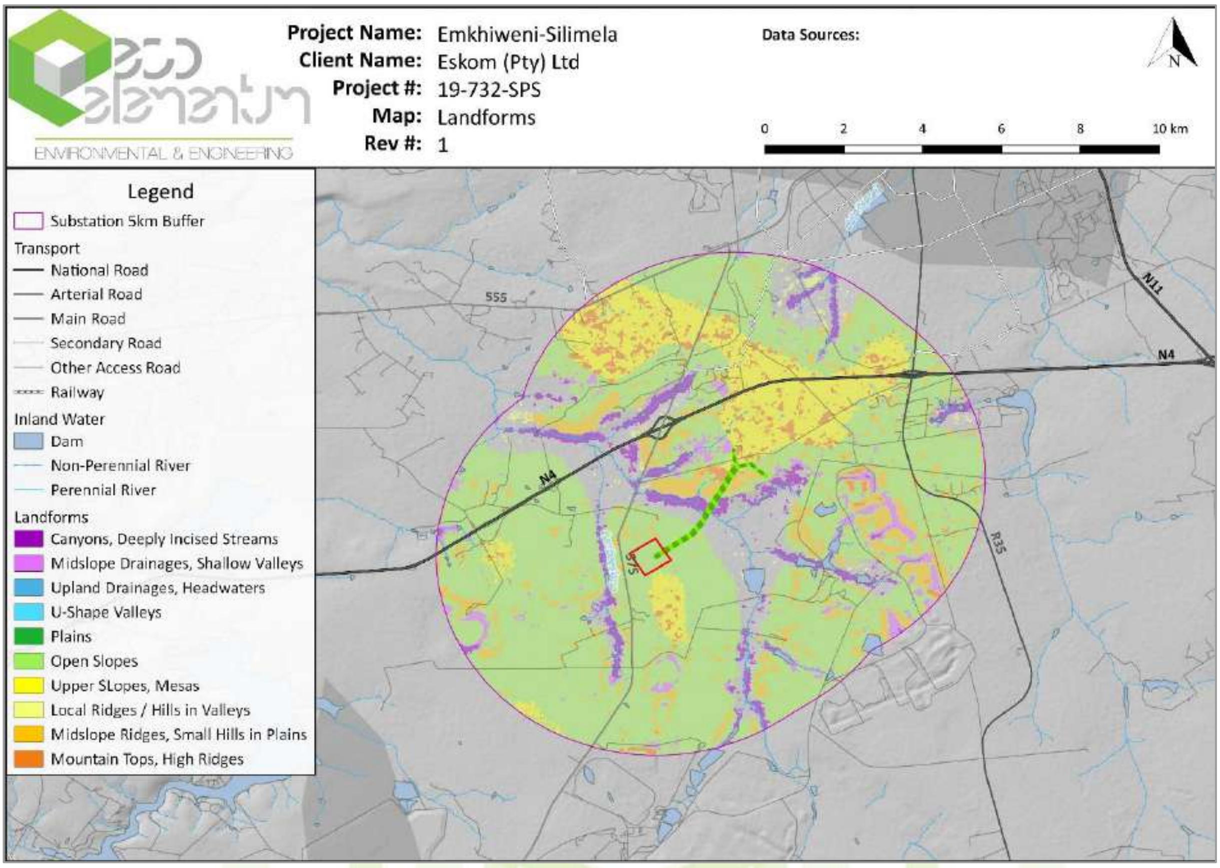

Figure 17: Landforms in a 5 km buffer area surrounding the proposed Emkhiweni Substation

5.2.6 Slope Position

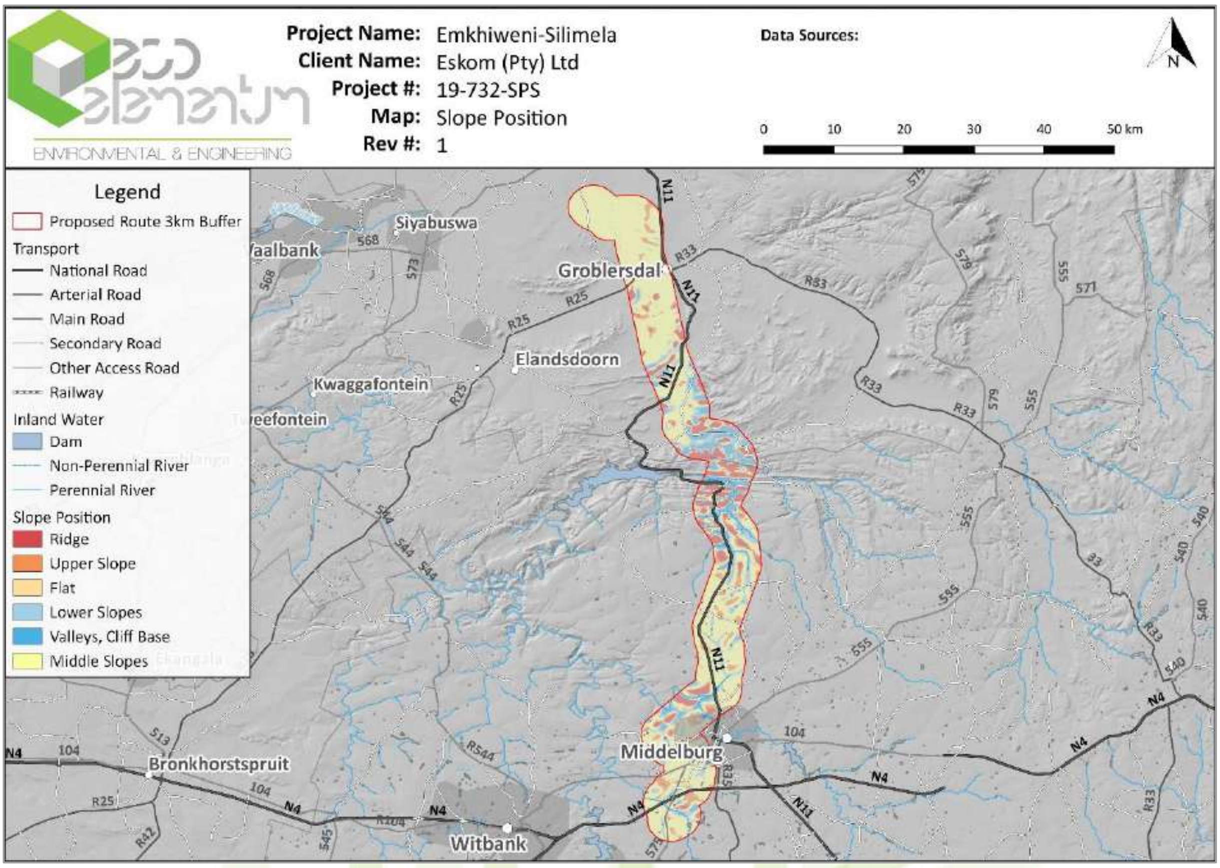

Figure 18: Slope Positions in the 3 km buffer area surrounding the proposed Emkhiweni-Silimela 400 kv Line

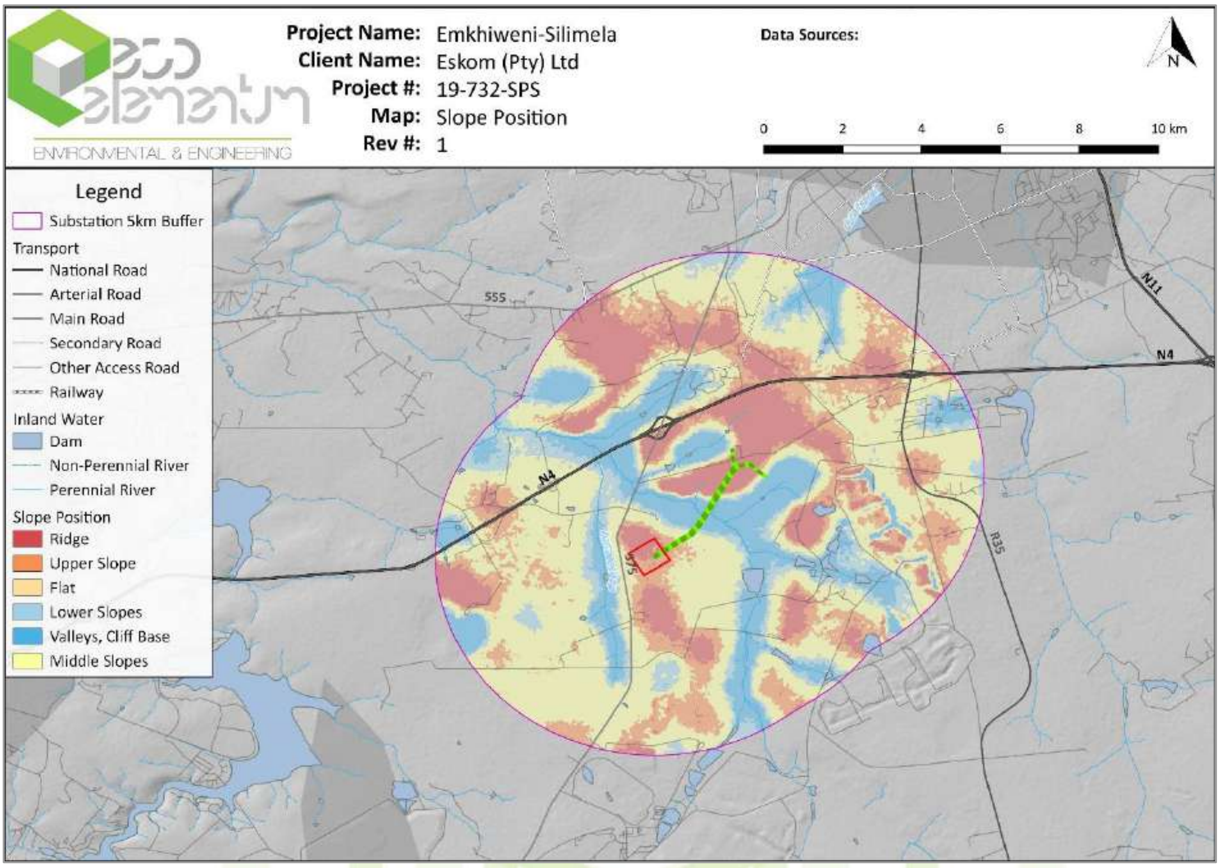

Figure 19: Slope Positions in the 5 km buffer area surrounding the proposed Emkhiweni Substation

5.3 GIS VISUAL IMPACT

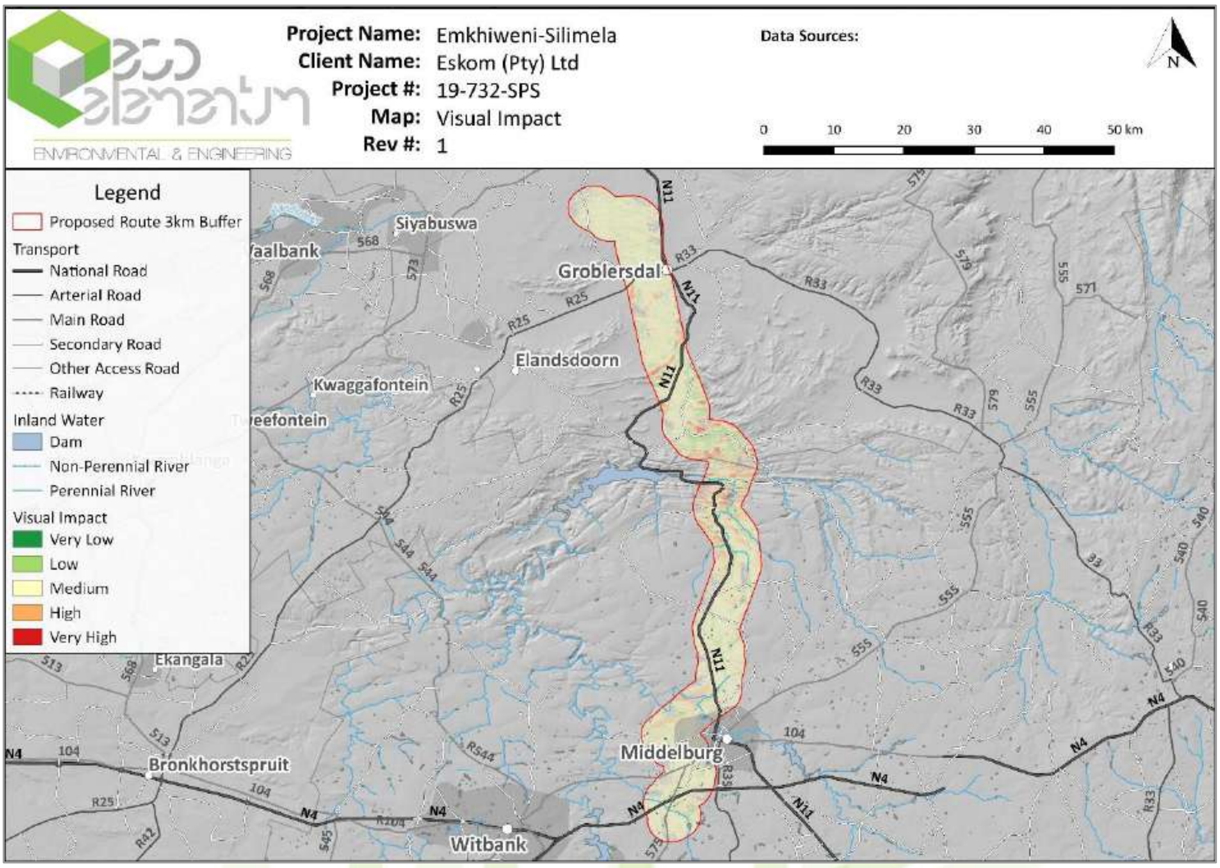

Figure 20: GIS Visual Impact of the proposed Emkhiweni-Silimela 400 kv Line

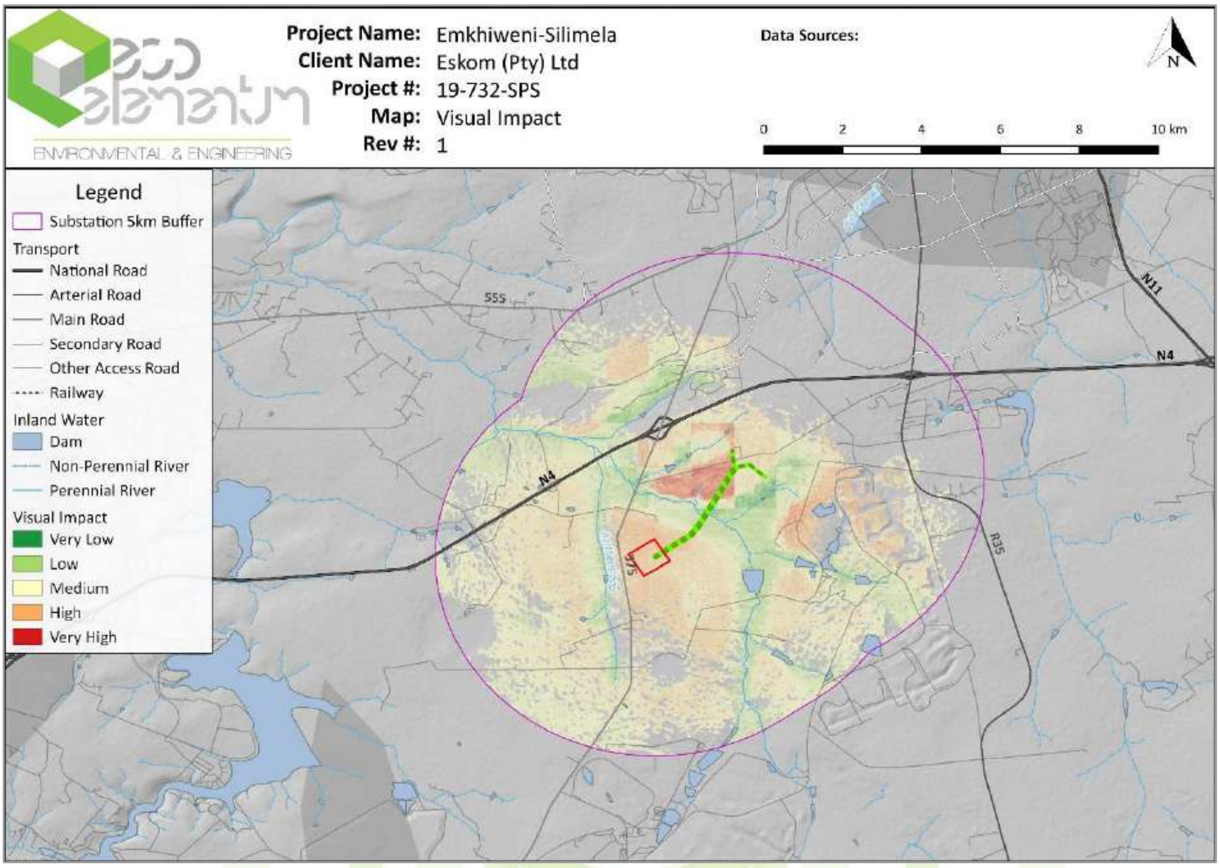

Figure 21: GIS Visual Impact of the proposed Emkhiweni Substation

The final Visual impact of the proposed infrastructure for the 400 kV line and Emkhiweni substation was calculated using all the datasets above then summarising all the pixel values of each corridor option to get to a final quantitative rating as shown in Table 8 below.

Table 8: GIS Calculated Visual Impact.

Alternative	Sum of GIS Pixel Values	Max of GIS Pixel Values	Mean of GIS Pixel Values	Visual Impact Rating
400 kv Line	2 521 338	20.886	4.414	Low
Emkhiweni Substation	258 977	18.953	3.846	Low

Categorizing the values into 5 categories from Very Low to Very High, the mean quantitative impact of the project can be categorised as Low. This however is the mean value for the full 3 km and 5 km buffer of the project. Specific locations along the proposed 400 kV line may be ranked higher.

Table 9: Visual Impact Ratings

Very Low
Low
Medium
High
Very High

6. VISUAL IMPACT SIGNIFICANCE RATING

6.1 VISUAL IMPACT SIGNIFICANCE RATING CRITERIA

Table 10: Criteria for Visual Impact Assessment

Intensity (Magnitude)	
The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it has a significant, moderate or insignificant, visual impacted.	
(I)nsignificant	The visual impact of the development will not have a negative effect on the surrounding environment and land users.
(M)oderate	The development will have an effect on the environment and land users, but will not be significant.
(V)ery High	The development will have a significant impact on the environment and land users.
Duration	
The lifetime of the impact, that is measure in relation to the lifetime of the proposed development.	
(T)emporary	The impact either will disappear with mitigation or will be mitigated through a natural process in a period shorter than that of the construction phase.
(S)hort term	The impact will be relevant through to the end of a construction phase (1.5 – 2 years).
(M)edium term	The impact will last up to the end of the development phases, where after it will be entirely negated.
(L)ong term	The impact will continue or last for the entire operational lifetime i.e. exceed 30 years of the development, but will be mitigated by direct human action or by natural processes thereafter.
(P)ermanent	This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact is transient.
Spatial Scale	
Classification of the physical and spatial aspect of the impact	
(F)ootprint	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
(S)ite	The impact could affect the whole, or a significant portion of the site.
(R)egional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
(N)ational	The impact could have an effect that expands throughout the country (South Africa).
(I)nternational	Where the impact has international ramifications that extend beyond the boundaries of South Africa.
Probability	
This describes the likelihood of the impact actually occurring. The impact may occur for any length of time during the life cycle of the activity. The classes are rated as follows:	
(I)mprobable	The possibility of the Visual Impact occurring is none, due to the circumstances or design. The chance of this Visual Impact occurring is zero (0%).
(P)ossible	The possibility of the Visual Impact occurring is very low, due either to the circumstances or design. The chance of this Visual Impact occurring is defined as 25% or less.
(L)ikely	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of the Visual Impact occurring is defined as 50%.

(H)ighly Likely	It is most likely that the Visual Impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75%.
(D)efinite	The Visual impact will take place regardless of any prevention plans and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100%.

Table 11: Assessment Criteria and Ranking Scale

PROBABILITY		MAGNITUDE	
Description Meaning	**Score**	**Description Meaning**	**Score**
Definite / don't know	5	Very high / don't know	10
Highly likely	4	High	8
Likely	3	Moderate	6
Possible	2	Low	4
Improbable	1	Insignificant	2
DURATION		**SPATIAL SCALE**	
Description Meaning	**Score**	**Description /Meaning**	**Score**
Permanent	5	International	5
Long Term	4	National	4
Medium	3	Regional	3
Short term	2	Local/Site	2
Temporary	1	Footprint	1/0

Equation 1: Significant Rating

Significant Rating (SR) = (Extent + Intensity + Duration) x Probability

Table 12: Significant Rating Scale without mitigation

SR < 30	LOW (L)	Visual Impact with little real effect and which should not have an influence on or require modification of the project design or alternative mitigation. No mitigation is required.
31 > SR < 60	MEDIUM (M)	Where Visual Impact could have an influence on the decision unless it is mitigated. An impact or benefit, which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SR > 61	HIGH (H)	Impact is significant, mitigation is critical to reduce impact or risk. Resulting impact could influence the decision depending on the possible mitigation. An impact that could influence the decision about whether or not to proceed with the project.

Table 13: Significant Rating Scale with mitigation

SR < 30	LOW (L)	The Visual Impact is mitigated to the point where it is of limited importance.
31 > SR < 60	MEDIUM (M)	Notwithstanding successful implementation of mitigation measures to reduce negative visual impacts to acceptable levels, the negative visual impact will remain of significance. Taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
SR > 61	HIGH (H)	The visual impact is of major importance. Mitigation of the visual impact is not possible on a cost-effective basis. The visual impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. The visual impact is regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

6.2 Activities Assessed

The following activities were assessed individually:

- Construction Camps;
- Power Line;
- Substation;
- Access Roads.

Visibility is determined by a line of sight where nothing obscures the view of an object. Exposure is defined by the degree of visibility, in other words “how much” of it can be seen. This is influenced by topography and the incidence of objects such as trees and buildings that obscure the view partially or in total.

6.2.1 Construction Camps

Potential construction camps visual impact will have a LOW significance impact before mitigation and LOW significance after mitigation, as indicated in the table below. Although the construction camps will be LOW visible, the time of exposure is minimal and thus the impact on the users will remain LOW.

Table 14: Summarizing the significance of visual impacts of the Construction Camps.

Nature of impact: Potential visual impact significance of the Construction Camps		
	No Mitigation	**With Mitigation**
	Proposed	**Proposed**
Extent	2	1
Duration	1	1
Magnitude	6	4
Probability	3	3
Significance Rating (SR)	Low (27)	Low (18)
Status (positive, neutral or negative)	Negative	
Reversibility	Yes	
Irreplaceable loss of resources	Yes	
Can impact be mitigated	Yes	
Mitigation:	The visual impact can be minimized by the creation of a visual barrier. The construction area will be cleared as soon as construction of the infrastructure is finished.	
Cumulative Impact:	The construction camps of the proposed Emkhiweni-Silimela project with its associated infrastructure will increase the cumulative visual impact of power line type infrastructure within the region. The construction camps of the Emkhiweni-Silimela structures will contribute to a regional increase in heavy vehicles on the roads in the region, with construction activity noticeable.	

6.2.2 Emkhiweni Substation

The Emkhiweni substation visual impact will have a MEDIUM significance impact before mitigation and remain MEDIUM significance after mitigation, although the value dropped from 56 to 40, as indicated in the table below. Although the construction camps will be MEDIUM visible, with the appropriate mitigation measure the impact on the users will remain MEDIUM.

Table 15: Summarizing the significance of visual impacts of the Substation.

Nature of impact: Potential visual impact significance of the Substation		
	No Mitigation	**With Mitigation**
	Proposed	**Proposed**
Extent	3	2
Duration	5	4
Magnitude	6	4
Probability	4	4
Significance Rating (SR)	Medium (56)	Medium (40)
Status (positive, neutral or negative)	Negative	
Reversibility	Yes	
Irreplaceable loss of resources	Yes	
Can impact be mitigated	Yes	
Mitigation:	The visual impact can be minimized by the creation of a visual barrier.	
Cumulative Impact:	The construction of the proposed Emkhiweni Substation with its associated infrastructure will increase the cumulative visual impact of powerline type infrastructure within the region. The Emkhiweni Substation structures will contribute to a limited amount of small maintenance vehicles on the roads in the region.	

6.2.3 Powerlines

Potential Powerlines visual impact will have a HIGH significance impact before mitigation and MEDIUM significance after mitigation, as indicated in Table 16 below. Although the Powerlines will be HIGH visible, the extent and magnitude of the exposure can be mitigated and thus the impact on the users will remain MEDIUM.

Table 16: Summarizing the significance of visual impacts of the Powerlines.

Nature of impact: Potential visual impact significance of the Powerlines		
	No Mitigation	**With Mitigation**
	Proposed	**Proposed**
Extent	4	3
Duration	5	5
Magnitude	8	6
Probability	5	4
Significance Rating (SR)	High (85)	Medium (56)
Status (positive, neutral or negative)	Negative	
Reversibility	Yes	
Irreplaceable loss of resources	Yes	
Can impact be mitigated	Yes	
Mitigation:	The visual impact can be minimized by the creation of a visual barrier during construction. The steel of the pylons can be painted a darker colour than galvanized steel to reduce the visual impact. Placing Powerlines next to existing linear features as far as possible. Clearing of vegetation should only be done by cutting and not earth moving equipment to reduce the visual impact of the vegetation scars.	
Cumulative Impact:	The Powerlines of the proposed Emkhiweni-Silimela project with its associated infrastructure will increase the cumulative visual impact of Power line type infrastructure within the region.	

6.2.4 Access Roads

Potential Access Roads visual impact will have a MEDIUM significance impact before mitigation and MEDIUM significance after mitigation, as indicated in the table below. Although the Access Roads visual impacts will be MEDIUM visible, the probability of the exposure is can be mitigated and thus the impact on the users will reduce although remain MEDIUM.

Table 17: Summarizing the significance of visual impacts of the Access Roads.

Nature of impact: Potential visual impact significance of the Access Roads		
	No Mitigation	**With Mitigation**
	Proposed	**Proposed**
Extent	3	3
Duration	4	4
Magnitude	6	6
Probability	4	3
Significance Rating (SR)	Medium (52)	Medium (39)
Status (positive, neutral or negative)	Negative	
Reversibility	Yes	
Irreplaceable loss of resources	Yes	
Can impact be mitigated	Yes	
Mitigation:	The visual impact can be minimized by using existing roads.	
Cumulative Impact:	The Access Roads of the Emkhiweni-Silimela structures will contribute to a regional increase in small maintenance vehicles on the roads in the region.	

6.3 CUMULATIVE IMPACTS

Cumulative landscape and visual effects (impacts) resulting from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future, may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the inter-visibility (visibility) of a range of developments and / or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effects on visual receptors within their combined visual envelopes. Inter-visibility depends upon general topography, aspects, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The Landscape Institute, 1996).

- The cumulative visual intrusion of the proposed Emkhiweni-Silimela structures will be MEDIUM as it is a power line. The site location expand several hundreds of kilometres through varying terrain and Landover types. The visual impact and impact on sense of place of the proposed project will contribute to the cumulative negative effect on the aesthetics of the study area.

To get a better understanding and quantify the cumulative impacts better, all the individual project elements were summed together and the average of each impact nature were calculated to form the cumulative significant impact rating for the complete project. The results can be seen in Table 19.

6.4 MITIGATION MEASURES

Mitigation measures may be considered in two categories:

- Primary measures that intrinsically comprise part of the development design through an iterative process. Mitigation measures are more effective if they are implemented from project inception when alternatives are being considered.
- Secondary measures designed to specifically address the remaining negative effects of the final development proposals.

Primary measures to be implemented will mainly be measures that will minimise the visual impact by softening the visibility of the structures by "blending" with the surrounding areas. Such measures will include:

- Rehabilitation of the construction areas by re-vegetation of the sites and surrounding area;
- Painting / coating of the pylons to a darker colour than Galvanized steel;
- Building the Powerlines and pylons next to existing linear structures as far as possible;
- Clear vegetation only by cutting and not earth moving equipment; and
- Use of existing roads for access roads.

7. CONCLUSION

7.1 GIS Visual Impact Ratings

Table 18: GIS Calculated Visual Impact.

Alternative	Sum of GIS Pixel Values	Max of GIS Pixel Values	Mean of GIS Pixel Values	Visual Impact Rating
400 kv Line	2 521 338	20.886	4.414	Low
Emkhiweni Substation	258 977	18.953	3.846	Low

Categorizing the values into 5 categories from Very Low to Very High, the mean quantitative impact of the project can be categorised as Low. This however is the mean value for the full 3 km and 5 km buffer of the project. Specific locations along the proposed 400 kV line may be ranked higher.

The visual impact generated in GIS cannot be guaranteed as 100% accurate. Some viewpoints, which are indicated on the viewshed as being inside of the viewshed, can be outside of the viewshed. This is due to the change of the natural environment by surrounding activities as well as natural vegetation that play a significant role and can have a positive or negative influence on the visual impact.

7.2 Significance Impact Ratings

The construction and operation phase of the proposed Emkhiweni-Silimela related activities and its associated infrastructure will have a MEDIUM visual impact on the natural scenic resources and the topography. However, with the correct mitigation measures the impact might decrease to a point where the visual impact can be seen as less significant although still MEDIUM. The moderating factors of the visual impact of the proposed infrastructure in close range are as follows:

- Number of human inhabitants located in the area;
- Natural topography and vegetation;
- Mitigation measures that will be implemented such as the establishment of barriers or screens;
- Paint colour of the Pylons;
- The size of the operation; and
- Absorption capacity of the landscape.

In light of the above-mentioned factors that reduce the impact of the facility, the visual impact is assessed as MEDIUM VISUAL IMPACT after mitigation measures have been implemented.

Table 19: The overall Assessment of the Visual Impact

Nature of impact: The overall Assessment of the Visual Impact of the area.		
	No Mitigation	**With Mitigation**
	Proposed	**Proposed**
Extent	3	2.25
Duration	3.75	3.5
Magnitude	6.5	5
Probability	4	3.5
Significance Rating (SR)	Medium (55)	Medium (38.25)
Status (positive, neutral or negative)	Negative	
Reversibility	No	
Irreplaceable loss of resources	Yes	
Can impact be mitigated	Yes	
Mitigation:	All mitigation as discussed in each individual project element.	
Cumulative Impact:	Cumulative of each individual project element.	

The Visual Impact due to the construction activities and associated project infrastructure can be seen as having a MEDIUM impact on the surrounding environment and inhabitants before mitigation measures are implemented. After mitigation, the visual impact can be seen as lowered although still classified as MEDIUM. Thus, mitigation measures are very important and two of the most significant mitigation measures are the rehabilitation of the area after construction has been concluded and reducing the visibility of the powerlines as much as possible. If the mitigation of the impact is not done correctly then the visual impact will become a concern. However, with the correct mitigation, the impact will be of minimal visual intrusion for the type of proposed structures.

8. REFERENCE

- *Chief Director of National Geo-spatial Information, varying dates. 1:50 000 Topo-cadastral maps and digital data.*
- *CSIR/ARC, 2000. National Land-cover Database 2000 (NLC 2000).*
- *The Landscape Institute, Institute of Environmental Management & Assessment. 2002. Guidelines for Landscape and Visual Impact Assessment. Second Ed. E & FN Spon, London (117).*
- *Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1. CSIR Report No ENV---S---C 2005. Provincial Government of the Western Cape, Department of Environmental Affairs &Development Planning, Cape Town.*
- *Weiss, A. 2001. Topographic Position and Landforms Analysis. Poster Presentation, ESRI User Conference, San Diego, CA.*

Appendix 6F: Socio-Economic Impact Assessment

PROPOSED Emkhiweni Substation and 400KV Line from Emkhiweni Substation to Silimela

Socio-Economic Impact Assessment

August 2019

Draft

Prepared for: Eskom Holdings (SOC) Ltd

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Title and Approval Page

Project Name:	Emkhiweni Substation and 400KV Line from Emkhiweni Substation to Silimela
Report Title:	Socio-Economic Impact Assessment
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Amendments Page

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1 INTRODUCTION

Eskom Holdings SoC Limited has proposed the construction of Emkhiweni Substation and 400KV Line from Emkhiweni Substation to Silimela. The network distribution in the Marble Hall area is currently experiencing low voltage problems, the proposed Emkhiweni Substation and 400kv powerline provides the means to support the additional power supply required.

The proposed project entails the construction of a 400kv powerline from Middleburg in Mpumalanga Province to Marble Hall in Limpopo Province. The approximate length of the line is 88 kilometres.

Marble Hall is located to the north of Middleburg with the towns being connected along the N11, N4 and R555 routes. Middleburg and Groblersdal lie along the N11 between the proposed Emkhiweni Substation and Marble Hall.

Nemai Consulting was appointed as the independent Environmental Assessment Practitioner by Eskom Holdings (SOC) Ltd to undertake the Environmental Authorisation process for the development of the proposed Emkhiweni Substation and 400KV Line from Emkhiweni Substation to the Silimela Substation.

One of the specialist studies required by the Environmental Impact Assessment (EIA) is a Social Impact Assessment. This report fulfils the requirements of the Social Impact Assessment and its recommendations will be included into the EIA.

1.1 Terms of Reference

The terms of reference for the study are as follows:

- Determine the specific social, land utilisation and acquisition implications of the project.
- Collect baseline data on the current social and economic environment.
- Gather an understanding of the socio-economic landscape of the project area through the following actions:
  - Attend and review minutes of public and individual stakeholder meetings; and
  - Review of the formally submitted commented for the project.
- Assess the social impacts of the project, both positive and negative;
- Suggest suitable mitigation measures to address the identified impacts; and
- Provide recommendations on the preferred route alternative from a socio-economic perspective.

1.2 Structure of the report

The remainder of the report is structured as follows:

Section 2: Legislation – A description of the statutory and regulatory requirements that inform this report.

Section 3: Project Description – This section provides an introduction and motivation to the project. It includes a description of the study area.

Section 4: Methodology – Outline the methodology used to determine the socio-economic impacts of the proposed project.

Section 5: Situational Analysis – A desktop analysis of the baseline situation in the study area. The section includes a discussion on the findings that resulted from community engagement, site visits and stakeholder participation.

Section 6: Identification of Activities - Aspects and Impacts – The identification of the project activities and an investigation into what aspects of these activities will result in socio-economic impacts.

Section 7: Analysis of Alternatives – Decision making with regards the preferred project alternatives from a socio-economic perspective.

2 LEGISLATION

Legislation, policy, plans and strategy provide an important framework and governance of the SEIA. This section provides a summary of the acts, policy, plans and strategy which were considered by this study.

2.1 Constitution of the Republic of South Africa (Act 108 of 1996)

As contained in the Constitution the rights of all South Africans are protected as outlined in Chapter 2: The Bill of Rights. These rights form the basis of democracy in South Africa. The Constitution (including the Bill of Rights) binds the Legislature, the Executive, the Judiciary and all organs of state and is the overriding legislation of South Africa.

While all items in the Bill of Rights are considered to be of equal importance, key items in the Bill of Rights that have a bearing on social rights and issues in this project include (but are not necessarily limited to):

- Life: Everyone has the right to life;
- Human Dignity: Everyone has inherent dignity and the right to have their dignity respected and protected;
- Equality: Everyone is equal before the law and has the right to equal protection and benefit from the law;
- Freedom of religion, belief and opinion: Everyone has the right of freedom of conscience, religion, thought, belief and opinion;
- Environment: Everyone has the right to an environment that is not harmful to their health or well-being, and to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development;
- Property: No person may be deprived of property except in terms of the law of general application, and no law may permit arbitrary deprivation of property. Property may be expropriated only in terms of the law of general application for a public purpose or in the public interest. The public interest includes South Africa’s commitment to land reform and to reforms to bring about equitable access to all South Africa’s natural resources. Property is not limited to land;
- Health care, food, water and social security: Everyone has the right to have access to health care services, including reproductive health care, sufficient food and water and social security, including, if they are unable to support themselves and their dependents, appropriate social assistance;

- Language and culture: Everyone has the right to use the language and participate in the cultural life of their choice, but no one exercising these rights may do so in a manner inconsistent with any provision of the Bill of Rights;
- Cultural, religious and linguistic communities: Persons belonging to cultural, religious or linguistic communities may not be denied the right, with other members of the that community to enjoy their culture, practice their religion and use their language, and to form, join and maintain cultural, religious and linguistic associations and other organs of civil society. These rights must be exercised in a manner that is consistent with any provision in the Bill of Rights;
- Access to information: Everyone has the right of access to any information held by the state and any information that is held by another person and that is required for the exercise or protection of any rights; and,
- Just administrative action: Everyone has the right to administrative action that is lawful, reasonable and procedurally fair. Everyone whose rights have been adversely affected by administrative action has the right to be given written reasons. This right has been given effect via the Promotion of Administrative Justice Act ((PAJA) Act 3 of 2000).

2.2 National Environmental Management (Act 107 of 1998)

The National Environmental Management Act (NEMA) and the principles contained therein have a significant influence on the need to identify and assess socio-economic impacts. The NEMA principles are based on the basic rights as set out in Chapter 2 (Bill of Rights) of the Constitution.

According to Barber (2007:16) the following NEMA principles have an important impact on social issues:

- Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably;
- Development must be socially, environmentally and economically sustainable;
- Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option;
- Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons;

- Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination;
- The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured;
- Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge;
- Community well-being and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means;
- The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in light of such consideration and assessment;
- The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected;
- Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law;
- The environment is held in public trust for the people. The beneficial use of environmental resources must serve the public interest and the environment must be protected as the peoples' common heritage; and
- The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted.

2.3 Development Facilitation Act (Act 67 of 1995)

The Development Facilitation Act (DFA) outlines various principles concerning land development in Section 3 of the Act. Some of the relevant principles are briefly highlighted below (Babour, 2007). These principles include (but are not limited to:

- Promoting the integration of the social, economic, institutional and physical aspects of land development;
- Promoting integrated land development in rural and urban areas in support of each other;
- Promoting the availability of residential and employment opportunities in close proximity to or integrated with each other;

- Optimising the use of existing resources including such resources relating to agriculture, land, minerals, bulk infrastructure, roads, transportation and social facilities;
- Promoting a diverse combination of land uses, also at the level of individual erven or subdivisions of land;
- Discouraging the phenomenon of "urban sprawl" in urban areas and contributing to the development of more compact towns and cities;
- Contributing to the correction of the historically distorted spatial patterns of settlement in the Republic and to the optimum use of existing infrastructure in excess of current needs;
- Encouraging environmentally sustainable land development practices and processes;
- Promoting land development which is within the fiscal, institutional and administrative means of the Republic;
- Promoting the establishment of viable communities; and
- Promoting sustained protection of the environment.

2.4 Restitution of Land Rights Act 22 Of 1994

The aim of the Restitution of Land Rights Act 22 of 1994 is as follows:

- To provide for the restitution of rights in land in respect of which persons or communities were dispossessed under or for the purpose of furthering the objects of any racially based discriminatory law;
- To establish a Commission on Restitution of Land Rights and a Land Claims Court; and
- To provide for matters connected therewith.

2.5 National Development Plan (2011)

The National Development Plan (NDP) of 2010 proposes to “invigorate and expand economic opportunity through infrastructure, more innovation, private investment and entrepreneurialism.

The Plan aims to ensure that all South Africans attain a decent standard of living through the elimination of poverty and reduction of inequality. The core elements of a decent standard of living identified in the Plan are:

- Housing, water, electricity and sanitation;
- Safe and reliable public transport;
- Quality education and skills development;
- Safety and security;

- Quality health care;
- Social protection;
- Employment;
- Recreation and leisure;
- Clean environment; and
- Adequate nutrition.

2.6 International Organisation for Standardization, ISO 14001:2004

The International Organisation for Standardization (ISO) is used for identifying impacts. The ISO 14001: 2004 – Environmental Management Systems definitions for aspect, activity and impact are used in keeping with best practice.

ISO 14001:2004 specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives and information about significant environmental aspects. It applies to those environmental aspects that the organization identifies as those which it can control and those which it can influence.

3 Project Description

Nemai Consulting was appointed by Eskom Holdings (SOC) Ltd as the Independent Environmental Assessment Practitioner (EAP) to undertake the EIA for the project. The project requires authorisation in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), and the EIA was undertaken in accordance with the 2014 EIA Regulations (as amended on 07 April 2017).

This project was previously authorised in May 2011 (Emkhiweni Substation) and July 2011 (Emkhiweni-Silimela 400kV line).

There are two transmission subsystems in the Mpumalanga and Limpopo Provinces, these are known as “Highveld North West” and “Lowveld North”. These subsystems are interconnected and are currently experiencing several problems:

- The lines in the study area are heavily loaded, if maintenance is required or there is a fault on the line, the remaining lines may exceed their thermal limits, as a result load shedding would become necessary;
- The distribution network in the Marble Hall area is experiencing low voltage problems; and
- The Proposed Steelpoort (Tubatse) Pumped Storage Scheme requires Transmission network strengthening.

The Emkhiweni Substation and Emkhiweni Substation to Silimela 400kV line provides the means to support the additional power supply within operational limits.

The firm capacity at the Rockdale substation is 500MVA and was exceeded in 2007. The new loads at the substation cannot be accommodated without violating the loading conditions of the transformers, which are 45 years old. The proposed solution is the construction of a new substation near to the existing Rockdale substation, the Emkhiweni substation.

3.1 Location

The proposed project is located in the Mpumalanga and Limpopo Provinces.

The proposed 400kV power line originates at the Silimela Substation, which is situated approximately 13km to the southeast of Marble Hall in the Limpopo Province and runs south-eastwards. The Emkhiweni Substation is to be located nearby the existing Rockdale substation, located to the southwest of Middleburg, near the N11.

The width of the powerline servitude upon completion is 55m. In addition to the Specialist Studies, a walk-down survey of the previously authorised powerline route was undertaken to ensure that the final pylon placement has a minimal impact.

The power line corridor passes through the following local municipalities:

- Steve Tshwete Local Municipality;
- Elias Motsoaledi Local Municipality; and
- Ephraim Mogale Local Municipality.

The directly affected municipalities are illustrated, in **Figure 1**, below.

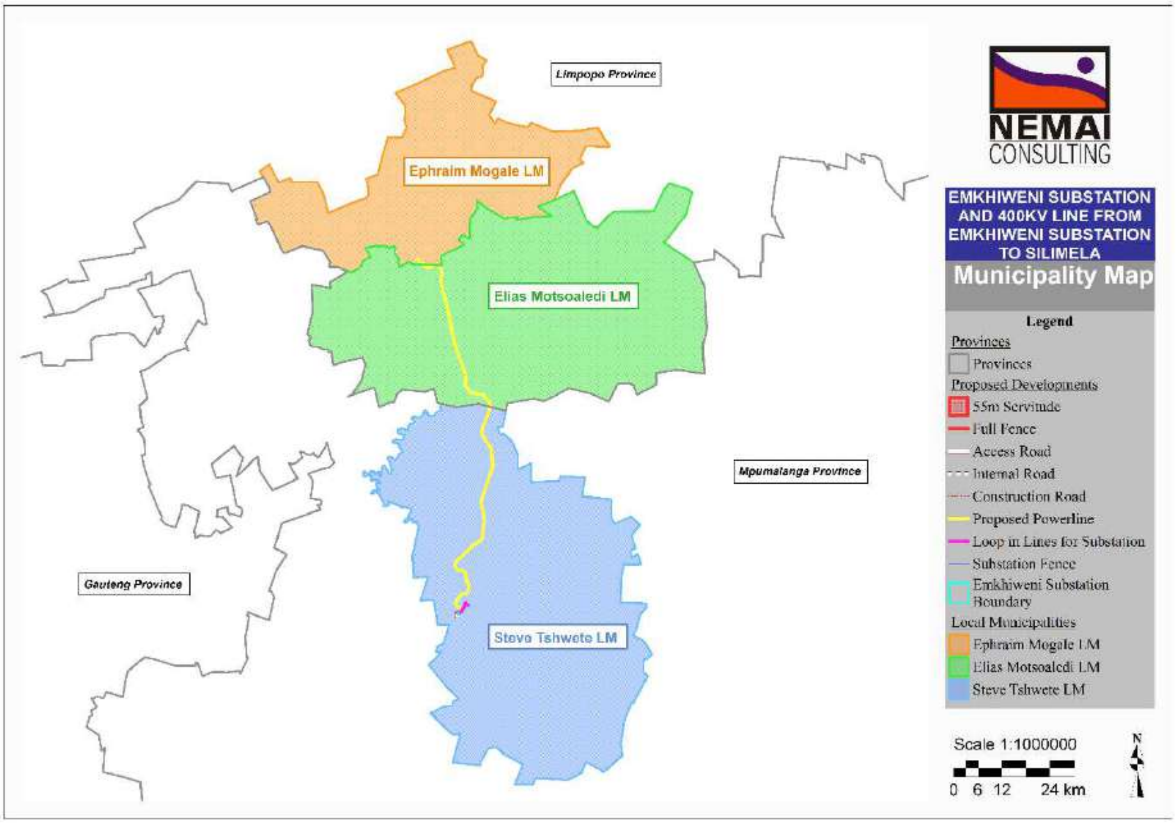


Figure 1: Map of the affected Municipal Wards within project area

The directly affected Sub-Places within the Local Municipalities for the power line are listed in the table below. Sub-Places are the smallest subdivision of municipalities used by Statistics South Africa in their Census 2011.

Table 1: Affected Local Municipalities, Wards and Places

Local Municipality	Sub-Main Places
Ephraim Mogale	Marble Hall NU
Elias Motsoaledi	Klipbank
Elias Motsoaledi	Elias Motsoaledi NU
Elias Motsoaledi	Groblersdal
Steve Tshwete	Steve Tshwete NU
Steve Tshwete	Middelburg
Steve Tshwete	Mhluzi

The sub-places indicated in the table above are those taken from Census 2011 - their names have been used in this report to identify local features within the project study area.

The main settlements bordering the project study area are described in the table below

Table 2: Main Settlements Along the Project Study Area

Local Municipality	Settlement/Town Name	Description
Steve Tshwete	Aerorand	Medium density urban residential area
Steve Tshwete	Clubville	Medium density urban residential area
Steve Tshwete	Malope Village	High density urban residential area
Steve Tshwete	Tokologo	High density urban residential area
Steve Tshwete	Mhluzi	Informal urban residential area
Steve Tshwete	Steve Tshwete NU (Middleburg) settlement	High density urban residential area
Steve Tshwete	Doornkop	High density rural settlement
Elias Motswaledi	Loskop Valley Irrigation Scheme	High intensity Agricultural production
Elias Motswaledi	Aquaville	Smallholdings
Elias Motswaldi	Groblersdal	Medium sized rural town

3.2 Description of Route Alternatives

There are no route alternatives proposed for this project. The project has been previously authorised and discussion with stakeholder along this corridor are well advanced.

3.2.1 No-Go alternative

The final alternative considered during this social impact assessment is the No-Go alternative. In this alternative, the socio-economic impacts of not going ahead with the proposed development have been considered.

The ‘No-go’ alternative would mean that the area where the proposed Emkhiweni 400kV powerline is to be built would not change in any way and the environment conditions would generally stay the same within the site.

This would imply that the anticipated load growth in southern Middleburg and the resulting need for further enhancement of capacity in the area would not be met. There would be no further network expansion if the powerline and other related projects are not built. The projected impacts on the society and communities would not prevail as the conditions would still remain generally the same.

3.3 Description of the Study Area

The study area for this socio-economic impact assessment is defined by the impact area of the project. As the distance from the centre of the powerline increases, so the socio-economic impact decreases. This can be seen in examples such as the direct impact on people who live under the proposed route and would have to be relocated, rather than those who live a safe distance from the powerline and would not have to be relocated. This example is similar to others with regards to the economic impact of the disruption due to the powerline servitude.

Impacts such as the visual impact are not only depended upon distance and are the subject of other areas of investigation, rather than the socio-economic impact assessment.

As a result of this analysis the study area can be defined.

The regional study area is the area within which socio-economic impacts can conceivably be felt. For this scale of project, the regional study area is defined as being the main places through which the powerline runs.

4 METHODOLOGY

Social Impact Assessment is an interactive process by its nature which relies on both desktop research as well as from site visits and input from the community stakeholders. This tool assists the community to be part of the environmental decision-making process, and empower communities to participate in decisions that will affect their livelihoods (DEAT, 2006).

The Australian Government Department of the Environment and Heritage (2005:5) states that Socio-economic Impact Assessment is a useful tool to help understand the potential range of impacts of a proposed change, and the likely responses of those impacted on if the change occurs. This, in a rather different but similar context, applies to the role that an SEIA performs.

An SEIA is used during the EIA process to identify and evaluate potential socio-economic impacts of a proposed development. The SEIA further recognises the important relationship between the socio-economic and biophysical environment.

The SEIA is aimed at minimising adverse impacts of the proposed development while also aiming to maximise the beneficial impacts. The SEIA sets out the socio-economic baseline, predicts impacts and makes recommendations for mitigation. The SEIA holds relationships with other impact assessment fields. Although the core of SEIA is relatively discrete, it overlaps other impact assessment studies and evaluation studies, sharing techniques, expertise, literature and so on (Barrow, 2000)

4.1 Sourcing of Information and Data Analysis

The SEIA sets out the socio-economic baseline of the study area, predicts socio-economic impacts and makes recommendations for mitigation of negative socio-economic impacts and measures which can be taken to enhance the positive socio-economic impacts. The socio-economic baseline study is based on both primary and secondary data. Primary data was collected directly from elected leaders, community members and private landowners. Secondary data was accessed through South African Databases, available reports and articles, internet searches and are referenced in the text and in the reference section of this report.

The profile of the baseline conditions includes describing the current status quo of the community, including information on a number of socio-economic and economic issues such as:

- Demographic factors;
- Socio-economic factors such as income and population data;
- Access to services;
- Institutional environment;
- Social Organisation (Institutional Context); and
- Statutory and Regulatory Environment.

4.1.1 Primary Data

4.1.1.1 Public Participation

Affected landowners and members of the public were given an opportunity to comment on the project during the public participation process carried out during the Scoping and EIA phases of the project. Comments and responses used during this process have been included into this report and have formed one of the bases the analysis of the socio-economic impacts considered in this report.

In cases where the socio-economic impacts were high, primary data was collected by consultation with elected leaders and interviews of community members.

4.1.2 Secondary Data

An assessment of the scoping phase was conducted to provide an understanding of the project details, location and possible impacts.

The required information was collected using different sources, these included Statistics South Africa Census data and a thorough review of relevant municipal, district and other literature.

The discussion of the demographics and the development profile of the municipality is carried out using Census 2011 data produced by Statistics South Africa.

The Census 2011 data is the most comprehensive dataset available for the subject areas, and it is currently the best data at hand. The ward and municipal data have been extracted using the project Geographic Information System, and the data for the affected areas will be presented in tables and figures throughout the report.

4.1.3 Geographic Information System

A Geographic Information System (GIS) was used to conduct an analysis of the area. The use of GIS brings together the demographic and socio-economic data to enable a thorough analysis of the project area.

4.2 Impact Assessment

An impact assessment should be designed as a bridge that integrates the science of environmental analysis with the policies of resource management (Barrow, 1997). Furthermore, an impact assessment allows for an estimate of the significance of the identified socio-economic impacts to those who will be affected. In addition, the response of the affected parties to such impacts also needs to be clarified (Centre for Good Governance, 2006). All impacts will be analysed with regard to their nature, extent, magnitude, duration, probability and significance (Barbour, 2007). Section 7 lists the definitions that apply to the impact assessment.

The determined impacts are clustered around a common-issue and are assessed before and after mitigation. The identification of the socio-economic impacts associated with the project is issues-based, with the main headings referring to a common theme addressing several related impacts. Under each of these issues the specific impacts and potential mitigation strategies are discussed for pre-construction, construction, operation and decommissioning phases.

4.3 Assumptions and Limitations

The following assumptions and limitations underlie this socio-economic impact assessment:

- It is assumed that information obtained during the public participation phase provide a comprehensive account of the community structure and community concerns for the project. Comments from the public participation phase were limited, indicating that the project has been well canvassed in the area owing to its having been previously authorised and discussions having taken place with landowners along the proposed route;
- The study was done with the information available to the specialist at the time of executing the study, within the available time frames and budget. The sources consulted are not exhaustive and additional information which might strengthen arguments, contradict information in this report and/or identify additional information which might exist. However, the specialist did take an evidence-based approach in the compilation of this report and did not intentionally exclude information relevant to the assessment;

- It is assumed that no relocation of families or people will take place for this project. The route would be refined to avoid relocation impacts.

5 SITUATIONAL ANALYSIS

The social status quo within the project study area is an important input to the impact study of the proposed project. Here the status quo is described using data obtained from Statistics South Africa's Census 2011 as well as by observations made during site visits to the project area.

5.1 Land Use and Infrastructure

The powerline runs through areas of different land use. The predominant land use is commercial agricultural.

5.1.1 Summary of Impacts for Route Alternatives

The proposed power line does not have any route alternatives, hence the available mitigation is to position the towers within the corridor. Impacted communities in the project area are: Marble Hall NU, Klipbank, Groblersdal, Elias Motsoaledi NU, Steve Tshwere NU, Mhluzi and Middleburg.

The table below provides a breakdown of the number of impacts for the proposed 400Kv powerline.

Table 3: Summary of Impacts

Nature of Impact	Powerline
Farm Buildings / Dwellings	28
Irrigation Pivots	15
Smallholdings (buildings/dwellings)	8
Commercial/Institutional	19
Other – Tourism, Hatchery and Rail	38

It should be noted that this impact table understates the scale of the impact of the powerline on the community of Uitkyk, south west of Middelburg. At currently planned, the powerline runs through the community with little regard for the locations of the dwellings. At the time of writing, Eskom is planning to relocate residents of the community away from the powerline servitude.

The proposed substation site is located in an area south west of Middelburg. The site is uninhabited and undeveloped. The R575 road, used to access surrounding settlement of Many

Waters, presents itself as a suitable access route. Construction of additional access routes leading to the proposed Emkhiweni substation site would be required during and after construction.

The settlements found to be directly affected by the proposed development are high density informal settlements and township areas of Uitkyk and Mhluzi. The remaining settlements are farm dwellings along the powerline for which the mitigation measure would be to reposition the towers within the corridor. The powerline should be able to pass through most farmlands without directly impacting upon individual dwellings.

5.1.2 Uitkyk Informal Settlement

The rural sections of the project do not have access to piped water supplies and as a result, they rely on public/communal water supplies. These supplies are provided by the Steve Tshwete Local Municipality in their efforts to improve the standards of living. **Figure 2** below shows an image of the water supply tank in Uitkyk as an example.

Figure 2: Community Water Storage Tank in Uitkyk

Subsistence farming is also seen as a main source of food supply in the poor communities, **Figure 3** below provides an image of the land use in Uitkyk.

Figure 3: Land Use in Uitkyk Settlement

Figure 4: Dwellings Impacted in Uitkyk

Figure 4 above shows the view from inside the settlement of Uitkyk, south west of Middelburg. The powerline in this portion of the project makes its way across the existing dwellings and the community water supply tank shown in **Figure 2.** Current planning for the location of the powerline and the pylons requires the relocation of the inhabitants in Uitkyk.

Figure 5: Land Use in Uikyk

Figure 5 above shows a small local convenience store "Super B" situated along Keiskamma Drive, at the main entrance of Uitkyk settlement. Despite the challenges of not having infrastructure, the store uses an electricity generator and a water storage tank to cater for the needs of the residents and passing traffic who stop for refreshments and basic needs. During consultation with the local councillor, it was reported that the store was constructed illegally and should be relocated.

Figure 5 above provides evidence of the rapid growth experienced in this settlement. During consultations, it was reported that since 2010, the number of shacks in Uitkyk has increased rapidly and is not estimated to be 500 structures.

Figure 6: Land Use in Uitkyk

There is a very low level of infrastructure provision in the community of Uitkyk. This settlement is situated on privately owned land and hence has not been provided with any form of services by the municipality. There is no formal sanitation, with the inhabitants making use of pit toilets, no electricity is supplied and water is gravity fed from a tank, with supplies being supplemented by water tanker. Inhabitants use containers to collect and store their water. The internal gravel roads are informal and narrow, with no storm water drainage.

Due to the location of the settlement and the rapid growth thereof, the Ward Councillor has stated that the local municipality is planning to relocate the inhabitants to serviced municipal land. These plans do not appear to have reached an advanced stage. To achieve relocation of the community, the client, Eskom SOC Ltd, would have to liaise with the municipality and work together in developing strategies to effectively relocate the affected households, see **Figure 6** above.

5.1.3 Mhluzi

Mhluzi, a township located west of Middelburg, consists of formal roads and formal housing structures with access to water and formal sanitation. The powerline in this section, makes its way across informal structures on the outskirts of Mhluzi**. Figures 7** and **8** below show the structures within the powerline corridor.

Figure 7: Affected Dwellings in Mhluzi

Figure 8: Affected Structure in Mhluzi

Figure 8 shows an informal recycling site which is directly affected by the powerline. “Mamosadi Scrap Metal” recycling centre is situated within the corridor in the same location as pylon 257 and as a result, either the centre will have to be removed and relocated, or the powerline would have to be relocated.

Figure 9: Affected Structure in Mhluze

Figure 9 above shows an internal view of the activities within the walled structure, on the outskirts of Mhluzi, which falls partially within the planned servitude. The structure is used to house livestock such as chicken and cattle as well as abandoned vehicles. Although this structure is within the corridor, Pylon 256 is situated seventeen metres outside the structure. Should the structure remain and not be relocated, security would be a concern owing to the influx of workers during construction.

5.1.4 Mhluzi Extension 2

Figure 10: Impacted Structures in Mhluzi Ext 2 [25°44'13.77" S, 29°25'14.77" E]

Figure 10 above shows an image of formal houses which have been developed north of Mhluze Extension 2 to accommodate the growing population of Steve Tshwete Local Municipality. Structures found in this section of the project have since emerged in 2014 and are seen to be growing in a south easterly direction towards the powerline corridor. 4 structures in particular, are located on the edge of the powerline corridor and can be avoided through careful sitting of the towers as the location of pylon 239 will not impact any structures.

5.2 Study Area Overview

The section below provides a more detailed description of the socio-economic environment of the study area and further illustrates the livelihoods of the study area

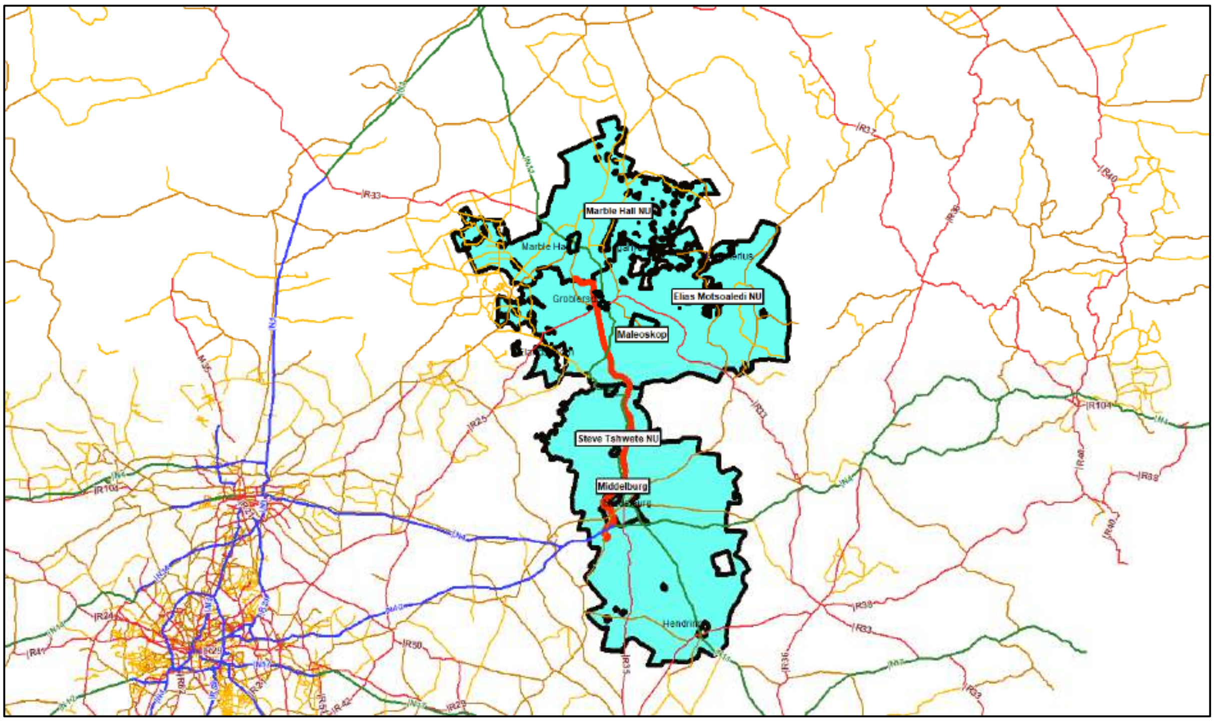


Figure 11: Affected Project Area

5.2.1 Population Data

The population of the project study area has been as determined using Statistics South Africa's Census 2011 data. The bar graph below shows the population of each of the affected sub-places in the project study area.

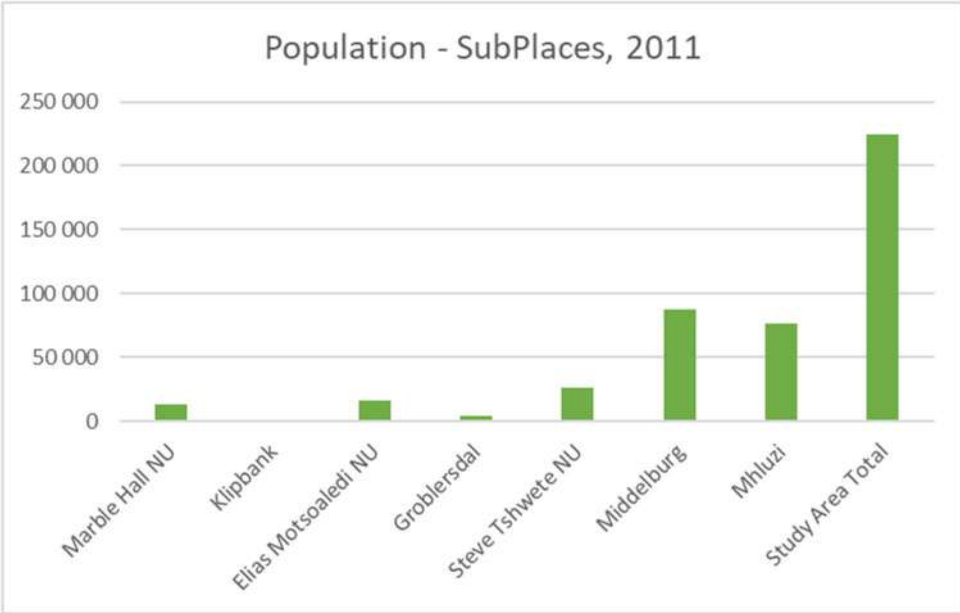


Figure 12: Total Population within the Project Areas

There are 224 000 people in the sub-places directly affected by the proposed project. The sub-places with the highest populations are Middelburg and Mhlusi, both are rural sub-division of the large urban town of Middelburg. The smallest towns are the Groblersdal and Klipbank sub-places at 4 329 and 1 618 people respectively.

There are 64 451 households in the study area, with household number and average household sizes being described in the figure below.

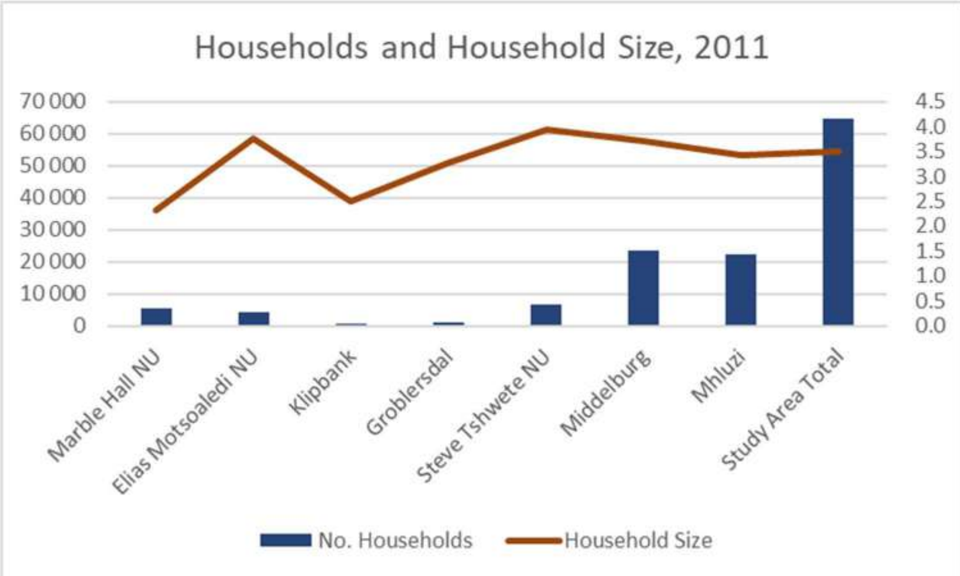


Figure 13: Household Data of the Affected Areas

The average household size is 3.5 people per household, with the lowest household size being lowest in the rural areas of Marble Hall, Klipbank and Groblersdal. Household size is highest in Steve Tshwete NU.

5.2.2 Dwelling Type

The characteristics of the dwellings in which households live and their access to various services and facilities provide an important indication of the well-being of household members. It is widely recognised that shelter satisfies a basic human need for physical security and comfort.

According to the Statistics South Africa household classification, the following definitions apply to formal and informal housing:

- **Formal dwelling**, refers to a structure built according to approved plans, i.e. house on a separate stand, flat or apartment, townhouse, room in backyard, rooms or flat let elsewhere. Contrasted with informal dwelling and traditional dwelling; and
- **Informal dwelling**, is a makeshift structure not erected according to approved architectural plans, for example shacks or shanties in informal settlements or in backyards.

The chart below shows the dwelling types located within the study area. The dwellings were listed taking into consideration the location, authorities and the lifestyle of the residing people. The dwelling types are categorised as being Formal (Brick/concrete house), Traditional and informal. See **Figure 14** for the results.

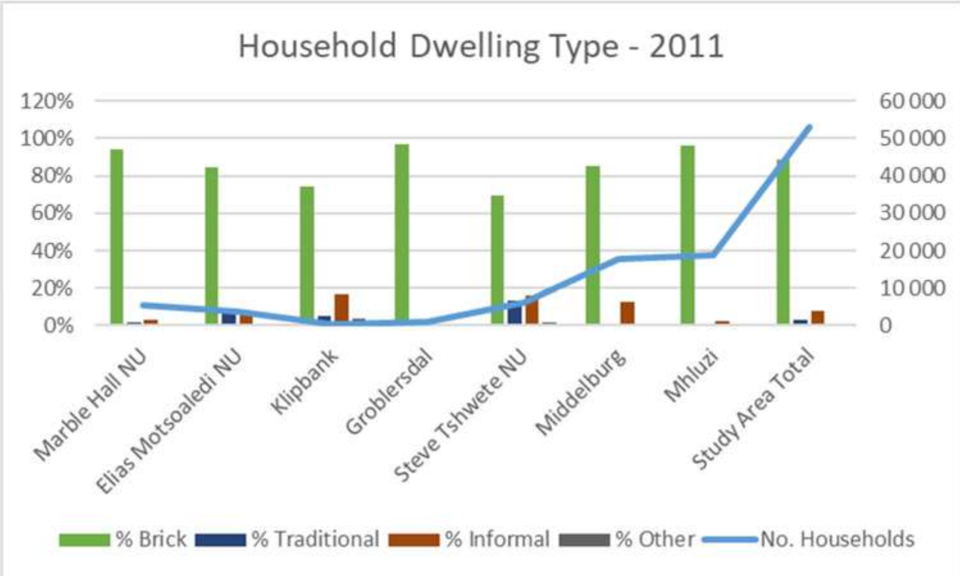


Figure 14: Types of Dwellings

It is evident that the vast majority (88%) of the inhabitants of the study area live in formal and brick dwellings. There are areas where informal settlements exist, notably Klipbank, Steve Tshwete NU and Middelburg.

5.2.3 Access to Piped Water

Understanding the water supply at a household level provides insight into the municipal level of service of a community as well on the standard of living. The graph below, which summarises Statistics South Africa's Census 2011 data, shows the use of the various water supply standards within each of the sub-places.

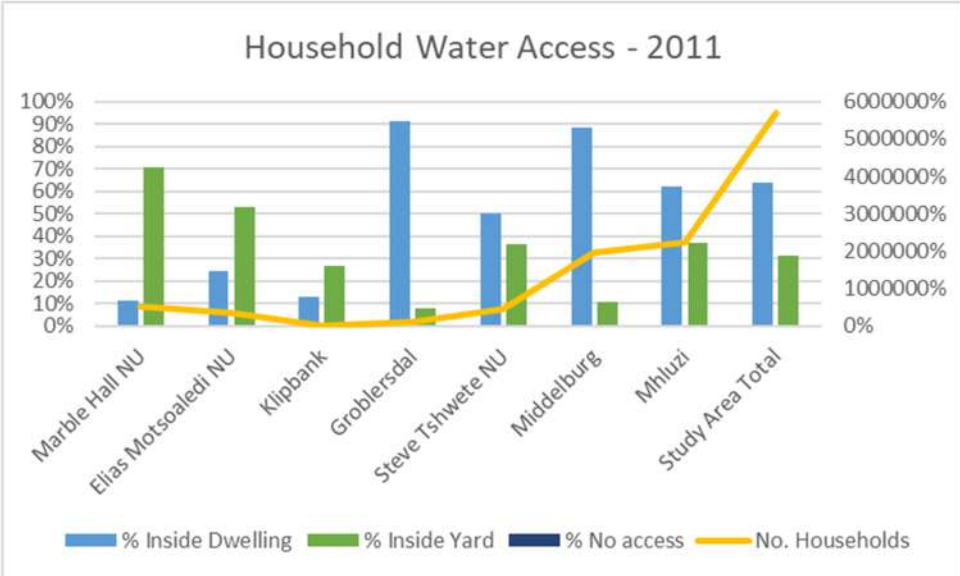


Figure 15: Access to Water

The majority of the supply area is dominated by a piped water supply inside homes, at 64% of all households. A further 31% of households reported having piped water inside their yards. Five percent of the households reporting not having formal access to water.

These figures mask variances between sub-places. Marble Hall NU, Elias Motsoaledi NU, Klipbank and Steve Tshwete NU have relatively higher level of yard access than the study area. This is due to the rural nature of the sub-places, and in the case of Steve Tshwete NU and Klipbank, the presence of informal settlements in the area.

5.2.4 Sanitation

Access to sanitation services is also an indicator of the standard of living amongst the population in the sub-places. The graph below, which summarises Statistics South Africa's Census 2011 data, shows the use of the various sanitation standards within each of the sub-places.

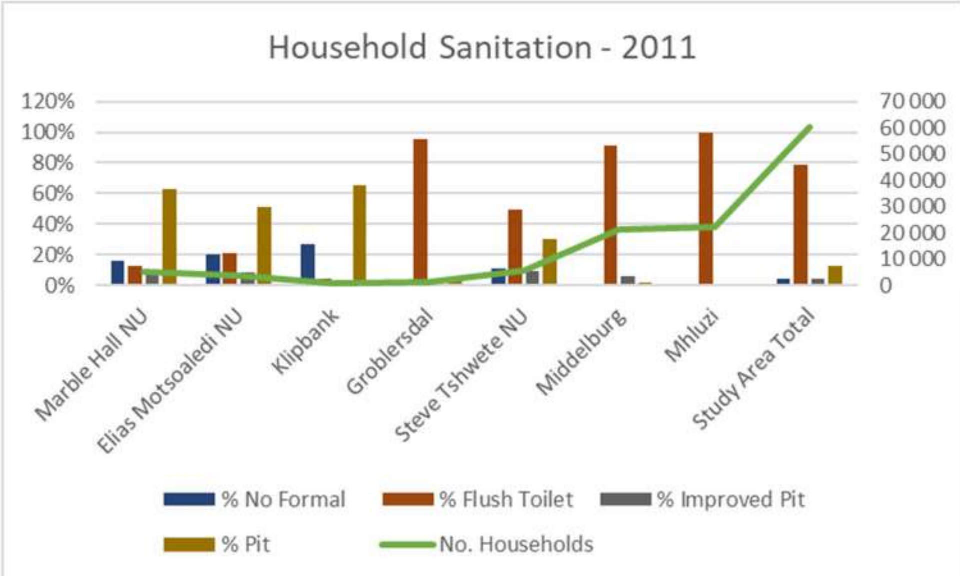


Figure 16: Access to Toilet Services in 2011

A large majority (78%) of households in the affected project vicinity make use of flush toilets, either connected to piped sewerage systems or directly to septic tanks. The study area is noteworthy for have a larger percentage of unimproved pit latrines than those of the improved type. This demonstrates the slow roll-out of improved pit latrines in the northern areas of Middelburg.

Marble Hall NU, Elias Motsoaledi NU, Steve Tshwete NU and Klipbank are areas which have very few flush toilets, with the majority of inhabitants having unimproved pit toilets, or no access to sanitation at all. This corresponds well with the rural nature of the areas, the presence of information settlements and the lack of access to piped water.

5.2.5 Education

Education levels are assessed in order to understand the potential grade or level of employment as well as livelihood of the community. Furthermore, it indicates the functional literacy and skill level of a community. **Figure 17** provides detail on the education levels within the study area. The figures are taken from Statistics South Africa's Census 2011.

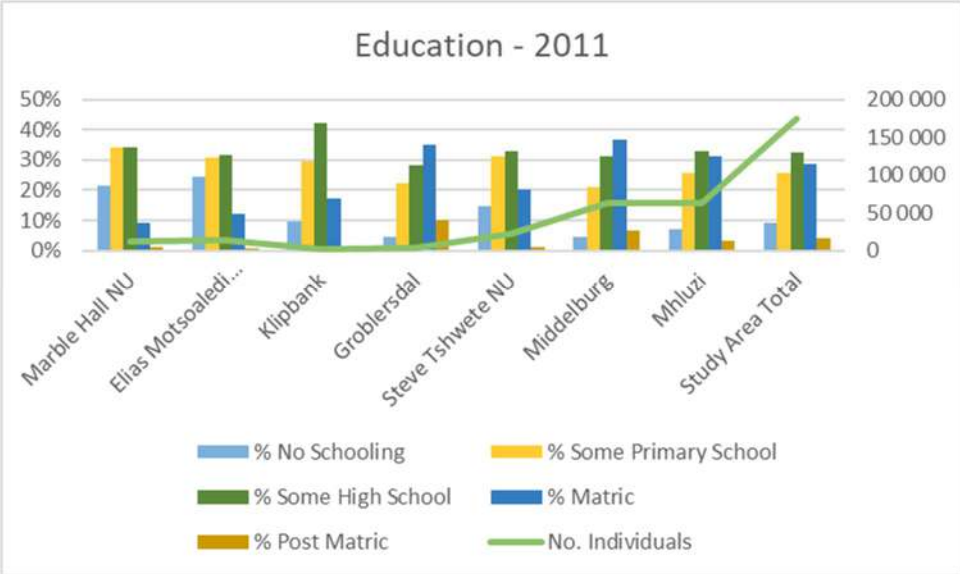


Figure 17: Education Levels in the Affected Project Areas 2011

The statistics show that an average of 9% of the inhabitants in the study area have never been to school, a further 26% have only attained education to the end of primary school. Thus 35% of the population has attained very low levels of education. A further 32% have not completed matric.

Over the entire study area, 33% of the population have completed matric, or have gone onto post matric studies.

The areas with the lowest educational outcomes are Marble Hall NU, Elias Motsoaledi NU, Steve Tshwete NU and Klipbank. This corresponds with the lifestyle data covered in the sections above.

The conclusion can be drawn from the statistics that the project study area has low levels of education which negatively influences income and lifestyle. Taking all of this into consideration, skills development programmes will greatly benefit the people in close vicinity to the project and assist with alleviating poverty.

Economic theory proves that education improves the level and quality of human capital, in turn increasing the productivity of individuals. Thus increasing the output generated per worker. Education facilitates long term growth and is critical to escape the poverty trap.

Economic theory is proven in practice in a study conducted by Altbeker and Storme (2013). The study shows that while the number of graduates in South Africa has more than doubled in the past fifteen years; the unemployment rate amongst graduates has declined to around five percent.

Furthermore, the study shows that the employment rate improves as the years of completed education increase (**Figure 18**) (Evelien & Altbeker, 2013). The study demonstrated that only thirty-three percent of those who had less than secondary education (eleven years or fewer) had jobs. This rose by twenty percent on completion of secondary school. With one extra year of education after secondary school, employment increased to seventy-one percent. Those with qualifications that take longer than one year after matric experience improving employments rates, until post-graduate degree holder’s employment rate, which was the highest at ninety-six percent (Evelien & Altbeker, 2013).

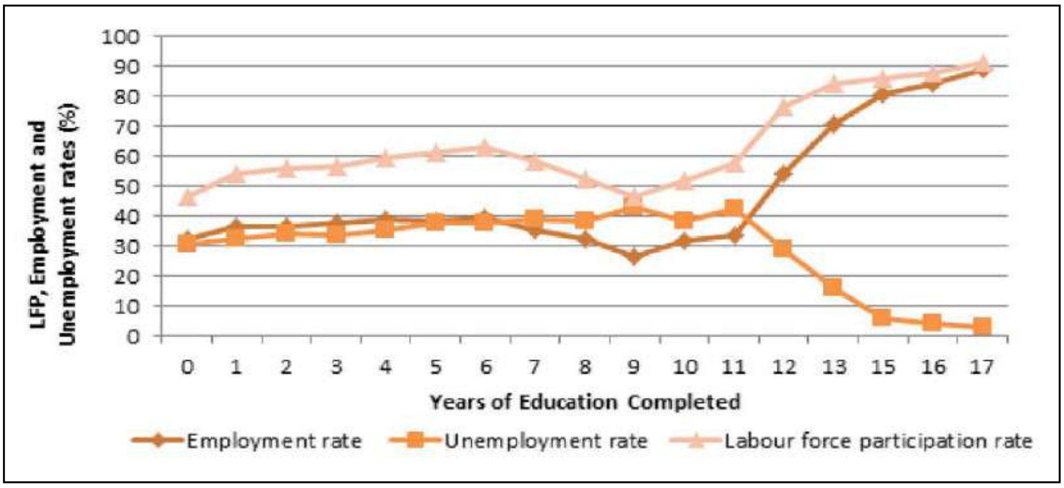


Figure 18: Labour Force Participation, Employment by Years of Education (2007)

The education levels in the study area demonstrate that most inhabitants have achieved less than eleven years of education, and the Altbeker and Storme study indicates that the study area is thus likely to be structurally geared towards high unemployment and thus higher levels of poverty.

The community are largely dependent on the population who have high school or received higher education.

The low education levels in the study areas indicate a perpetuating cycle of low income and thus perpetuating low education rates. This structural problem requires intervention of an external entity to improve current education levels. A generation of youth with some form of higher education is required to break the poverty cycle in these project areas

5.2.6 Annual Household Income

Annual household income is important to assess as it provides information on the poverty level of a community. Development of unskilled rural households is much slower than that of skilled households, this is due to the unskilled communities tending to generate low incomes per household than higher skilled communities.

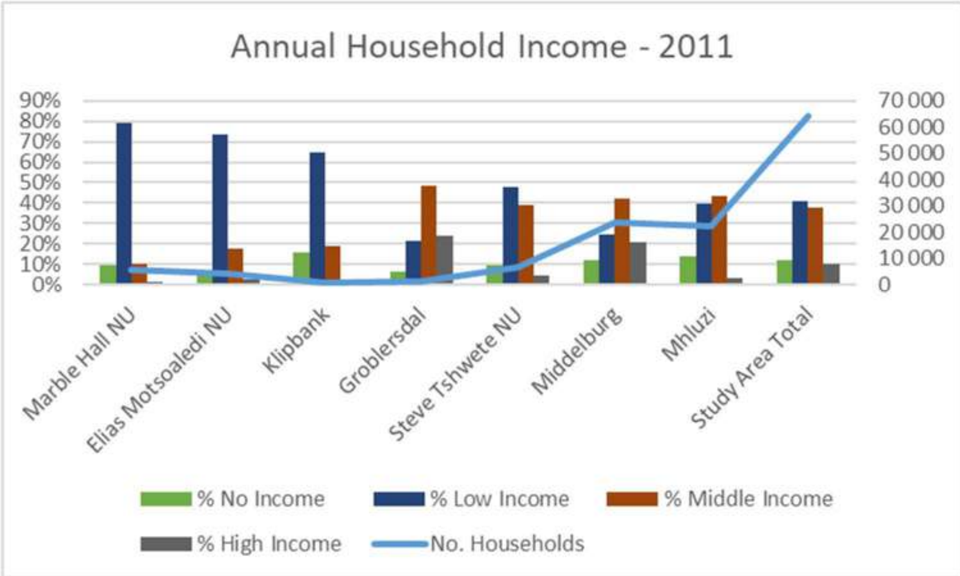


Figure 19: 2011 Annual Household Income

Of particular note in **Figure 19**, are the figures for households with "No Income". Statistics SA in their publication "Income Dynamics and Poverty Status in Households in South Africa, Census 2011", (Statistics SA: 2015) define income as being "…all money received from salary, wages or own business; plus money benefits from employer, such as contributions to medical aid and pension funds; plus all money from other sources, such as additional work activities, remittances from family members living elsewhere, state pension or grant, other pensions or grants, income from investments, etc. The census question asks for the total before tax."

Twelve percent of the households in the study area have no reported income. The areas reporting the highest levels of no income are Klipbank (16%), Middelburg (12%), Mhluzi (14%) These households are dependent upon community support and in the case of Klipbank, subsistence agriculture. They are highly vulnerable to economic shocks, or displacement from the land they occupy.

A further 41% of the households in the study area have incomes up to R38 000 per annum. These households are poor and dependent upon a functioning economy for their livelihoods. In Marble Hall NU, Elias Motsoaledi NU, Klipbank the two categories of no and low incomes dominate the population. There are very few higher income households in these geographic areas. This makes these community less able to adjust to economic change and have less resilience than communities which have a wider spread of wealth. This latter category applies to areas such as Middelburg and Mhluzi which have 63% and 46% middle and high income families.

Poorer communities would benefit most from additional employment and skills development opportunities.

5.2.7 Employment

Census 2011 uses the following definitions applicable to employment that are useful for reference purposes:

- "**Employed** - Those who performed work for pay, profit or family gain for at least one hour in the seven days prior to the interview or who were absent from work during these seven days, but did have some form of paid work to return to";
- "**Economically Active Person** - A person of working age who is available for work, and is either employed, or is unemployed but has taken active steps to find work in the reference period". These are the sum of the employed and unemployed persons;
- "**Unemployed** – Those people within the economically active population who: (a) did not work during the seven days preceding the census; (b) want to work and are available to start work within two weeks of the interview; and (c) have taken active steps to look for work or start some form of self-employment in the four weeks preceding the census night."; and
- "**Other Not Economically Active** – People who are not available for work such as full-time scholars and students, full-time homemakers, those who are retired and those who are unable or unwilling to work"; and

The reported employed and unemployed person in the sub-places is reported in the graph below. For the purposes of the official definition of employment, the workforce are the sum of the employed persons and the unemployed persons. For the unemployment rate including discouraged work seekers, the workforce and the figures for unemployed includes discouraged work seekers.

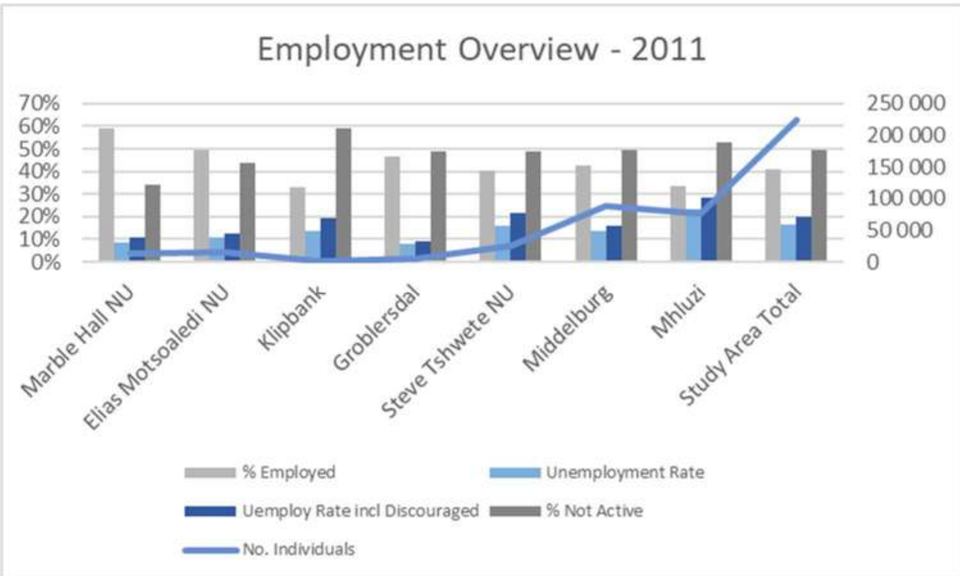


Figure 20: 2011 Employment Status

According to the official definition for unemployment, the unemployment rate is 16% in the study area. The unemployment rate including those who are discouraged (the expanded definition) was 20% for the study area.

The areas with the highest expanded unemployment were Steve Tshwete NU, Middelburg and Mhluzi at 21%, 16% and 29% respectively.

In the case of Marble Hall NU, Elias Motsoaledi NU and Klipbank, the poverty levels are high and yet the unemployment levels are relatively lower than other sub-places of the study area. This implies that the areas have widespread lower paying jobs. This links to the findings on education, where these three areas are those with low levels of matriculants and those with post-matric studies.

5.3 Stakeholder Engagement

The following stakeholder engagement was carried out as part of either the public participation process of the EIA and as part of this SEIA.

5.3.1 Uitkyk Informal Settlement

During a review of the route for the powerline, the community of Uitkyk is affected by the powerline route. The powerline runs through the community with little regard to the location of the dwellings.

Figure 21: Routing Through Uitkyk

There are at least 28 households that are directly affected by the proposed project. In order to provide a clear servitude of 55m, these households would have to be relocated. The powerline crosses the main entrance of Uitkyk, and impacts upon commercial entities there.

The bulk of the community have located to Uitkyk to seek employment at the nearby quarries. As the population has grown, the area has generated a natural momentum, which has seen the community expand. The community has grown to its current size, from a small group of dwellings along the western boundary of the nearest quarry, in 2010. The community reached a tipping point in 2015, where the growth in population expanded rapidly to its current size. The project as previously authorised did not impinge on the community since at that stage it was small and the powerline passed it by within impacting on the dwellings.

At a minimum, this servitude is required to be clear in order for the powerline to safety pass through the community. Having the powerline which runs through the community is however, not recommended and efforts should be made to re-locate the route of this powerline past the community.

The authors assess that knowledge of the project in the area is low and that a relocation framework would need to be discussed and agreed with the community in order to achieve relocation of households. The conditions within the community are such that relocation would likely be favourably viewed, should the receiving area replace the current economic services that are available to the community.

5.3.2 Contact with Directly Affected Landowners

Directly affected landowners/parties were contacted, this was carried out as part of the Public Participation process of the Environmental Impact Assessment during the Scoping phase. This process included individual meetings with the IAP's, focus group meetings, public meetings and authority meetings of the impacted areas. During the meetings, there were socio-economic issues that were raised as resulting from the proposed project. The overall responses include the following:

- Many landowners were concerned about the **Financial Compensation** for the loss of land where the towers would be located. Most of the farmers raised issues which were related to the previous experience of being promised compensation for servitudes, but that this was never forthcoming. Impacts reported included the farm footprints where there would be physical construction of towers and of reduced access to the landowner's farm;
- **Security concerns** were highlighted by participants. Concerns were mostly with regards to contractors having access to their properties throughout the duration of the project. Concerns were raised that the project would increase public movements which would increase the incidents of trespassing on private land;
- **Reduction of access to farmland**; landowners were concerned about the project reducing access to their land by the construction phase interfering with agricultural activities or permanent access roads cutting properties in half. This would have a knock-on effect on farm productivity;
- The possibility that the project would create **socio-economic** benefits was raised. This was with regards to the benefits that the project will introduce into the affected communities, these can be in form of employment of labour for the project, the development of skills for future employment and development of the communities.

A detailed analysis of the concerns and comments during the public participations is outlined below. These concerns and comments were collected as parts of the EIA scoping phase, specialist's site visits as and consultation with the Comments and Response Report (CRR):

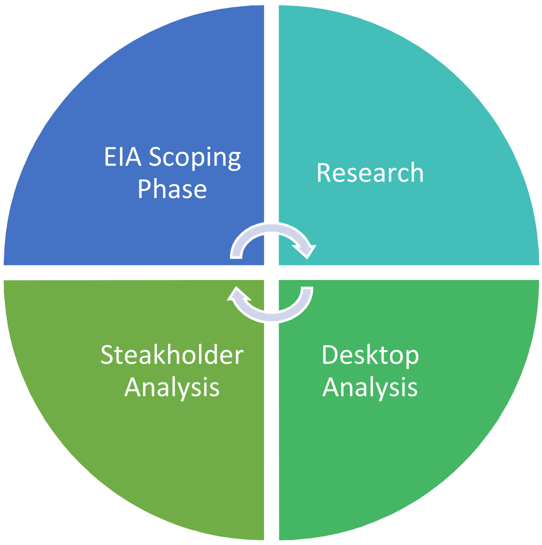
5.3.3 Steve Tshwete - Affected Main Places

Within Steve Tshwete LM the directly affected main areas include Mhluzi and Uitkyk. Stakeholder engagement was carried out in the form of Authority meeting with the Ward Councillor and informal interviews with the landowners and community members on site. The concerns which were noted from the engagements are as follows:

- **Socio-economic benefits**: the councillor and community members were interested in the economic benefits resulting from the project. According to the Councillor, the area experiences great amounts of electricity power outages and has a substantial amout of unemployed youth. The project, is seen to have the potential to create jobs for the local community members, skills development and certificates for future enhancement of the people as they currently rely on temporary odd jobs.
- **Developments within the servitudes**: community members were concerned about the permanent loss of land and the possibility of being relocated.
- **Landowner Consent:** a community member in Uitkyk was concerned about the project being carried out on his property without his consent. This was influenced by a historic incident where his trading store was said be relocated without his knowledge and consultation.

6 IDENTIFICATION OF ACTIVITIES, ASPECTS AND IMPACTS

The methodology for the identification of impacts was threefold. Firstly, an assessment of the scoping phase took place. This was followed a research and desktop analysis. Finally, a stakeholder and site visit was conducted.



The assessment of the scoping phase was important to understand the project background details, location and possible impacts. In this section, the Geographic Information System was used to conduct a thorough analysis of the area. Project details were understood and located.

The second aspect to the identification of impacts was a research and desktop study. Data on the community such as population statistics; health; education; and services were analysed using Census 2011 data. Consultation of relevant studies was conducted to provide an insight and supplement the already acquired knowledge where deemed necessary. A brief analysis of the economic aspect of the community was also assessed. It also allows for the identification of the challenges faced by the community. Not only does the desktop study facilitate site visits; it also directs the discussion during interviews.

Finally, stakeholder engagements were conducted in the form of interviews with directly affected landowners. The Scoping Phase Comments and Response Report also provided valuable insight on interested and affected party's views on the project. Using this methodology, aspects were identified from the activities that proposed. These aspects have triggered impacts which will be discussed in Section 7. In order to contextualise the impacts, the activity and aspects have been outlined and discussed below.

According to ISO 14001-2004 4.3.1 Environmental Aspects; the Organisation shall establish, implement and maintain a procedure(s)

- To identify the environmental aspects of its activities, products and services within the defined scope of the environmental management system that it can control and those it can influence taking into account planned new developments or new or modified activities, products and services, and
- To determine those aspects that have or can have significant impact(s) on the environment (i.e. significant environmental aspects) (International Organization for Standardization, 2011).

6.1 Identification of Activities and Aspects

An “Activity” is defined as a distinct process or risks undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation (International Organization for Standardization, 2011).

The activities identified for the project are listed below as either high risk or lower risk to the socio-economic environment.

High Risk Activities:

- Land and Servitude Rights Acquisition;
- Construction Works:
    - the Emkhiweni substation;
    - the 400kV Powerline – the erection of the towers and the stringing of the conductors;
    - clearing of vegetation from the servitude;
    - creation of access roads and maintaining existing roads; and
- Rehabilitation of the construction site
- Scheme Operations:
    - Operation and maintenance of the servitudes
    - Operation and maintenance of the two substations;
    - Road Maintenance;

Lower Risk Activities:

- The expansion of the Silimela Substation

An aspect is defined as elements of an organisation’s activities or products or services that can interact with the environment.

In order to capture the impacts associated with the proposed infrastructure, an activity – aspect – impact table was created refer to **Table 10**.

The table presents an overview of the impacts associated with aspects during the various stages of the project. Some impacts, including their mitigation measures, are thereafter discussed in detail while the remaining impacts not discussed in this report are addressed in a separate specialist study as part of the EIA study. If the impact is not significant then no further investigation is recommended.

Table 4: Table outlining the Activity, aspects and Impacts of the project

Activity	Aspect	Potential Impact
Land and Servitude Rights Acquisition	Land Acquisition	Partial loss of livelihood on the part of landowners
	Servitude Rights	Reduced access to productive land
	Re-location within the Uitkyk community	Relocation of at least 28 households in the community.
	Alteration of land use	Development constraints within the sub places.
Operations	Enabling development through the network expansion of electricity.	Economic growth and induced impacts
	Supply of goods and services to the scheme	Opportunity for local business.
		Opportunity for local business.
	Administration and Technical Input	Employment of local people
		Skills development
Construction Phase	Access into properties	Security Concerns
		Damage to property or equipment
		Damage or wear to access roads
		Improvement of access in the project area
	Erection of towers and stringing of the conductors.	Proximity to construction work and associated inconvenience and dangers.
		Employment of local people
		Sourcing of equipment, machinery and services locally
	Earthworks and Roadworks	Noise
		Dust
	Concrete and Civil Works	Noise
		Influx of workers
		Employment of local people
		Sourcing of equipment, machinery and services locally
		Temporary road closures
		Increased traffic
	Transport of goods to site and employment of staff	Increased traffic
		Security
		Improved access to amenities
		Damage or wear to access roads
	Mechanical and Electrical Works	Noise
		Employment of local people
		Sourcing of equipment, machinery and services locally
	Rehabilitation	Damage or wear to access roads
		Security Concerns
		Damage to property or equipment

Activity	Aspect	Potential Impact
		Damage or wear to access roads

6.2 Impacts and Mitigation Framework

ISO 14001-2004 defines impacts as "any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects".

When considering an assessment of the impacts, the following definitions apply.

Nature	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.

Mitigation	Information on the impacts together with literature from social science journals, case studies and field work will be used to provide mitigation recommendations to ensure that any negative impacts are decreased and positive benefits are enhanced.
Monitoring	Monitoring usually involves developing and implementing a monitoring programme to identify deviations from the proposed action and to manage any negative impacts. The recommended mitigation measures will also include monitoring measures.

A well-designed, well implemented, well managed power line network expansion can bring significant socio-economic benefits to the communities that it serves. If configured or operated in a way that ignores significant socio-economic needs or potential impacts, a power line may have significant socio-economic costs or liabilities for the stakeholders and affected communities.

Therefore, assessing socio-economic impacts is a complex process due to the multi-dimensional nature of the human interactions. This occurs in situations where a particular impact affects a group of stakeholders differently. An inter-connection of impacts can also be encountered whereby a number of impacts are related and when assessed cumulatively their impacts may be of significance.

The impact assessment scores both before and after mitigation were arrived at by the specialist team engaging in a modified version of the Delphi technique, where the team discussed the scores, and through a process of iteration arrived at a consensus for each of the values. Where additional information was needed to make a determination, the technique would be halted, the necessary information would be uncovered and included in the report, and the technique would be recommenced.

6.3 Impact of Providing Electricity through the Network Expansion.

The network expansion proposed through the development of the proposed 400kV powerline has socio-economic implications. The socio-economic benefits of a sufficient and sustainable power supply are fundamental to the project and the community.

The United Nations Educational Scientific and Cultural Organisation highlight that socio-economic development depends upon the human's use of electricity since electricity is an essential component of modern living.

Electricity supply shortages, and the associated interruptions; have large economic and socio-economic implications. Electricity is used as an input by many businesses – manufacturing, irrigated agriculture and offices, whilst sufficient power supply ensures continuing delivery of socio-economic benefits such as health care services. Power interruptions cause negative impacts on daily social activities. These include the efficiency and flow of traffic within the cities or towns which rely on traffic lights, the running of trains, lighting in the home and public spaces and other uses in the home such as preparation of food, heating, cleaning, refrigeration and entertainment.

With a secure electricity supply, safety improves since the use of energy sources to carryout household duties such as cooking and lighting require the use of paraffin, candles and possibly small generators, all of which represent a higher safety risk that using electricity.

Agricultural production, even on a subsistence level, thrives with a secure water supply and this is often provided by electricity. Thus, increased electricity supply increases food security. These benefits are all realised through an increase and secures electricity supply.

Environmental Feature	Impacts Created by Providing a Secure, Sufficient Power Supply					
Project life-cycle	Operational Phase					
Potential Impact	Proposed Management Objectives / Mitigation Measures					
Economic	• Increased business productivity; • Economic growth;					
Social Benefits	• Convenient and less time-consuming daily tasks; • Facilitation of education • Facilitation of mass transport; • Health care.					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Regional	High	Long Term	Likely	3
After Mitigation	Positive	Regional	High	Long Term	Likely	3
Significance of Impact and Preferred Alternatives	Mitigation is not necessary for this positive impact. This mitigation measure does not influence the choice of alternatives considered in the study.					

6.4 Impact Owing to Routing and Site Selection

The implementation of the proposed project will have an impact on landowners in that land would need to be acquired, and servitudes registered for the various project components.

Landowners would have a reduced land area to generate income and servitude conditions are likely to restrict the existing use of land.

In this regard, the final route and tower location will be carried out prior to construction. A final walk down survey by the specialists will be carried out and negotiations with landowners will begin after route selection has been completed.

Where impacts on agricultural productivity occur and cannot be mitigated by re-location of towers, compensation will be required for all affected landowners. Those landowners who will be directly affected through the sale of their property and loss of land through the footprints of the towers should be compensated for the land, immovable assets and loss of business. Landowners who will be impacted upon by Eskom requiring a servitude over their land should be compensated for the servitude rights.

Eskom (SOC) Ltd are responsible for land and rights acquisition. They should ensure that this process is conducted accordance with the Expropriation Act, 63 of 1975. The process should be a fair and independent land valuations should be conducted. This process should be undertaken in the project planning phase and should be concluded prior to the start of construction.

Similarly, servitudes would have to be negotiated and registered in terms of the Alienation of Land Act, 68 of 1981. There will be discussions and engagement with landowners to come to an agreement with regards to the servitude registration and servitude restrictions.

There are a number of sections along the various powerline route alternatives where impacts upon existing land-use will be higher than that along other sections. These high impact sections are captured in the figures below and in more detail elsewhere in this report.

Figure 22: Uitkyk Affected Area - 25°49'48.37" S 29°25'18.08" E

Figure 23: Mine Infrastructure - 25°47'19.38" S 29°25'12.29" E

Figure 24: Mhluze Settlement - 25°46'35.98" S 29°24'01.53" E

Figure 25: Middelburg Informal Settlement - 25°44'55.11" S 29°24'33.46" E

Figure 26: Irrigated Agriculture - 25°20'56.46" S 29°25'13.89" E

Figure 27: Irrigated Agriculture - 25°19'31.57" S 29°24'45.90" E

Figure 28: Irrigated Agriculture - 25°17'51.39" S 29°24'04.70" E

Figure 29: Irrigated Agriculture - 25°17'51.39" S 29°24'04.70" E

Figure 30: Irrigated Agriculture - 25°06'06.32" S 29°19'27.72" E

Figure 22 illustrates the southern section of the project which is near the proposed Emkhiweni substation site. Settlements of Uitkyk, Mhluze, Mhluze Extension 2 and Middelburg are located in this vicinity. The area consists of grazing land, coal mining activities, quarrying and commercial farming. The settlements are medium density with the Uitkyk settlement being the most affected settlement.

The analysis of the corridor shows that at least 28 structures would be impacted by the new powerline in Uitkyk and two structures in the Mhluze, Figure 24. Both communities would have households relocated as part of the project.

Middelburg Informal Settlement is also directly affected by the project. The impact can be seen in Figure 25 and elsewhere in this report. Again, careful siting of the towers is needed to avoid dwellings and infrastructure. Similar impacts are felt at Mhluze Extension 2 (Section 5.1.4), where careful siting of the powerline will avoid most impacts.

Irrigated agriculture, located towards the northern region of the powerline near Groblersdal, as seen in Figure 26, Figure 27, Figure 28, Figure 29 and Figure 30 is also directly affected, the impacts in Groblersdal are mainly on the farming activities and structures e.g. irrigation pivots.

Environmental Feature	Impact owing to Land and Rights Acquisition
Relevant Alternatives & Activities	Acquisition of land
Project life-cycle	Pre-construction
Potential Impact	Proposed Management Objectives / Mitigation Measures
Loss of income from the acquisition of land	• Where-ever possible, the final routing of the project infrastructure should be adjusted to avoid impacts. If the powerline servitude is such that it allows powerline alignment to the extent that an impact on a dwelling can be avoided, this should be done. The alternative, the relocation of communities, is very disruptive to the affected residents. • Where impacts cannot be avoided, all negotiations and payments relating to compensating affected landowners should be conducted and concluded before construction begins. • Those landowners who will be required to sell their property to Eskom SOC Ltd must be compensated for any business that is operating on the premises. • All landowners whose businesses will be affected by the proposed project should be compensated to the full value of their immovable assets and any loss of income. • Negotiations should take place between the landowner and Eskom for any compensation of potential income denied as a result of the servitude agreements.
Relocation of Households	• In the event that household relocation will be necessary, the process to be followed is as follows: o A Resettlement Action Plan to be drawn up providing detail on the impacted households, households needs and how these will be catered for during and after the

	relocation, provides detail on the area to which they are to be relocated and the timeframes associated with the relocation; o The relocation action plan is to be discussed with every impacted household and agreed to in writing; o The relocation action plan is to be discussed with every impacted landowner (if this is not the same as the impacted household) and agreed to in writing; o Relocation is to be effected in strict accordance with the relocation action plan; and o An independent audit, carried out by a suitably qualified relocation expert, is to be conducted after every relocation to: determine the relocation's effectiveness and to identify shortfalls in adhering to the relocation action plan; and o Shortfalls are to be addressed by the proponent within the duration of the construction period of the project.					
Construction Period and time frame	• Careful planning should be adopted to reduce the impact of land acquisition on the overall programme for the works					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Regional	High	Long term	Almost Certain	3
After Mitigation	Negative	Regional	Low	Medium term	Likely	1
Significance of Impact and Preferred Alternatives	The final routing of the powerline is the primary mitigation measure that should be adopted. The final routing should be amended to avoid impacts on dwellings. Relocation should be undertaken with great circumspection.					

6.5 <u>Impacts on Siting of the Emkhiweni Substation</u>

The selection of the Emkhiweni substation site will have very few impacts since there are no inhabitants located close to the proposed site.

Environmental Feature	Impact of the siting Emkhiweni substation					
Project life-cycle	Planning Phase					
Potential Impact	Proposed Management Objectives / Mitigation Measures					
Loss of productive land due to site selection	• Landowner to be compensated for the loss of productive land					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Medium Term	Likely	2
After Mitigation	Negative	Local	Low	Short-Term	Likely	1
Significance of Impact and Preferred Alternatives						

6.6 Impacts during the Construction Phase

The construction activity will impact the social environment both positively and negatively. Given the nature of the project area, construction activity is likely to cause a number of social nuisances as well as possible economic implications on the communities and commercial activities.

Cumulative impacts can be both positive and negative. Cumulative impacts refer to the impacts that are incremental on the environment that results from the impacts of the proposed action when added to the existing and foreseeable future actions. These impacts can also be temporary in nature (by being restricted to the construction phase) and permanent (occurring in both the construction and operation phase).

6.6.1 Economic Opportunity

The high number of impoverished households shows that there are vulnerable communities in the study area. It is recommended that the appointed contractor use local SMME's and local labour as far as possible during the construction phase to enhance any local economic impact. In addition, this would increase the skills in the area after construction is completed.

In this way project revenue will stay in the area, raising economic activity and increasing welfare, resulting in induced economic opportunity. In South Africa, most employment is generated through small and medium business. Given the size of the proposed project, should contracts between local SMMEs be implemented, it is likely that there will be an increase in employment by SMMEs for the duration of the contracts.

In particular, the project has the potential to create a number of opportunities for existing and new local SMMEs. These opportunities range from site clearing, to fencing, parts of the construction scope and supply of materials. There are also opportunities for community members to provide labour, catering, accommodation and other services to the new workers.

Where possible, Eskom should support and encourage the development of SMMEs and local or regional suppliers in line with government policy.

Education levels provide an indication of the level of skill in the community and the degree to which skills can be skilled. Rural and less developed areas are mostly defined by poverty, while poverty is associated with poor education outcomes.

Attempts to break the poverty cycle of the project areas will require more than secondary school education. Higher education or further skills training is required. It is therefore important that the community members under-go skills development. It is also recommended that the Eskom institute a skills development program during construction.

Eskom should monitor the employment process. Employment audits should be conducted. It is important that women are also provided employment opportunities. Audits should pay attention to the employment process of women to ensure that exploitation does not take place.

6.6.2 Noise and Dust

During the construction phase communities may be exposed to increased dust, noise, visual and other nuisance disturbances.

The generation of dust stems from activities such as earthworks and as well as vehicle movement during the construction phase. This situation will be worst during the dry season and during windy seasons. Air borne particulates may pose a hazard to residents in the vicinity or downwind of the construction site that suffer from upper respiratory tract problems. Mitigation through dust suppression methods will allow for this impact to be effectively managed.

During the construction, heavy equipment may be required for the site clearance, road construction, substation and the erection of the electrical towers and powerlines. Noise generation will be unavoidable. The degree of noise, frequency of noise and individual perception are all important considerations when determining the impact on noise. Drilling; blasting and construction activities will also create noise pollution. Adequate warning of high noise events such as blasting should be communicated to the affected communities prior to carrying out the activities.

6.6.3 Worker Health and Safety

The impacts of construction can affect the health and safety of those working on the construction site; disturbance, health and income of the host communities; and disturbance to the environment and animals. These impacts can be mitigated in the Environmental Management Programme (EMPr) and through adherence to the Occupational Health and Safety Act 85 of 1993.

An influx of workers is often characterised by higher health risks, particularly if the influx is male dominated. These include a higher disease burden and rise in HIV/AIDS rates. There should also be awareness and education campaigns on health and social risks such as HIV/AIDs and crime prevention.

6.6.4 Security

There a safety concerns related to the construction activity. Landowners have expressed a number of security concerns including increased access to the farms and crime. Trespassing was cited as a concern as well of damage to property once access is granted.

Mitigation measures include Eskom, prior to construction, agreeing with farmers on appropriate access points to ensure the safety of the businesses, livestock and residents. A security policy must be drafted and strictly enforced by the contractors; this would include a requirement to obtain landowner permission prior to any property. As good practice and mitigation against security risks, Eskom should provide some level of security and emergency response services for the duration of the construction measure. All contractors and service providers should obtain permission to enter any property.

6.6.5 Damage to Property Once Access is granted

Once access to a property is granted, mitigation measures should be taken to ensure that any damage that is caused as a result of this access is made good. This includes damage to infrastructure such as fences, gates, electrical connections or roads.

Property damage includes the destruction of crops that may be required at the time of site clearance.

Where there is a risk of damage occurring, the contractor is to document to the condition prior to the start of work. If the condition has deteriorated after the completion of the work, any such damage should be made good. Landowner signed off that the damage has indeed been rectified should be obtained.

6.6.6 Local Road Condition and Traffic Impacts

Local road access will be used during the project, and as a result these roads may be subject to damage. The project is to maintain the local roads for the duration of the contract and should leave them in a state the same or better than they were prior to the start of the construction phase.

Heavy duty trucks and construction vehicles will cause damage to the current road conditions as well as contribute to congestion on the roads.

The greater the number of trucks on the road, the greater the risk of road accidents occurring. It is important that the contractors are sensitive to the road conditions and ensure that throughout the construction process that these roads are maintained and suitable for small vehicles

Environmental Feature	Economic opportunities arising from the construction phase
Project life-cycle	Construction phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
SMME Creation	• Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment.
Job Creation and Skills Development	• The main contractor should employ non-core labour from the Main places as far as possible during the construction phase. • The principles of Expanded Public Works Programme can be used for guiding the construction.

Environmental Feature	Economic opportunities arising from the construction phase					
Project life-cycle	Construction phase					
Potential Impact	Proposed Management Objectives / Mitigation Measures					
Indirect Employment Impacts	• Spaza/informal trader shops may open next to the site as a consequence of construction. These should be controlled by the contractor to limit their footprint and to ensure that the local Municipalities – Informal Trading By-laws are complied with.					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Local	Medium	Short Term	Likely	1
After Mitigation	Positive	Local	Low	Short Term	Likely	3
Significance of Impact and Preferred Alternatives	Individuals who will benefit during the construction are limited to those who actively participate in the construction activity through employment, sub-contracting or other economic opportunities. Active participation should be encouraged. The benefits on such a construction will take place irrespective of which routing alternative is preferred.					

Environmental Feature	Disturbance arising from the construction phase
Project life-cycle	Construction phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
Traffic	• Ensure that the necessary signage and traffic measures are implemented for safe and convenient access to the site; • Additional creation of routes and access roads must be implemented to reduce heavy traffic flow; • The EMPr must include restrictions on the Contractor and its sub-contractors related to minimising impacts on the safety of road users; Restrictions should include appropriate speed limitations, restricting travel times to daylight hours, communication measures and the establishment of haul routes.; • Measures must be put in place to prevent construction vehicles from entraining dirt onto public roads; • Traffic control personnel must be assigned where deemed necessary, this will be to control the movement of construction vehicles in relation to local vehicles to ensure maximum safety and coherence.
Local Road Condition	• A continuous condition survey of the local roads to be used during the construction phase should be made prior to construction; • Delivery routes should be defined and adhered to during the construction phase; • Maintenance of local roads should take place during the construction phase, ensuring that the local roads used by the contractor are left in the same or better condition than they were prior to the start of construction.

Environmental Feature	Disturbance arising from the construction phase
Project life-cycle	Construction phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
Increase in Dust	• Dust and disturbance can be mitigated through the use of appropriate dust suppression mechanisms; • Adherence to road signage can be added as an advantage and a measure to manage the increase in dust levels; • Mitigation measures management should be adhered to according to the relevant specialist studies.
Influx of workers	• All employment of locally sourced labour should be controlled on a contractual basis. If possible, and if the relevant Ward Councillors deem it necessary, the employment process should include the affected Ward Councillors. • People in search of work may move into the area, however, the project will create a limited number of job opportunities. Locally based people should be given opportunities and preferences over others; • No staff accommodation should be allowed on site; • Influx of workers could may lead to increased diseases and HIV/AIDSs & STI as well as STD infections, therefore awareness programmes should be implemented through the local educational institutions and for the workers as well.
Worker Health and Safety	• The provisions of the OHS Act 85 of 1993 and the Construction Regulations of 2014 should be implemented on all sites; • Account should be taken of the safety impacts on the local community when carrying out the longitudinal aspects of the project, such as the pipelines; • Contractors should establish HIV/AIDs awareness programmes at their site camps.
Security	• The sites of the substations should be fenced for the duration of construction; • All contractors' staff should be easily identifiable through their respective uniforms; • A security policy should be developed which amongst others requires that permission be obtained prior to entering any property and provisions controlling trespassing by contractor staff; • Security staff should only be allowed to reside at contractor camps and no other employees; • Contractors should establish crime awareness programmes at their site camps.
Noise impacts	• Prior notice should be given to surrounding communities of drilling events; • Construction work should take place during working hours – defined as 07h00 to 17h00 on weekdays and 07h00 to 14h00 on Saturdays. Should overtime work be required, that will generate noise, consultation with the affected community or landowner should take place.
Damage to property	• If a risk existing of damage taking place on a property as a result of construction, a condition survey should be undertaken prior to construction; • The contractor is to make good and acknowledge any damage that occurs on any property as a result of construction work;

<table>
<tr><td colspan="2">Environmental Feature</td><td colspan="5">Disturbance arising from the construction phase</td></tr>
<tr><td colspan="2">Project life-cycle</td><td colspan="5">Construction phase</td></tr>
<tr><td colspan="2">Potential Impact</td><td colspan="5">Proposed Management Objectives / Mitigation Measures</td></tr>
<tr><td colspan="2"></td><td colspan="5">• Where crops and agricultural machinery are damaged, compensation is to be paid to the farmer for the loss of these crops;
• The farmer should be compensated for any loss of income experienced at the account of the contractor.</td></tr>
<tr><td></td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td>Before Mitigation</td><td>Negative</td><td>Local</td><td>Medium</td><td>Short Term</td><td>Likely</td><td>2</td></tr>
<tr><td>After Mitigation</td><td>Negative</td><td>Local</td><td>Low</td><td>Short Term</td><td>Moderate</td><td>1</td></tr>
<tr><td>Significance of Impact and Preferred Alternatives</td><td colspan="6">Disturbances and irritation during construction is to be expected. These can then be successfully mitigated through contractor specifications that are issued at a tender stage and through the continuous monitoring of contractor proceedings and performance during construction phase.

Negative impacts owing to the construction will unfortunately be experienced irrespective of the site and routing alternative that is most preferred and chosen.</td></tr>
</table>

7 ANALYSIS OF ALTERNATIVES

With regards to single project alternative – go/no go, the table below describes the alternative and the reasons for its selection.

Table 5: Table illustrating Project Components and Alternatives

Component	Alternatives	Order of Preference (1: most preferred, 3: least preferred)	Comments
Go / No Go	To not carry out the proposed project	Not Supported	Subsequent electricity supply to the area will be less secure that if the project did not go ahead. A secure power supply is a fundamental input to the social and economic activities of the area.

8 CONCLUSION

The study assessed the social and potential economic impacts of the proposed project. As expected of any construction project, there were several positive and negative social as well as economic impacts identified.

The socio-economic impact assessment has identified two areas where households would have to be relocated if the powerline was to follow the indicated route. In these cases, it is recommended that the route be amended to avoid these impacts, rather than relocate households.

If the powerline route was amended to avoid the relocation of households, the remaining identified negative impacts can be successfully mitigated and the positive impacts will bring economic and social benefit to the area.

9 REFERENCES

Babour, T. (2007). *Guideline For Involving Social Assessment Specialists in EIA Processes.* Western Cape Province, Departmetn of Environmetnal Affairs and Development Planning,. Cape Town: Departmetn of Environmetnal Affairs and Development Planning, Western Cape Province.

Barbour, T. (2007). *Socio-Economic Impacts Assessment Specialists in the EIA Process.* Western Cape Province: Department of Environmental Affaris and Development Planning.

Centre for Good Governance. (2006). *A Comprehensive Guide for Social Impact Assessment.* Centre for Good Governance.

DEAT. (2006). *Socio-Economic Impact Assessment, Integrated Environmental Management Information Series 22.* Pretoria: Department of Environmental Affairs and Tourism.

Ingwe LM. (2012). *Ingwe Spatial Development Framework 2011/12.* Ingwe Local Municipality.

International Organization for Standardization. (2011, 11 03). *ISO 14001:2004 Environmental management systems*. Retrieved 11 2013, from International Organization for Standardization: http://www.iso.org/iso/catalogue_detail?csnumber=31807

JH Consulting. (2016). *Environmental Noise Assessment.* Johannesburg : JH Consulting.

Mkhambathini LM. (2012). *Mkhambathini Spatial Development Framework.* Durban: Mkhambathini Local Municipality.

Quantec. (2012, May 14). RSA Regional Indicators. Lynnwood, Gauteng, South Africa: Quantec Research (Pty) Ltd.

Richmond LM. (2014). *Richmond Municipality Draft Integrated Development Plan -2014/15 Review.* Richmond: Richmond Local Municipality.

Statistics South Africa. (2013, 11 01). Census 2011. Pretoria, Gauteng, South Africa.

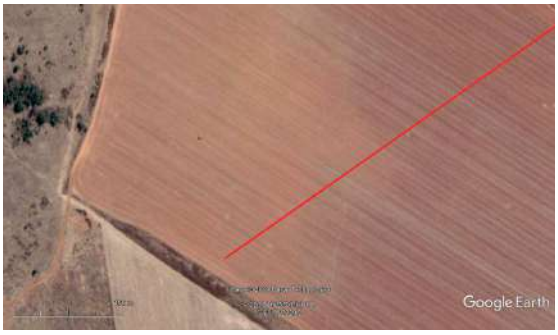
Vanclay. (2003). International Principles For Social Impact Assessment. *Impact Assessment and Project Appraisal, 21*(1), 5–11.

Vanclay, F. (2003). International Principles For Social Impact Assessment. *Impact Assessment and Project Appraisal, 21*(1), 5-11.

WKC Group. (2016). *Lanseria Wastewater Treatment Works Project: Odour Impact Assessment .* Johannesburg : WKC Group.

APPENDIX 1: CENSUS OF PROPOSED POWERLINE IMPACTS

Table 1: Property Directly Impacted by the Powerline

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Emkhiweni Sub-Station		25°52'22.35" S 29°24'03.36" E	Emkhiweni Sub-Station	
Road Crossing		25°51'23.59" S 29°23'53.12" E	R575 Road Crossing	
Road Crossing		25°50'51.23" S 29°23'45.22" E	N4 Road Crossing	
Road Crossing		25°50'01.48" S 29°24'25.89" E	R575 Crossing	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Road Crossing		25°49'53.08" S 29°24'37.70" E	Keiskamma Road Crossing	
House		25°49'54.07" S 29°24'46.06" E	Middelburg	
Commercial – Quarry	Rieftontein River Sands: 013 244 2088 082 612 5292	25°49'54.10" S 29°24'51.31" E	Middelburg	
Commercial – Transport		25°49'54.36" S 29°24'56.34" E	Middelburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Commercial – Coal Workings	Imilingo Mineral Processing: 012 880 1559	25°49'54.78" S 29°25'00.91" E	Middelburg	
High Density Dwellings		25°49'52.24" S 29°25'06.36" E	Middelburg	
Rod Crossing		25°49'46.78" S 29°25'14.57" E	Keiskamma Road Crossing	
High Density Settlement		25°49'46.75" S 29°25'16.64" E	Middelburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Road Crossing		25°49'35.73" S 29°25'28.13" E	Unnamed Road Crossing	
Commercial – Quarry		25°49'13.04" S 29°25'24.22" E	Middleburg	
Quarry		25°49'20.20" S 29°25'36.32" E	Middleburg	
Commercial – Offices	Izimbiwa Coal Pty LTD 013 244 8000	25°48'55.07" S 29°25'45.85" E	Middleburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Road Crossing		25°48'30.10" S 29°25'39.42" E	Keiskamma Road Crossing	
Commercial – Quarry		25°48'29.05" S 29°25'27.14" E	Middleburg	
Road Crossing		25°48'05.52" S 29°25'16.59" E	R555 Road Crossing	
Commercial – Transport		25°47'59.67" S 29°25'09.57" E	Middleburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Commercial – Coal Mining		25°47'21.34" S 29°25'01.05" E	Middleburg	
Waste Water Treatment Settling Pan		25°47'19.20" S 29°25'12.70" E	Mddleburg	
Road Crossing		25°46'57.98" S 29°25'06.94" E	R575 Road Crossing	
Commercial – Coal Mining		25°46'53.72" S 29°24'54.47" E	Middleburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Road Crossing		25°46'50.17" S 29°24'56.78" E	President Kruger Street Road Crossing	
Commercial	Gradco South Africa – HDPE Pipe Supplies 013 241 7977	25°46'51.35" S 29°25'01.62" E	Middleburg	
Commercial	Graspan Colliery 013 241 1122	25°46'46.92" S 29°24'37.71" E	Middleburg	
Road Crossing		25°46'42.27" S 29°24'38.29" E	President Kruger Street Road Crossing	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Commercial	Federale Stene 013 241 2302	25°46'35.76" S 29°24'35.02" E	Middleburg	
Tower		25°46'40.13" S 29°24'34.32" E	Middleburg	
Dwelling		25°46'48.82" S 29°24'19.01" E	Middleburg	
Road Crossing		25°46'40.03" S 29°24'12.73" E	Unnamed Road Crossing	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Clustered Dwellings		25°46'35.75" S 29°24'01.87" E	Middleburg	
Dwelling		25°46'31.99" S 29°23'53.53" E	Middleburg	
High Density Dwellings		25°46'04.14" S 29°23'43.71" E	Middleburg	
Road Crossing		25°45'20.50" S 29°23'59.56" E	9th Avenue Road Crossing	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Road Crossing		25°45'17.24" S 29°24'03.36" E	Unnamed Road Crossing	
Low Density Dwellings		25°45'00.84" S 29°24'28.49" E	Middleburg	
High density Dwellings		25°44'37.49" S 29°25'01.53" E	Middleburg	
Road Crossing		25°44'16.20" S 29°25'14.31" E	Unnamed Road Crossing	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Commercial – Transport		25°44'14.48" S 29°25'14.09" E	Middleburg	
High Density Dwellings		25°44'14.32" S 29°25'15.79" E	Middleburg	
Road Crossing		25°43'48.16" S 29°25'47.47" E	Unnamed Road Crossing	
Commercial – Quarry		25°43'46.46" S 29°25'53.42" E	Middleburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Farm Dwelling		25°43'42.60" S 29°25'59.68" E	Middleburg	
Road Crossing		25°43'28.30" S 29°26'10.85" E	Unnamed Road Crossing	
Road Crossing		25°43'03.18" S 29°26'43.97" E	Unnamed Road Crossing	
Road Crossing		25°42'58.68" S 29°26'50.70" E	Unnamed Road Crossing	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Commercial – Quarry		25°42'52.53" S 29°26'52.11" E	Unnamed Road Crossing	
Road Crossing		25°42'36.00" S 29°27'25.55" E	N11 Road Crossing	
Farm Dwellings		25°42'10.22" S 29°27'46.01" E	Middleburg	
Farm Dwelling		25°41'10.91" S 29°27'53.03" E	Middleburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Farm Dwellings		25°41'05.40" S 29°27'39.69" E	Middleburg	
Road Crossing		25°41'02.08" S 29°27'45.61" E	Unnamed Road Crossing	
Farm Dwelling		25°40'32.76" S 29°27'44.16" E	Middleburg	
Farm Dwellings		25°40'24.57" S 29°27'41.59" E	Middleburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Water Storage tank/facility		25°39'30.36" S 29°27'48.65" E	Middleburg	
Road Crossing		25°39'13.89" S 29°27'53.97" E	Unnamed Road Crossing	
Farm Dwelling		25°38'17.13" S 29°27'26.38" E	Middleburg	
Farm Dwelling		25°37'56.09" S 29°27'33.96"	Middleburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Farm Dwelling/ Structure		25°37'26.62" S 29°27'20.84" E	Middleburg	
Substation		25°36'41.14" S 29°27'39.23" E	Middleburg	
Road Crossing		25°36'40.65" S 29°27'45.84" E	Unnamed Road Crossing	
Road Crossing		25°34'31.86" S 29°28'33.18" E	Unnamed Road Crossing	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Farm dwelling		25°34'26.75" S 29°28'35.72" E	Middelburg	
Commercial - Farming		25°34'22.96" S 29°28'36.86" E	Middelburg	
Tower		25°32'43.85" S 29°29'15.87" E	Middleburg	
Farm Dwelling		25°32'19.68" S 29°28'56.91" E	Middleburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Irrigation Pivot		25°32'01.00" S 29°29'09.51" E	Middleburg	
Road crossing		25°29'04.92" S 29°27'58.01" E	Unnamed Road Crossing	
Farm dwelling	Sungiti Game Lodge 081 025 7972	25°29'01.50" S 29°27'50.39" E	Middleburg	
Farm dwelling		25°28'56.98" S 29°27'47.51" E	Middleburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Farm dwellings		25°28'39.44" S 29°27'39.56" E	Middleburg	
Road Crossing		25°26'31.20" S 29°28'14.55" E	Unnamed Road Crossing	
Farm Dwellings		25°26'22.13" S 29°28'28.08" E	Middleburg	
Farm Dwelling		25°26'19.55" S 29°28'10.12" E	Middleburg	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Farm Dwelling		25°23'05.87" S 29°26'39.28" E	Groblersdal	
Irrigation Pivot		25°23'03.47" S 29°26'09.46" E	Groblersdal	
Farm Dwelling		25°22'44.34" S 29°25'58.79" E	Groblersdal	
Road Crossing		25°22'41.45" S 29°25'44.38" E	Unnamed Road Crossing	

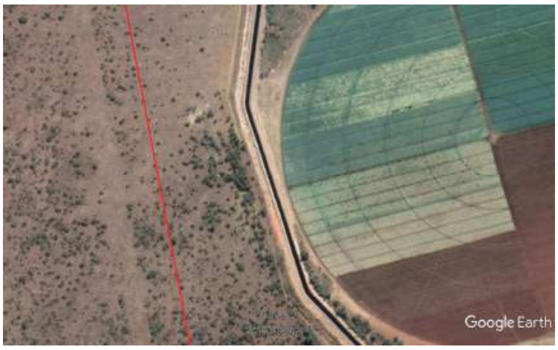
Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Sub-station		25°22'26.17" S 29°25'23.44" E	Groblersdal	
Learning Institution	De Wagendrift Primary School 082 295 7134	25°21'35.41" S 29°25'02.62" E	Groblersdal	
Commercial - Faming		25°21'21.54" S 29°25'00.00" E	Groblersdal	
Farm Dwelling		25°21'16.36" S 29°25'00.94" E	Groblersdal	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Road Crossing		25°21'10.98" S 29°25'12.76" E	Unnamed Road Crossing	
Irrigation Pivot		25°21'06.04" S 29°25'09.04" E	Groblersdal	
Irrigation Pivot		25°20'53.82" S 29°25'13.98" E	Groblersdal	
Road Crossing		25°20'14.36" S 29°25'03.26" E	Unnamed Road Crossing	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Farm Dwelling		25°20'12.96" S 29°24'59.58" E	Groblersdal	
Farm Dwelling		25°20'02.43" S 29°25'02.63" E	Groblersdal	
Irrigation Pivot		25°19'56.00" S 29°24'44.33" E	Groblersdal	
Road Crossing		25°19'47.06" S 29°24'52.88" E	Kameeldoorn Road Crossing	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Farm Dwelling		25°19'44.51" S 29°24'47.72" E	Groblersdal	
Irrigation Pivot		25°19'35.22" S 29°24'48.14" E	Groblersdal	
Irrigation Pivot		25°19'12.89" S 29°24'32.12" E	Groblersdal	
Road Crossing		25°18'39.57" S 29°24'27.27" E	Unnamed Road Crossing	

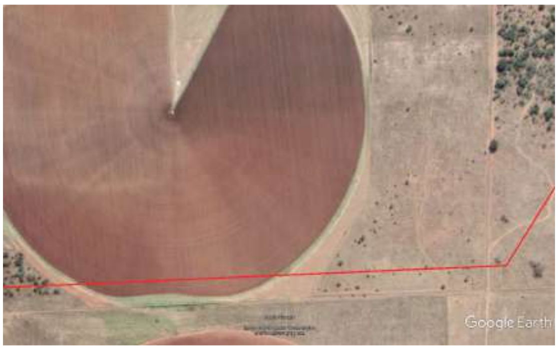
Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Farm Dwellings		25°18'35.86" S 29°24'28.12" E	Groblersdal	
Road Crossing		25°18'28.63" S 29°24'22.22" E	N11 Road Crossing	
Road Crossing		25°17'57.14" S 29°24'07.63" E	Unnamed Road Crossing	
Irrigation Pivot		25°17'46.62" S 29°24'02.45" E	Groblersdal	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Road Crossing		25°17'20.62" S 29°23'51.98" E	Unnamed Road Crossing	
Irrigation Pivot		25°16'27.74" S 29°23'41.23" E	Groblersdal	
Farm Dwelling		25°13'47.08" S 29°23'01.87" E	Groblersdal	
Road crossing		25°13'09.57" S 29°22'50.04" E	Unnamed Road Crossing	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Dwelling – House		25°12'01.18" S 29°22'39.55" E	Groblersdal	
Dwelling - Commercial		25°11'53.82" S 29°22'46.48" E	Groblersdal	
Commercial – Quarry		25°11'51.73" S 29°22'29.01" E	Groblersdal	
Fam Dwellings		25°11'04.27" S 29°22'28.66" E	Groblersdal	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Road crossing		25°11'00.53" S 29°22'22.91" E	Unnamed Road Crossing	
Irrigation Pivot		25°10'51.62" S 29°22'27.60" E	Groblersdal	
Storage tanks		25°10'22.09" S 29°22'00.30" E	Groblersdal	
Greater Groblersdal Cemetery		25°10'11.03" S 29°21'50.26" E	Groblersdal	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Road Crossing		25°10'04.61" S 29°22'01.90" E	R25 Road Crossing	
Road Crossing		25°08'20.65" S 29°21'37.07" E	Unnamed Road Crossing	
Farm Dwelling		25°06'35.87" S 29°21'59.40" E	Groblersdal	
Farm Dwelling		25°06'26.03" S 29°21'50.74" E	Groblersdal	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Irrigation Pivot		25°06'05.38" S 29°19'53.98" E	Groblersdal	
Irrigation Pivot		25°06'09.83" S 29°19'54.28" E	Groblersdal	
Road Crossing		25°06'06.52" S 29°19'39.96" E	Unnamed Road Crossing	
Irrigation Pivot		25°06'10.60" S 29°19'31.96" E	Groblersdal	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Irrigation Pivot		25°05'50.16" S 29°19'01.72" E	Marble Hall	
Road Crossing		25°05'43.29" S 29°18'52.64" E	Unnamed Road Crossing	
Irrigation Pivot		25°05'39.80" S 29°18'48.53" E	Marble Hall	
Low Density Dwellings		25°05'39.90" S 29°18'29.10" E	Marble Hall	

Name	Activity	Co-Ordinates	Nearest Town/ Project Component	Image
Farm Dwelling		25°05'02.03" S 29°18'11.90" E	Marble Hall	
Silimela Sub – station		25°05'10.69" S 29°17'56.65" E	Marble Hall	

Appendix 6G: Aquatic and Wetland Impact Assessment

Environmental Consulting

EMKHIWENI SUBSTATION AND 400KV LINE FROM EMKHIWENI SUBSTATION TO SILIMELA WETLAND AND AQUATIC ASSESSMENT REPORT.

FEBRUARY 2019

Title:	Emkhiweni Substation and 400kv Line from Emkhiweni Substation to Silimela Wetland and Aquatic Assessment Report
Authors:	Zona Dotwana
Reviewed By:	Nonkanyiso Zungu
Status of Report:	Draft
First Issue:	February 2019

APPROVED BY:

Nonkanyiso Zungu, MSc, Pr.Nat.Sci

Wetland Specialist/ Specialist Ecologist

Date: February 2019

Indemnity

This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as information available at the time of study. Therefore, the author reserves the right to modify aspects of the report, including the recommendations, if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although the author exercised due care and diligence in rendering services and preparing documents, she accepts no liability, and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of this document.

EXECUTIVE SUMMARY

I. INTRODUCTION

In 2013, Sazi Environmental Consulting cc (Sazi), was appointed by Nzumbululo Heritage Soultions on behalf of Eskom to undertake a walk down of a proposed powerline route and to provide input with regards to the presence and outer edge of wetlands as part of a water use licence application. Eskom requires an update of this report according to the minimum requirements of Appendix 6 of the 2014 EIA Regulations (as amended 07 April 2017), in accordance with the National Environmental Management Act (Act No. 107 of 1998) (NEMA).

Sazi Environmental Consulting cc (Sazi) was appointed by Nemai Consulting on behalf of Eskom to update the wetland report undertaken in 2013 and to undertake an aquatic assessment on rivers crossing the proposed powerline route.

II. APPROACH AND METHODOLOGY

The activities for this assessment include the following:

- Desktop assessment of the site;
- A site visit to confirm the presence or absence of wetland areas within the proposed project area as well as verification of towers within wetland areas that will require a water use licence application;
- A site visit to sample at the selected sites;
- Assessment of the catchment;
- SASS and IHAS assessments at the selected sites;
- Determination of the water quality at the sampled sites;
- Undertake an impact assessment of the proposed activities on the wetlands; and
- Provide mitigation measures.

III. ASSESSMENT RESULTS

The powerline route runs from the Limpopo Province to the Mpumalanga Province. Seven vegetation types occur in or in close proximity to the study area. The Rand Highveld Grassland covers the largest part with smaller areas of Loskop Bushveld and the Loskop Mountain Bushveld.

The Emkhiweni-Silimela powerline runs through 8 (eight) quaternary catchments namely: B32H (towers 1 - 33); B32D (towers 34 – 96); B32C (towers 97 – 118); B32B (towers 119 – 126); B32A (towers 127 – 192); B12E (towers 193 – 229 and 238 – 259); B12D (towers 230 – 237 and 260 – 279); and B11H (towers 280 – 301).
The main rivers that are intercepted by the proposed powerline include the Moses River, Olifants River, Selons River, a non-perennial stream which drains directly into the Olifants River and Spookspruit River.

Wetlands identified within the project site consisted of an unchanneled valley bottom wetland, channelled valley bottom wetlands, a pan wetland, and seep wetlands associated with towers of the proposed powerline route.

Only 1 site out of 5 pre-selected sample points was suitable for aquatic macro invertebrate assessment. The only biotope that could be sampled at the site was stones. Only 8 families were found at the site. The MH 3 site was dominated by aquatic macro-invertebrate taxa with low requirement (4) for unmodified water quality, followed by taxa with low (2) and moderate (2) requirement for unmodified water quality. The SASS score was 37 and the ASPT was 4.63. The ecological state indicated a highly modified ecosystem that was only suitable for hardy adaptable taxa, however, the type of taxa found show the site has great ecological potential.

IV. CURRENT IMPACTS

Some of the identified wetland and aquatic areas were observed to be impacted by agriculture, alien invasive species, mining and littering.

V. ASSESSMENT OF IMPACT

The expected and observed impacts associated with the wetland due to the proposed development are summarised as follows:

- Changes in waterflow regime;
- Changes in sediment entering and exiting the system;
- Introduction and spread of alien vegetation;
- Loss and disturbance of wetland/riparian habitat;
- Changes in water quality due to foreign material and increased nutrients;

- Erosion of stream banks and subsequent sedimentation; and
- Clearing of vegetation habitat.

VI. CONCLUSION

The impact assessment found that the greatest impact the construction of powerline infrastructure is likely to have on the assessed watercourses is the removal of vegetation and compaction of soil around the tower footprint as well as along the servitude. Proper mitigation measures must be put in place when commencing with the activities that might have detrimental negative impact on the wetlands and rivers.

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LIST OF TERMS AND ABBREVIATIONS

Delineation – the technique of establishing the boundary of an aquatic resource such as a wetland or riparian area.

Drain – In the context of wetlands, refers to a natural or artificial feature such as a ditch or trench created for the purpose of removing surface and sub-surface water from an area (commonly used in agriculture).

Ecological Importance – An expression of the importance of an environmental resource for the maintenance of biological diversity and ecological functioning on local and wider scales.

Ecological Sensitivity – A system's ability to resist disturbance and its capability to recover from disturbance once it has occurred.

EIS – Ecological Importance & Sensitivity.

GIS – Geographical Information Systems.

GPS – Global Positioning System.

Gulley (or erosion gulley) - A gully (commonly called a "donga") is an erosion landform or feature, created by running water eroding sharply into soil. Gullies generally resemble small ditches that can be several meters in depth and width. Gullying or gully erosion is the process by which gullies are formed.

HGM – Hydro-Geomorphic.

NFEPA – National Freshwater Ecosystem Priority Areas, identified to meet national freshwater conservation targets (CSIR, 2010).

PES – Present Ecological State, referring to the current state or condition of an environmental resource in terms of its characteristics and reflecting change from its reference condition.

RESERVE - The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

Declaration of Independence

I, **Zona Dotwana**, in my capacity as a specialist consultant, hereby declare that I -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being a member of the general public;
- this document and all information contained herein is and will remain the intellectual property Environment Research Consulting and the specialist investigator responsible for conducting the study. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigator;
- As a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member; and
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement.

____

A.Z Dotwana 2019.02.08

Environmental Scientist

SACNASP Reg No. 115598

Summary of expertise

Tertiary Qualifications:	Med (Environmental Education), Rhodes University Biodiversity and Conservation Honours, Rhodes University Tools for Wetland Assessment Course, Rhodes University
Professional Affiliation:	SACNASP Reg No.115598 (Candidate Scientist, upgrading to Professional Scientist)

Experience with wetland assessments: 5 years

1 INTRODUCTION

In 2013, Sazi Environmental Consulting cc (Sazi), was appointed by Nzumbululo Heritage Solutions on behalf of Eskom to undertake a walk down of a proposed powerline route and to provide input with regards to the presence and outer edge of wetlands as part of a water use licence application. Eskom requires an update of this report according to the minimum requirements of Appendix 6 of the 2014 EIA Regulations (as amended 07 April 2017), in accordance with the National Environmental Management Act (Act No. 107 of 1998) (NEMA).

Sazi Environmental Consulting cc (Sazi) was appointed by Nemai Consulting on behalf of Eskom to update the wetland report undertaken in 2013 and to undertake an aquatic assessment on rivers crossing the proposed powerline route.

The wetland/aquatic assessment was undertaken on the 26 of January 2019 and this report presents the findings of the assessment.

1.1 TERMS OF REFERENCE

The activities for this assessment include the following:

- Desktop assessment of the site;
- A site visit to confirm the presence or absence of wetland areas within the proposed project area as well as verification of towers within wetland areas that will require a water use licence application;
- A site visit to sample at the selected sites;
- Assessment of the catchment;
- SASS and IHAS assessments at the selected sites;
- Determination of the water quality at the sampled sites;
- Undertake an impact assessment of the proposed activities on the wetlands; and
- Provide mitigation measures.

1.2 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations are applicable to this report:

- In order to obtain a comprehensive understanding of the dynamics of the wetland/aquatic habitats of the study area, surveys should ideally have been replicated over several seasons and over several years. However, due to project time constraints such long-term studies are not feasible, and this survey was conducted in one season during a once-off site visit of one day;
- Data collection in this study relied heavily on data from representative, homogenous wetland sections, as well as general observations, analysis of satellite imagery from the past until the present, generic data and a desktop analysis;
- During the fieldwork phase of this assessment, access to all farms was not possible due to lack of contact details at the time. The final wetland assessment therefore relied somewhat on extrapolation from surrounding areas that were actually visited;
- The SASS 5 method was designed to be conducted on low to moderate flow river systems. The method is not designed or well suited for environments where there is no flow. This includes wetlands and lentic habitats. This is the reason behind some selected points of assessment not being sampled as there was no flow and SASS5 was not recommended on the pools of water present at the sites;
- Although it would be ideal to find specific crossing points between the powerline line and the rivers along its route, it is not always practical or possible. Additional potential sites were selected in this regard;
- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies, due to the use of handheld GPS instrumentation, may occur. If more accurate assessments are required, the wetlands will need to be surveyed and pegged according to surveying principles;
- Aquatic, wetland and riparian ecosystems are dynamic and complex. The effects of natural seasonal and long-term variation in the ecological conditions are therefore largely unknown; and
- The specialist responsible for this study reserves the right to amend this report, recommendations and/or conclusions at any stage should any additional or otherwise significant information come to light.

1.3 DEFINITIONS AND LEGAL FRAMEWORK

1.3.1 GENERAL REGULATORY REQUIREMENTS

Specialists' reports must comply with Appendix 6 of Government Notice No. 326 of 07 April 2017 as published under sections 24(5), and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and whereby the following are to be included:

- The details of:
  - The specialist who prepared the report; and
  - The expertise of that specialist to compile a specialist report including curriculum vitae.
- A declaration that the specialist is independent in a form as may be specified by the competent authority;
- An indication of the scope of, and the purpose for which, the report was prepared;
- The date and season of the site investigation and the relevance of the season to the outcome of the assessment;
- A description of the methodology adopted in preparing the report or carrying out the specialised process; the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;
- An identification of any areas to be avoided, including buffers;
- A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;
- A description of any assumptions made and any uncertainties or gaps in knowledge;
- A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;
- Any mitigation measures for inclusion in the EMPR;
- Any conditions for inclusion in the environmental authorisation;
- Any monitoring requirements for inclusion in the EMPR or environmental authorisation;
- A reasoned opinion-
  - As to whether the proposed activity or portions thereof should be authorised;
  - If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPR, and where applicable, the closure plan;
- A description of any consultation process that was undertaken during preparation of the specialist report;

- A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
- Any other information requested by the competent authority.

1.3.2 THE NATIONAL WATER ACT

In a South African legal context, the term watercourse is often used rather than the terms wetland, or river. The National Water Act, 1998 (Act No. 36 of 1998) (NWA) includes wetlands and rivers into the definition of the term watercourse (DWAF, 2005).

The NWA, defines a riparian habitat as follows: "Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas."

The NWA defines a wetland as "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

The scope of work within this study includes assessments of wetlands within 500m radius of the Emkhiweni Substation, loop-in lines and the 400KV Power line from Emkhiweni to Simelani Substation and this study was undertaken within the context of the definitions as stated above.

The figure below (Figure 1) illustrates the location of the study area.

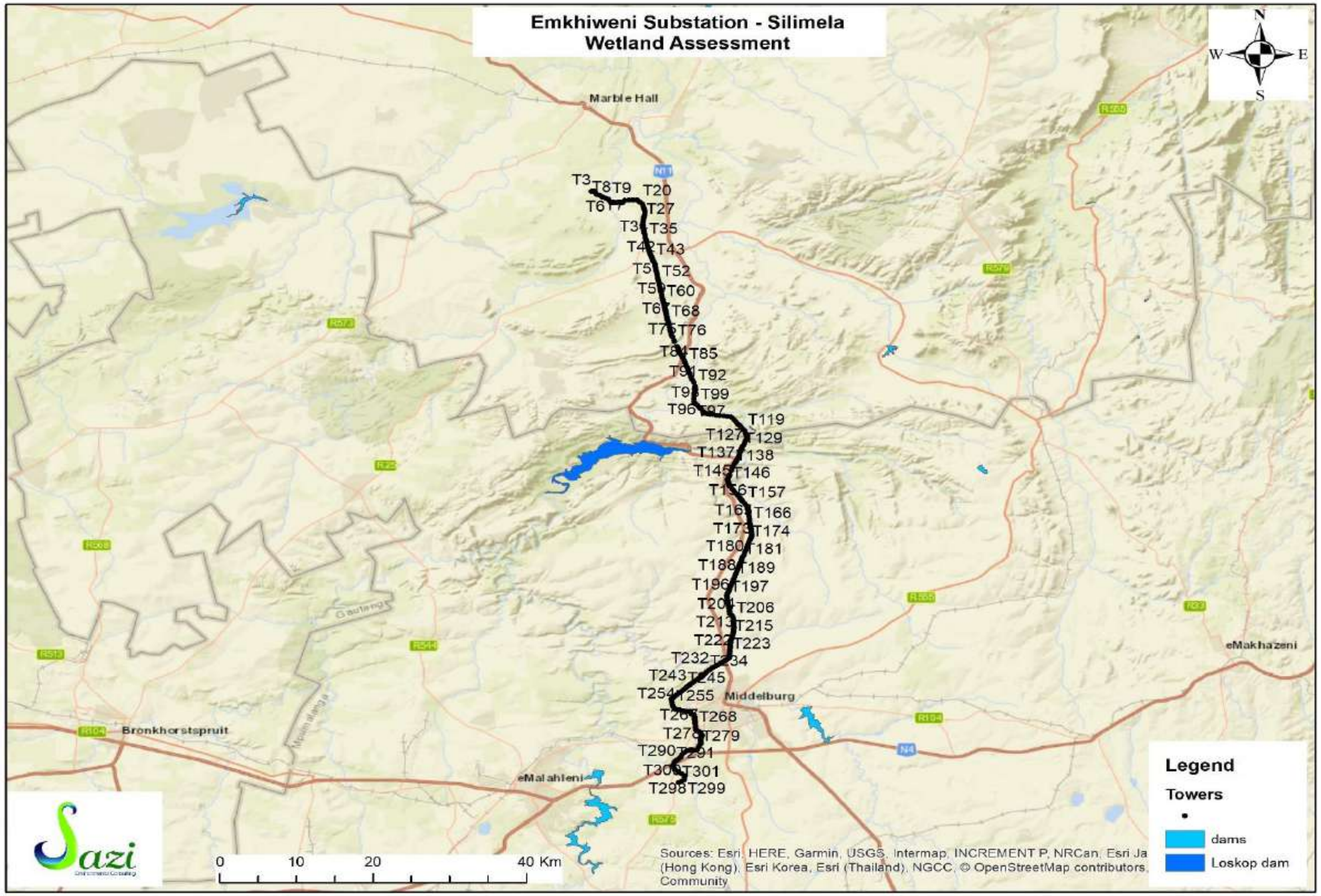


Figure 1: Location of the proposed powerline route

2 APPROACH AND METHODOLOGY

In a South African legal context, the term watercourse is often used rather than the terms wetland, or river. The National Water Act, 1998 (Act No. 36 of 1998) (NWA) includes wetlands and rivers into the definition of the term watercourse (DWAF, 2005).

2.1 LITERATURE REVIEW

A wetland delineation and assessment study were previously conducted within the study area in support of a water use licence application (Sazi, 2013). The results of the study were used to inform the field assessment and were considered during the assessment of impacts on wetlands and aquatic habitats as a result of the proposed development.

2.2 DESKTOP ASSESSMENT

The following data sources were used to inform the desktop assessment:

- NFEPA wetland coverage, which shows location of FEPA wetland sites;
- 1:50,000 imagery as well as latest Google Map Imagery for desktop assessment of the site as well as for the selection of biomonitoring sites;
- Biodiversity GIS (BGIS) to obtain conservation areas; and
- The topography data was obtained from the Surveyor General’s 1:50 000 top sheet data for the region.

2.3 WETLAND/AQUATIC ASSESSMENT

A site visit to confirm wetland areas was undertaken during the summer season on 26 January 2019. Several wetland areas were observed along the Eskom power line route during the initial assessment undertaken in 2013. These included floodplains, channelled/ un-channelled valley bottom wetlands, depressions and seeps. Verification of wetlands was based on the findings in the 2013 Sazi wetland delineation and assessment report.

During the site visit, a visual reconnaissance of the area was undertaken before surveying commenced. Maps and Google Earth™ images were studied to determine the position of possible wetlands and/or riparian zones in the study area. All possible wetlands and water courses were subsequently surveyed.

2.4 WATER QUALITY

2.4.1 IN-SITU WATER QUALITY

Conductivity, pH, water temperature, dissolved oxygen and oxidation reduction potential were measured on site, using the Lovibond Multi-Meter Instrument (SensoDirect 150). The Lovibond Multi-Meter and all parameters were calibrated to ensure accuracy of the results.

2.4.2 AQUATIC INVERTEBRATE ASSESSMENT

Benthic macro-invertebrate communities of the selected site were investigated according to the South African Scoring System, version 5 (SASS5) approach (Dickens and Graham, 2001). This method is based on the British Biological Monitoring Working Party method and has been adapted for South African conditions by Dr. F.M. Chutter (Thirion et al., 1995). The SASS method is a rapid, simple and cost-effective method, which has progressed through four different upgrades or versions. The current Version 5 is specifically designed to comply with international accreditation protocols.

2.4.3 SAMPLE COLLECTION

An invertebrate net (30x30cm square with 1mm mesh netting) was used for the collection of the organisms. The available biotopes at each site were identified on arrival. Each of the biotopes was sampled by different methods as described below. Note: samples should not be collected when the river is in flood.

The biotopes were combined into three different groups, which were sampled and assessed separately:

- Stone (S) Biotopes

  Stones in current (SIC) or any solid object: Movable stones of at least cobble size (3cm diameter) to approximately 20cm in diameter, within the fast and slow flowing sections of the river. Kick-sampling is used to collect organisms in this biotope. This is done by putting the net on the bottom of the river, just downstream of the stones to be kicked, in a position where the current will carry the dislodged organisms into the net. The stones are then kicked over and against each other to dislodge the invertebrates (kick-sampling) for ± 2 minutes.

Stones out of current (SOOC): Where the river is still, such as behind a sandbank or ridge of stones or in backwaters. Collection is again done by the method of kick-sampling, but in this case the net is swept across the area sampled to catch the dislodged biota. Approximately $1m^2$ is sampled in this way.
Bedrock or other solid substrate: Bedrock includes stones greater than 30cm, which are generally immovable, including large sheets of rock, waterfalls and chutes. The surfaces are scraped with a boot or hand and the dislodged organisms collected. Sampling effort is included under SIC and SOOC above.

- Vegetation (Veg) Biotopes
  Marginal vegetation (MVeg): This is the overhanging grasses, bushes, twigs and reeds growing on the edge of the stream, often emergent, both in current (MvegIC) and out of current (MvegOOC). Sampling is done by holding the net perpendicular to the vegetation (half in and half out of the water) and sweeping back and forth in the vegetation (± 2m of vegetation).

- Aquatic vegetation: This vegetation is totally submerged and includes filamentous algae and the roots of floating aquatics such as water hyacinth. It is sampled by pushing the net (under the water) against and amongst the vegetation, in an area of approximately one square meter.

- Gravel, Sand and Mud (GSM) Biotopes
  Sand: This includes sandbanks within the river, small patches of sand in hollows at the side of the river or sand between the stones at the side of the river. This biotope is sampled by stirring the substrate by shuffling or scraping of the feet, which is done for half a minute, whilst the net is continuously swept over the disturbed area.

  Gravel: Gravel typically consists of smaller stones (from 2-3mm and up to 3cm). The sampling process is similar to that of sand.

  Mud: It consists of very fine particles, usually as dark-coloured sediment. Mud usually settles to the bottom in still or slow flowing areas of the river. The sampling process is similar to that of sand.

- Hand picking and visual observation

Before and after disturbing the site, approximately 1 minute of “hand-picking” for specimens that may have been missed by the sampling procedures, was carried out.

2.4.4 SAMPLE PREPARATION (TRAYS)

The organisms sampled in each biotope group were identified and their relative abundance also noted on the SASS5 datasheet.

2.4.5 CALCULATION OF RESULTS

There are three main indices calculated for the SASS5: Number of Taxa, SASS5 Score and Average Score per Taxon (ASPT). The calculation of results is done by ticking any families seen in any of the biotopes in the Total column of the score sheet. Quality scores for each taxon noted in the Total column are summed to provide the SASS5 Score. The SASS5 Score divided by the number of taxa found provides the ASPT.

2.4.6 HABITAT ASSESSMENT

An evaluation of Integrated Habitat Assessment (IHAS) is important to any assessment of ecological integrity and should be conducted at each site at the time of sampling. On site habitat assessments were conducted by using existing habitat evaluation indices (McMillan, 1998). IHAS can be utilised in the interpretation of data. Evaluation of the habitat availability and suitability scores of the biotopes at the site are recorded directly on the SASS5 score sheet. These are the scores for Stones, Vegetation and GSM biotopes that range from 0 to 5, where 0 is absent and 5 represents full availability and suitability.

2.5 EXISTING IMPACTS AND CATCHMENT CONTEXT

Using available information, existing impacts to the wetlands/aquatic areas and within the delineated micro-catchment were mapped and described.

2.6 IMPACT ASSESSMENT

The following methodology (Table 1) has been adopted from the DWA's Operational Guideline, 2010 entitled "Operational Guideline: Integrated Water and Waste Management Plan' and used to inform an assessment of the likelihood and significance of potential impacts associated with the proposed powerline development.

Table 1: Ranking scales for impact assessment

DURATION (D)	MAGNITUDE (M)
5 – Permanent 4 - Long term (ceases with operational life) 3 - Medium term (5-15 years) 2 - Short term (0-5 years) 1 - Immediate	10 - Very high/do not know 8 - High 6 - Moderate 4 - Low 2 - Minor
SCALE (S)	**PROBABILITY (P)**
5 - International 4 - National 3 - Regional 2 - Local 1 - Site 0 - None	5 - Definite/do not know 4 - Highly probable 3 - Medium probability 2 - low probability 1- Improbable 0 - None
SIGNIFICANCE POINTS (SP) = (D+M+S) X P	
HIGH (H) = >60 POINTS	
MODERATE (M) = 30-60 POINTS	
LOW (L) = <30 POINTS	
NO SIGNIFICANCE = 0	
POSITIVE IMPACT	

The maximum value of significance points is 100. Environmental effects could therefore be rated as either high (H), moderate (M), or low (L) significance, as seen above.

2.7 RIPARIAN DELINEATION: METHODOLOGY

The riparian delineation was conducted as per the procedures described in 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (Department of Water Affairs, 2005). Riparian delineation considers the indicators used in wetland delineation, such as:

- Hydrology – the distribution and movement of water through a system.
- Vegetation – plant species have varying tolerances to different moisture regimes. The presence, composition and distribution of specific hydrophytic plants within a system can be used as an indication of wetness and allow for inference of riparian characteristics.
- Geomorphology - prolonged saturation of soil has a characteristic effect on soil morphology, affecting soil matrix chroma and mottling in particular. The hue, value and chroma of soil samples obtained at varying depths can be visually interpreted with the aid of the Munsell Colour Chart and the interface between wetland and non-wetland zones verified.

However, when delineating riparian systems, emphasis is placed predominately on topography; vegetation; alluvial soils and deposition of material. For this study, desktop assessment of topo-maps was undertaken to give a representative indication of the edge of riparian zones.

3 RECEIVING ENVIRONMENT

The powerline route runs from the Limpopo Province to the Mpumalanga Province. Seven vegetation types occur in or in close proximity to the study area. The Rand Highveld Grassland covers the largest part with smaller areas of Loskop Bushveld and the Loskop Mountain Bushveld (Figure 2).

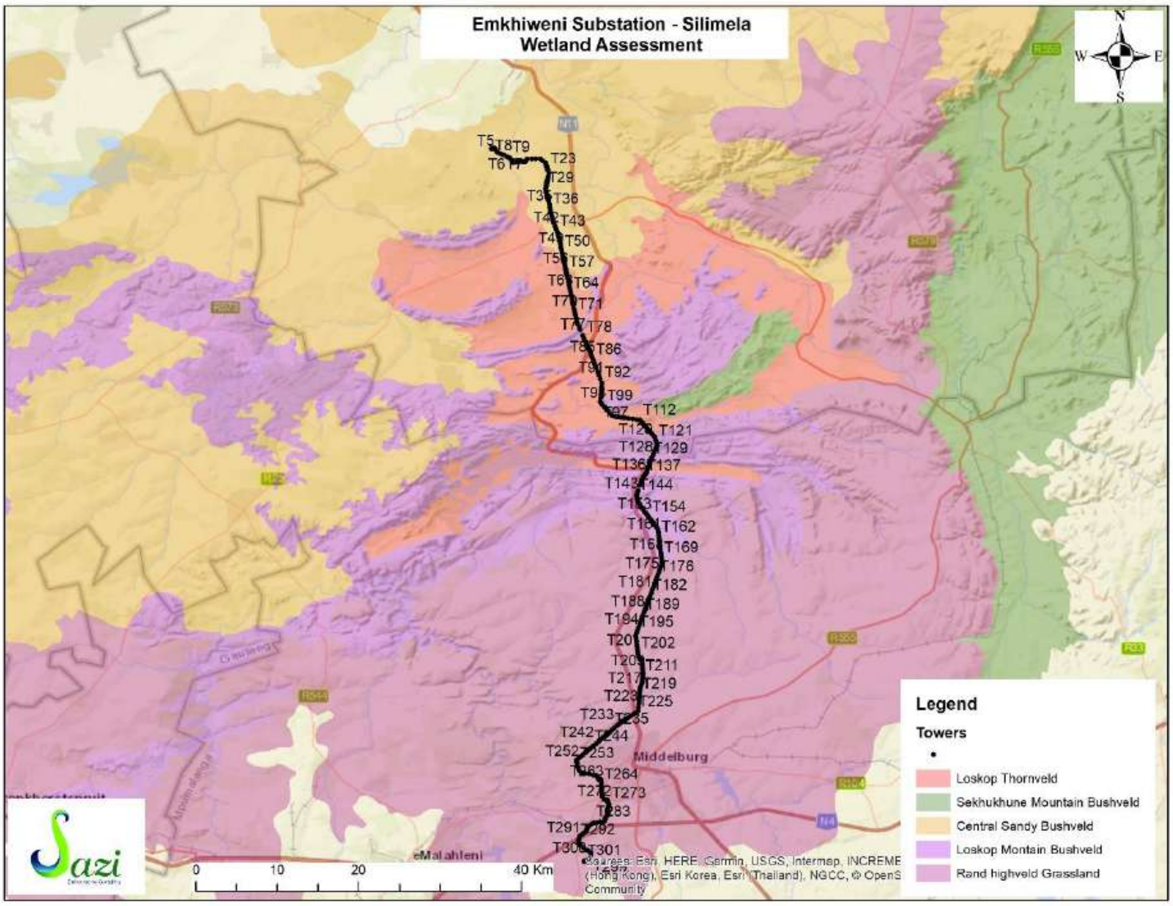


Figure 2: Vegetation along the powerline route

3.1 DESCRIPTION OF WATER RESOURCES

The Emkhiweni-Silimela powerline runs through 8 (eight) quaternary catchments namely: B32H (towers 1 - 33); B32D (towers 34 – 96); B32C (towers 97 – 118); B32B (towers 119 – 126); B32A (towers 127 – 192); B12E (towers 193 – 229 and 238 – 259); B12D (towers 230 – 237 and 260 – 279); and B11H (towers 280 – 301). All these quaternary catchments are located within the Olifants Water Management Area (WMA 4).

The main rivers that are intercepted by the proposed 400KV line from Simelani to Emkhiweni substation and loop-in lines include the Moses River, which runs through the B32H quaternary catchment; Olifants River in the B32D quaternary catchment; Selons River in the B32C and B32B quaternary catchments; a non-perennial stream in B32A, which drains directly into the Olifants River; and Spookspruit River in B11H quaternary catchment. Table 2 below shows the water resources in relation to the towers and Figure 3 illustrates the location of the towers in relation to water resources.

Table 2: Location of the Eskom towers along water resources within the Olifants WMA

DESCRIPTION	QUATERNARY CATCHMENT	MAIN RIVERS
1 - 33	B32H	Moses
34 - 96	B32D	Olifants
97 - 118	B32C	Selons
119 - 126	B32B	Selons
127 - 192	B32A	Non-perennial stream
193 – 229; 238 - 259	B12E	Klein Olifants
230 – 237; 260 - 279	B12D	Klein Olifants
280 - 301	B11H	Spookspruit

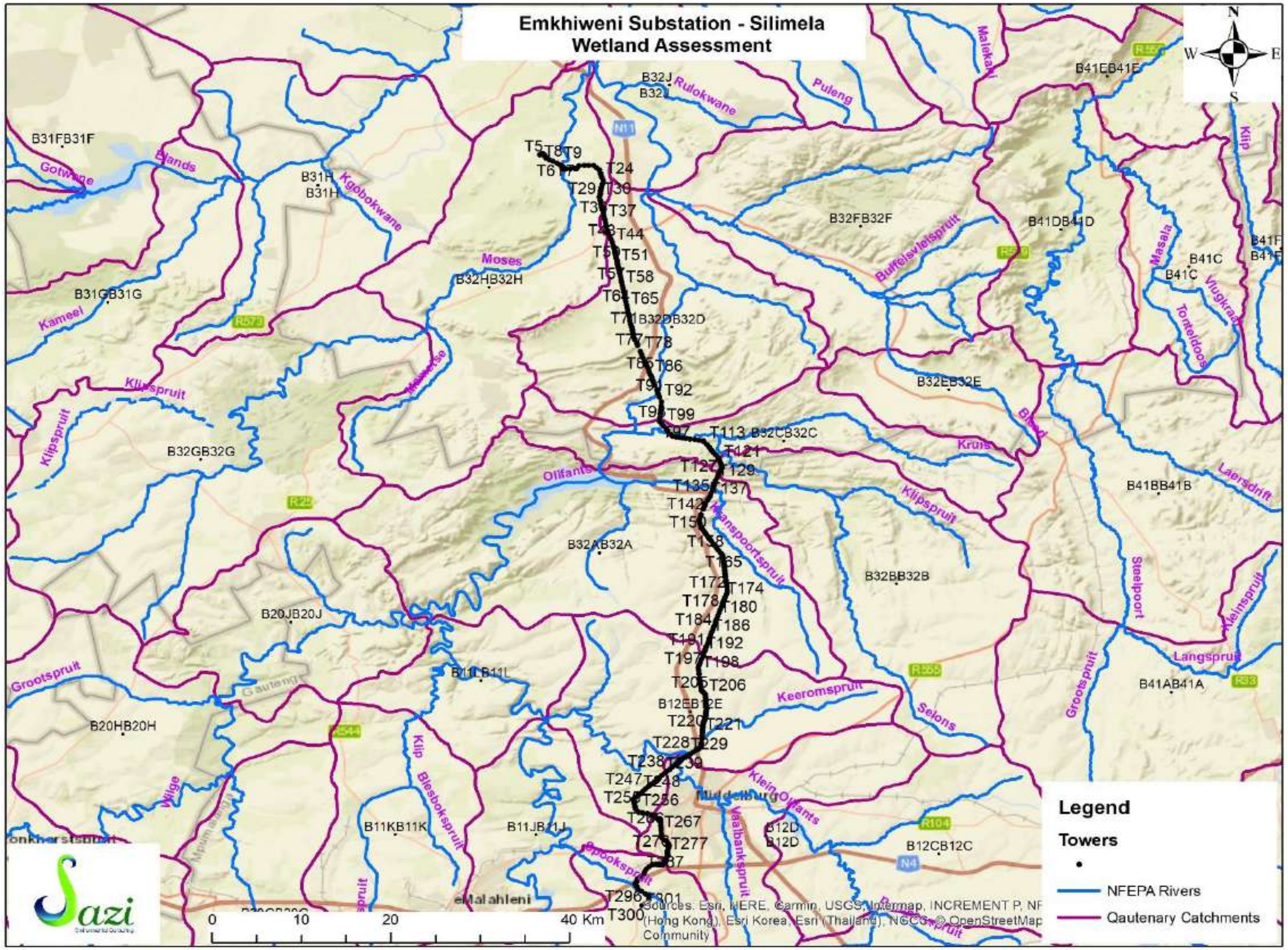


Figure 3: Water resources within the assessment area

4 ASSESSMENT RESULTS

4.1 CLASSIFICATION OF WETLANDS

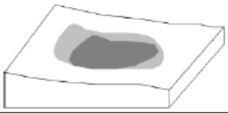
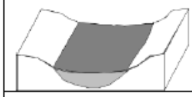
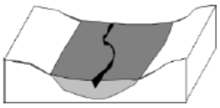
Wetlands identified within the project site consisted of an unchanneled valley bottom wetland, channelled valley bottom wetlands, a pan wetland, and seep wetlands associated with various rivers and non-perennial streams. Figure 4 below illustrates the wetlands observed on site in relation to the powerlines. Table 3 provides a description of the wetlands observed on site.

	
Unchanneled valley bottom wetland at tower 7	Channelled valley bottom wetland in vicinity of tower 8, 9, 10 and 11
	
Channelled valley bottom wetland in vicinity of tower 89 and 90	Channelled valley bottom wetland in vicinity of tower 222 to 225

	
Channelled valley bottom wetland in vicinity of tower 240 to 242	Pan wetland in vicinity of tower 260
	
Seep wetland in vicinity of tower 284 to 286	

Figure 4: Wetlands observed at accessible tower points

Table 3: Description of the wetlands identified on site

WETLAND TYPE	DESCRIPTION
Pans 	A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent.
Seepages 	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a watercourse.
Un-channelled Valley Bottom 	Valley bottom areas with no clearly defined stream channel are usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channels entering the wetland and also from adjacent slopes.
Channelled Valley Bottom 	Linear fluvial, net depositional valley bottom surfaces which have a straight channel with flow on a permanent or seasonal basis. Episodic low is thought to be unlikely in this wetland setting. The straight channel tends to flow parallel with the direction of the valley (i.e. there is no meandering), and no ox-bows or cut-off meanders are present in these wetland systems. The valley floor is, however, a depositional environment such that the channel flows through fluvially-deposited sediment. These systems tend to be found in the upper catchment areas.

The Figures below illustrate Eskom towers that were assessed and are located within wetlands or within 500m of wetlands (with 32m buffers).

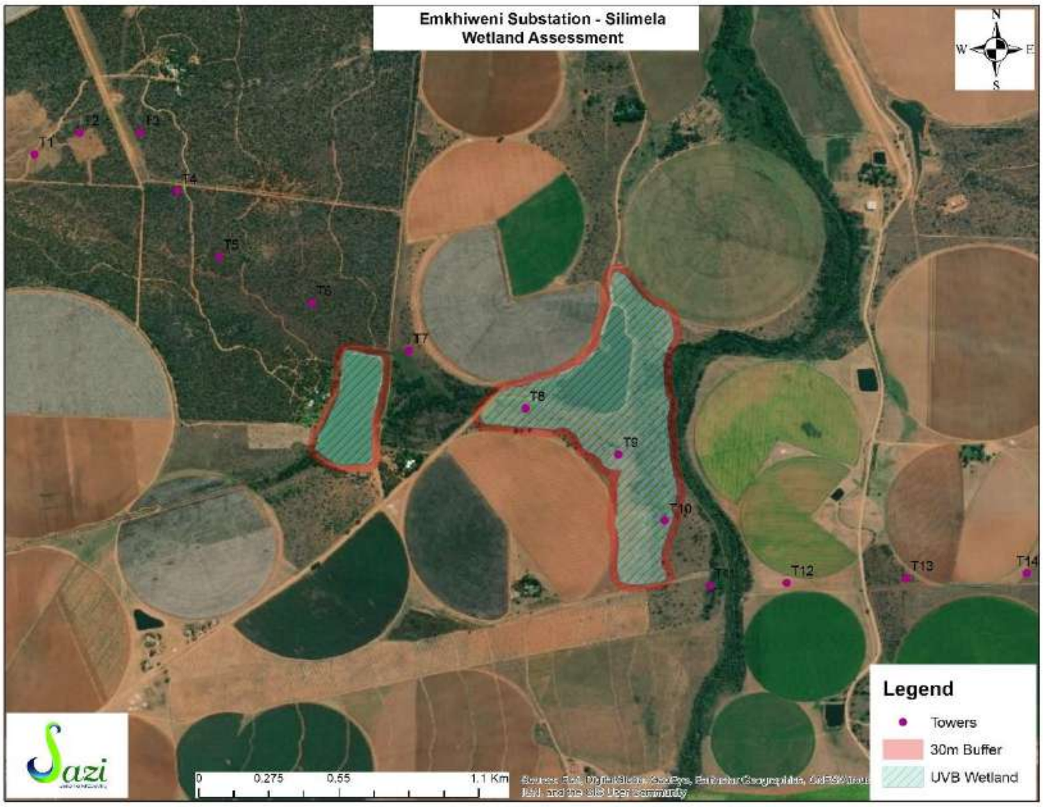


Figure 5: Unchannelled valley bottom wetland within 500m of tower 7

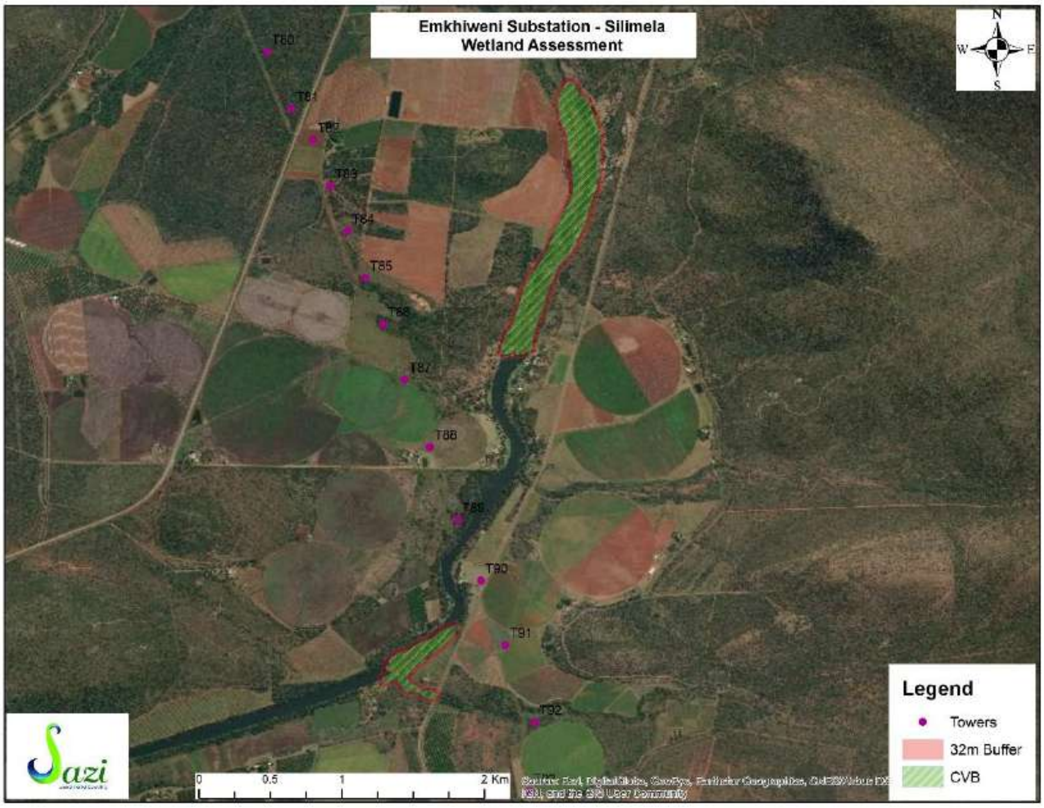


Figure 6: Channelled valley bottom wetland associated with tower 89 and 90

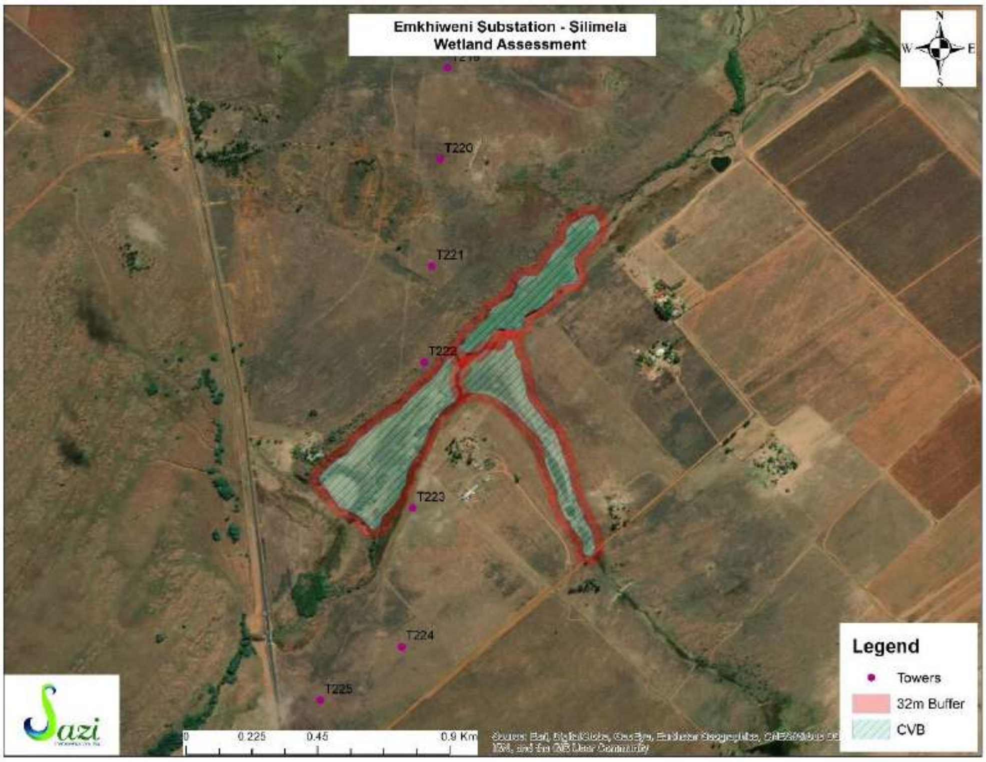


Figure 7: Channelled valley bottom wetland associated with tower 222-225

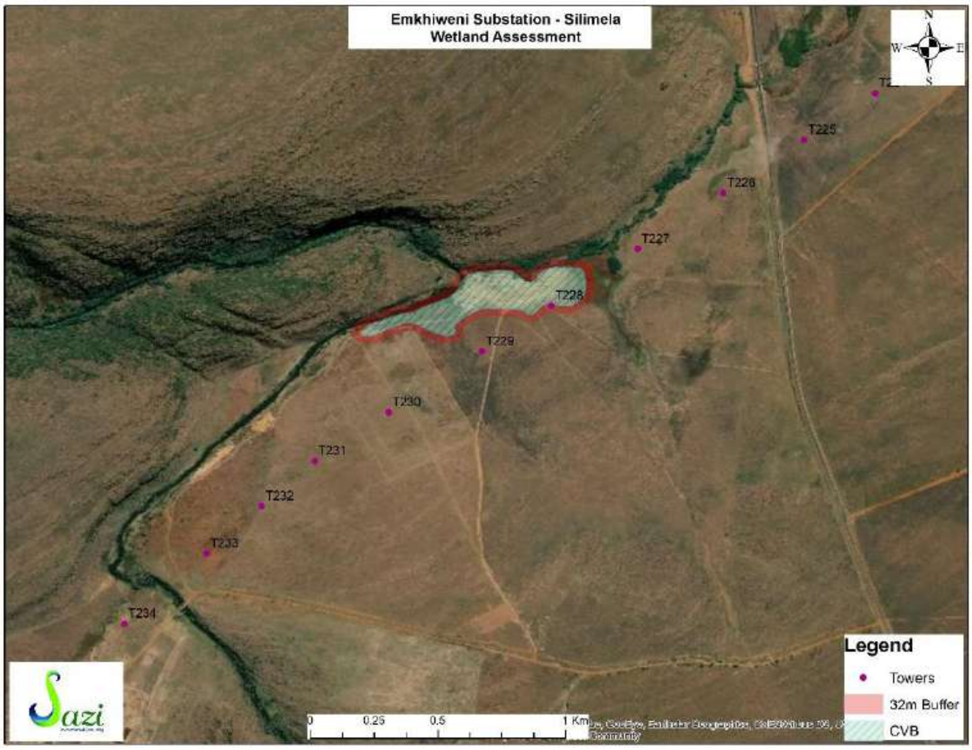


Figure 8: Channelled valley bottom wetland associated with tower 240 to 242

Figure 9: Flat/Pan wetland associated with tower 260

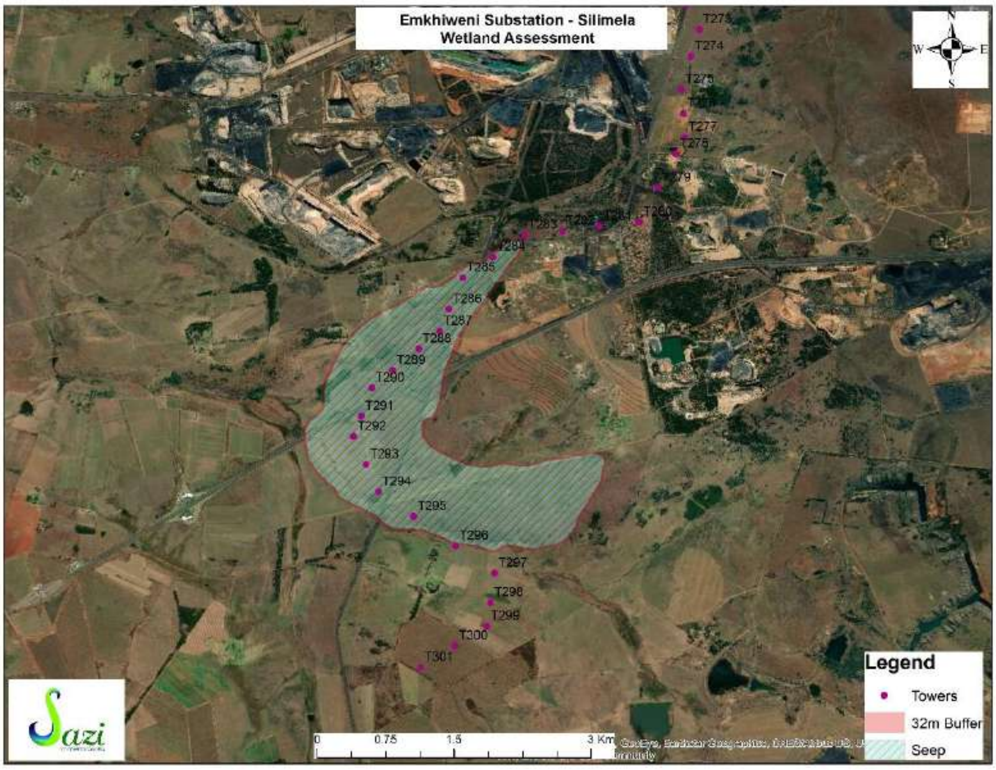


Figure 10: Seep wetland associated with tower 284 to 286

A buffer zone of 32m from the edge of the wetlands was used, as prescribed in Government Notice 327 in Government Gazette 40772 of 7 April 2017.

4.2 AQUATIC ASSESSMENT RESULTS

This section provides the biomonitoring results obtained during this survey. The table below provides the powerline biomonitoring sampling points and GPS coordinates. Due to access problems to the selected points, only two sites were accessible, namely, MH1B and MH3. Table 4 depicts the sampled points. Figure 11 is an illustration of the sampled points.

Table 4: Biomonitoring points

Monitoring site	**Stream**	**GPS Co-ordinates**	
		Latitude (South)	**Longitude (East)**
MH1	Olifants	25°20'04.3"S	29°24'58.4"E
MH1B	Olifants	25°09'45.0"S	29°24'55.7"E
MH2	Selons	25°23'08.9"S	29°26'35.7"E
MH3	Kraanspoortsruit	25°29'19.0"S	29°27'32.8"E
MH4	Moses	25°04'26.3"S	29°19'18.4"E
MH5	Spook Spruit	25°51'37.9"S	29°24'13.0"E

Plate 2.1: MH1B

Plate 2.2: MH3

Plate 2.3: MH3

Figure 11: Sampled points

4.2.1 OLIFANTS RIVER

MH1B

The only assessment that could be done at the site was the in-situ water quality assessment. The site was too deep, and as such SASS 5 assessment was not possible. There were some pools of water, which had no flow.

IN-SITU WATER QUALITY

The conductivity (EC) levels at MH1B was 0.763 mS/cm. The criteria for EC and temperature depend on local conditions and the life of species present (Kempster et al., 1982). The pH fell within the target water quality ranges for aquatic health, irrigation, aesthetics and human health at the site (Table 4-3). The target pH for quality health is between 6.5 and 9.0 as it is expected that most aquatic species will tolerate and reproduce successfully within this pH range (DWAF, 1996).

Table 5: In-situ water quality results

Survey Date	Monitoring Site	Conductivity (EC) (mS/cm)	pH	Dissolved oxygen	Water Temperature	ORP
		(mS/cm)		mg/l	(°C)	(mV)
Jan-19	MH1B	0.605	7.74	5.7	28.2	-78

4.2.2 KRANSPOORTSPRUIT

- **MH3**

IN-SITU DATA

MACRO-INVERTEBRATES (SASS5)

The MH 3 site only had one suitable biotope, it was mostly dominated by rocks. Although vegetation was present, it was not submerged under water. This site was dominated by aquatic macro-invertebrate taxa with low requirement (4) for unmodified water quality, followed by taxa with low requirement (2) as well as moderate requirement (2) for unmodified water quality. A total of 8 families were sampled at this site (Table 6). Although the SASS score was relatively low, the ASPT score was not too low (Table 7) and (Figure 12).

Table 6: Aquatic macro-invertebrate taxa sampled at the MH 3 site (January 2019)

Taxon	MH3			
	Stones	Veg	GSM	Total
Oligochaeta	A	-	-	A
Baetidae	A	-	-	A
Caenidae	A	-	-	A
Tricorythidae	A	-	-	A
Gomphidae	A	-	-	A
Veliidae*	A	-	-	A
Hydropsychidae	A	-	-	A
Chironomidae	A	-	-	A
Total SASS5 score	37	0	0	37
No. of families	8	0	0	8
ASPT	4,63	#DIV/0!	#DIV/0!	4,63
Total IHAS				54
IHAS - Habs sampled				21
IHAS - Stream condition				33
Suitability score	10	0	0	10

Key:
- High requirement for unmodified water quality
- Moderate requirement for unmodified water quality
- Low requirement for unmodified water quality
- Very low requirement for unmodified water quality

A = 1-10 individuals; B = 11-100 individuals; C = 101-1000 individuals; ASPT = Average score per taxon.

Table 7: SASS5, ASPT and biotope availability and suitability index scores for the MH 3 biomonitoring site (January, 2019).

Monitoring site	SASS 5 score	ASPT	SASS5-score per biotope			Biotope availability and suitability (Scores)			
			SASSStones	SASSVegetation	SASSGSM	Stones	Vegetation	GSM	Habitat availability and suitability
MH3	37,00	4,6	37,00	0,00	0,00	10,00	0,00	0,00	10,00

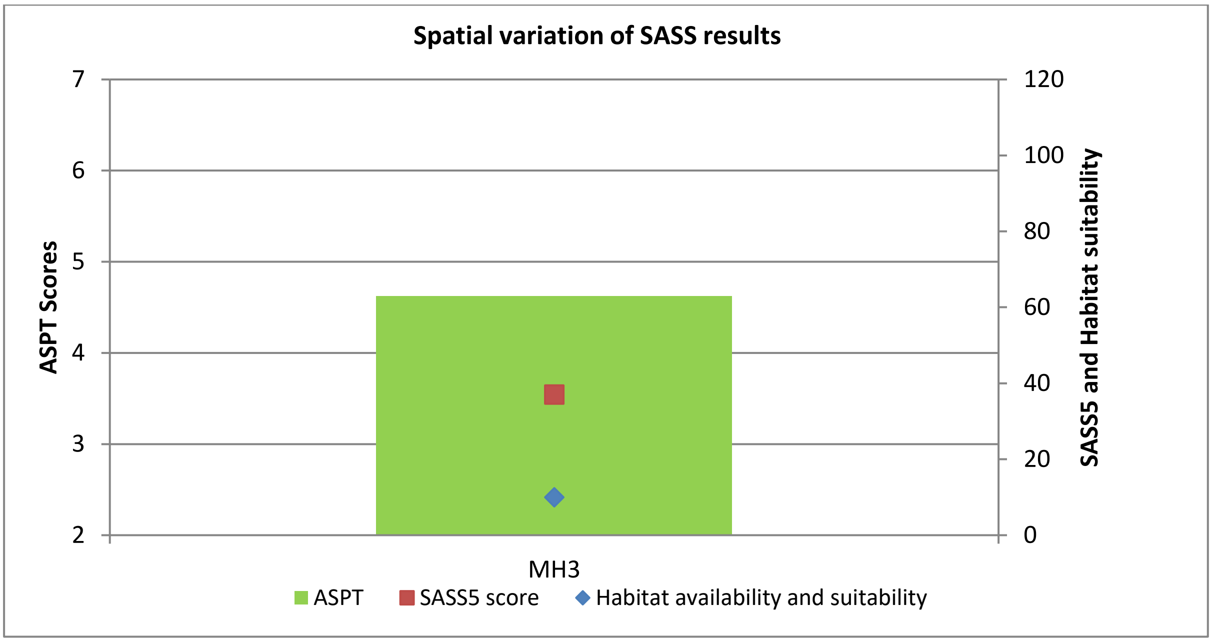


Figure 12: ASPT, SASS5 and total biotope suitability scores at the MH 3 biomonitoring site (January 2019)

This site is found in the Highveld Basin eco region (Kleynhans et.al. 2005) . Biological bands or ecological categories are a standardised way to interprete SASS data and were developed to reduce inconsistencies in terms of interpreting data (Dallas (2007). The MH 3 site fell under the ecological category E/F (Figure 13) and present state class E (Figure 15) due to the SASS score at the site which is 37. Figure 14 provides a description of the ecological categories.

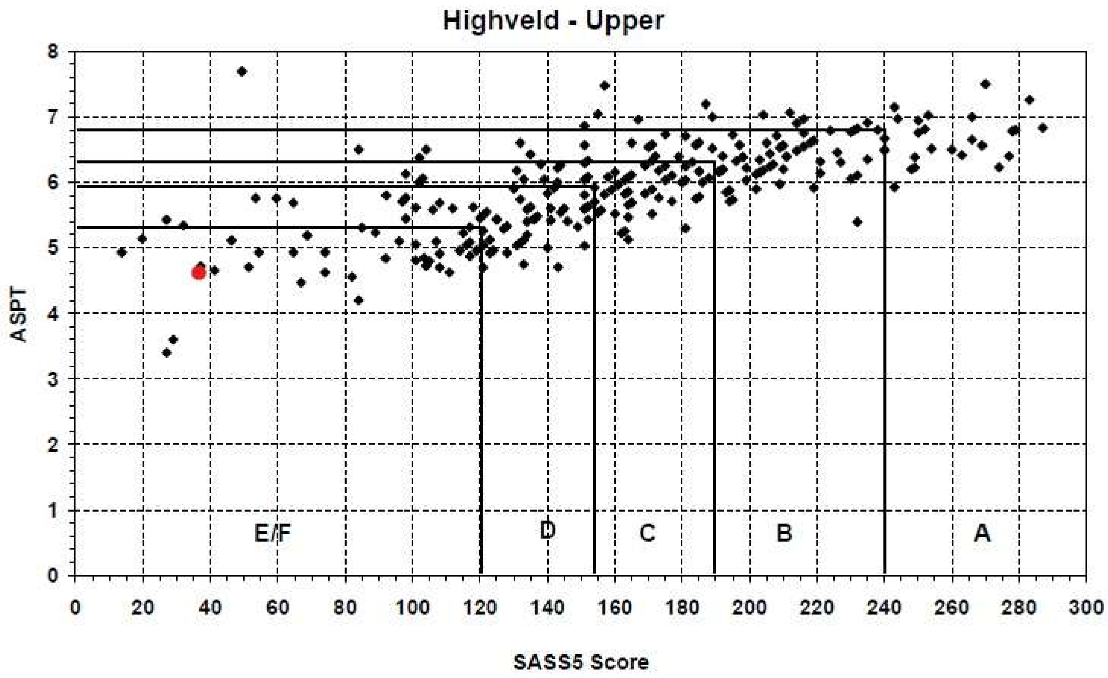


Figure 13: Biological bands for the Highveld basin (Adapted from Dallas H.F., 2007)

Biological Band/ Ecological Category	Ecological Category Name	Description
A	Natural	Unmodified natural
B	Good	Largely natural with few modifications
C	Fair	Moderately modified
D	Poor	Largely modified
E	Seriously modified	Seriously modified
F	Critically modified	Critically or extremely modified

Figure 14: Ecological categories defined

Class	Description	SASS Score%	ASPT
A	Unimpaired. High diversity of taxa with numerous sensitive taxa.	90-100 80-89	Variable >90
B	Slightly impaired. High diversity of taxa, but with fewer sensitive taxa.	80-89 70-79 70-89	<75 >90 76-90
C	Moderately impaired. Moderate diversity of taxa.	60-79 50-59 50-79	<60 >75 60-75
D	Largely impaired. Mostly tolerant taxa present.	50 - 59 40-49	<60 Variable
E	Severely impaired. Only tolerant taxa present.	20-39	Variable
F	Critically impaired. Very few tolerant taxa present.	0-19	Variable

Figure 15: Present state classes as defined by Dickens & Graham (2001) in terms of the SA

INTEGRATED HABITAT ASSESSMENT (IHAS)

The Invertebrate Habitat Assessment System (IHAS) applied according to the protocol of McMillan (1998), was used to determine specific habitat suitability for aquatic macro-invertebrates. IHAS is also a tool that can be used to aid in the interpretation of the results of the South African Scoring System version 5 (SASS5) scores. According to Bremner & van Staden (2012), the scores for the IHAS index may be interpreted according to the following guidelines:

- <65%: habitat diversity and structure are inadequate for supporting a diverse aquatic macro-invertebrate community.
- 65%-75%: habitat diversity and structure are adequate for supporting a diverse aquatic macro-invertebrate community.
- >75% habitat diversity and structure are highly suited for supporting a diverse aquatic macro-invertebrate community.

Table 8 : The IHAS scores indicating habitat availability and suitability at site MH 3

IHAS		
Habitat sampled (Max score = 55)	Stream condition (Max Score = 45)	Total (%)
21	33	54

The percentage overall habitat availability and suitability at MH 3 is 54%.

4.3 RIPARIAN ZONES DELINEATION

A desktop analysis of riparian zones was undertaken on the towers in relation to the Moses river tower (no.9 to 11), Olifants tower (no.89 to 90; 102 to 109), klein-olifants tower (223 to 229) Figure 16. According to wetland delineation guideline, to delineate riparian areas terrain unit indicator should be utilised; vegetation indicator species, soil wetness indicator, combined with geomorphology of the banks, as well as the extent of riparian vegetation. As advised on the guideline the evidence of alluvial deposits was utilised in the study.
Secondly, on the 26 January 2019, a site visit was conducted. In-field procedures to delineate the zones were performed: vegetation sampling, soil sampling (using auger and Munsell Colour Chart), and topography assessment. The site was traversed, and auger sample points taken at intervals. Auger points and various observation points were logged using a Garmin GPS.

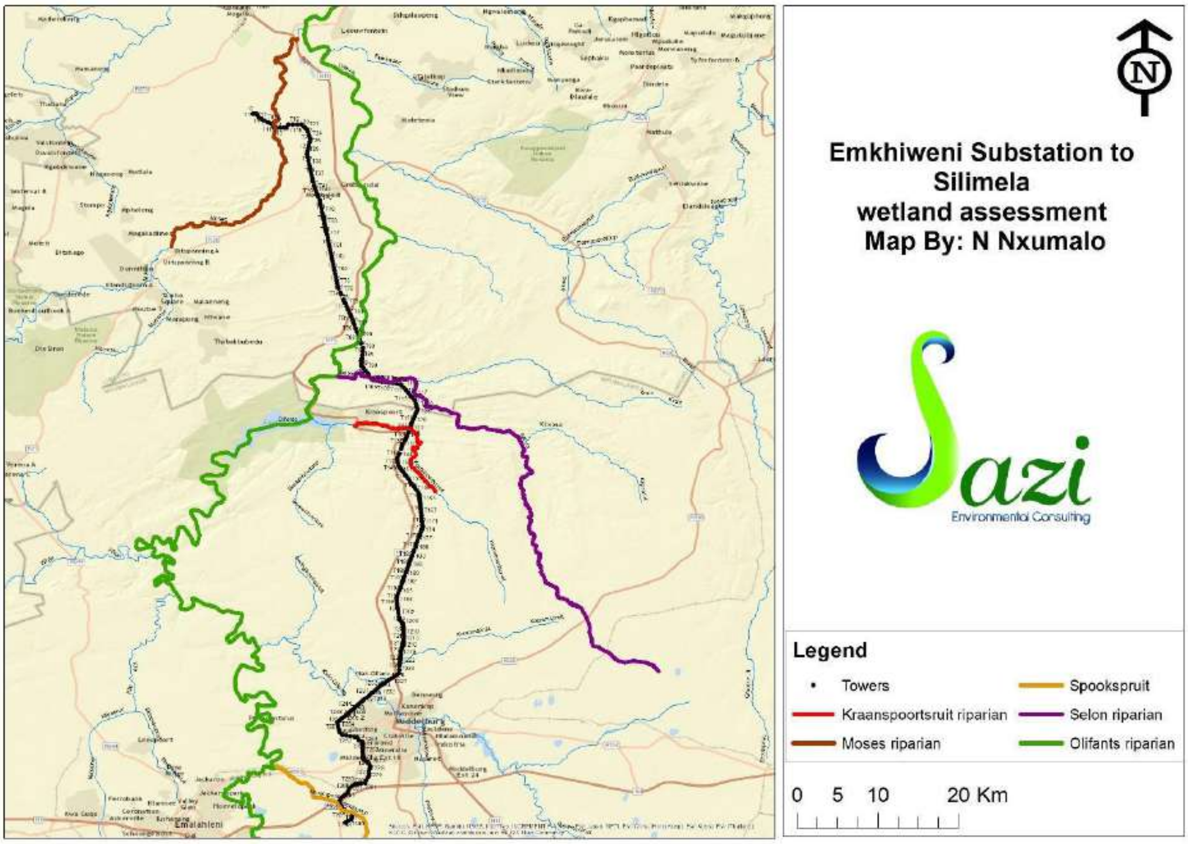


Figure 16: Riparian zones delineation

5 CURRENT IMPACTS

Some of the identified wetland and aquatic areas were observed to be impacted by agriculture. The unchanneled valley bottom wetland associated with tower 7 is surrounded by large scale crop farming. This is also the case with the channelled valley bottom wetland and river associated with towers 8-11. Sporadic alien invasive species were also observed on the wetland and river associated with towers 7-11 and towers 222- 225. Wetlands associated with tower 240 to approximately tower 242 and 260 are surrounded by large scale mining activities which may have a detrimental effect on the wetlands. The channelled valley bottom wetland associated with towers 240 to approximately 242 are located a few metres from a residential area with informal dwellings near the wetland. Littering on the wetland and the Klein-Olifants River was observed (Figure 17).

	
Alien invasive species (*Solanum mauritianum*) on wetland associated with towers 7-11	Alien invasive trees on channelled valley bottom wetland associated with towers 222-225

	
Mining activities in vicinity of wetlands associated with towers 240-242	Informal dwellings and littering on wetland associated with towers 240-242
	
Mining activities in vicinity of wetlands associated with towers 284-286	

Figure 17: Some of the impacts observed on site

5.1 SENSITIVITY OF THE SEEP WETLANDS

These wetland areas are regarded as highly sensitive as they are a critical part of our natural environment, provide habitat for fauna and flora, therefore contain a wide diversity of life.

6 NFEPA WETLANDS

The National Freshwater Ecosystem Priority Areas (NFEPA) strategic spatial priorities for conserving the country's freshwater ecosystems and supporting sustainable use of water resources were considered for this wetland assessment. **The identification of wetland and aquatic NFEPA's takes place on a large scale and as a result, not all wetland units present on a site are always identified nor are all wetlands identified by NFEPA available on site.** During the desktop assessment of the NFEPA atlas, various wetland types (HGM Units) were identified.

The Figure 18 below depicts the wetland types identified on site by the NFEPA dataset in relation to those identified in this report. The Figure also depicts wetland types identified by the NFEPA dataset as being present in areas associated with the towers that could not be assessed because access to site was not granted; i.e. privately owned land.

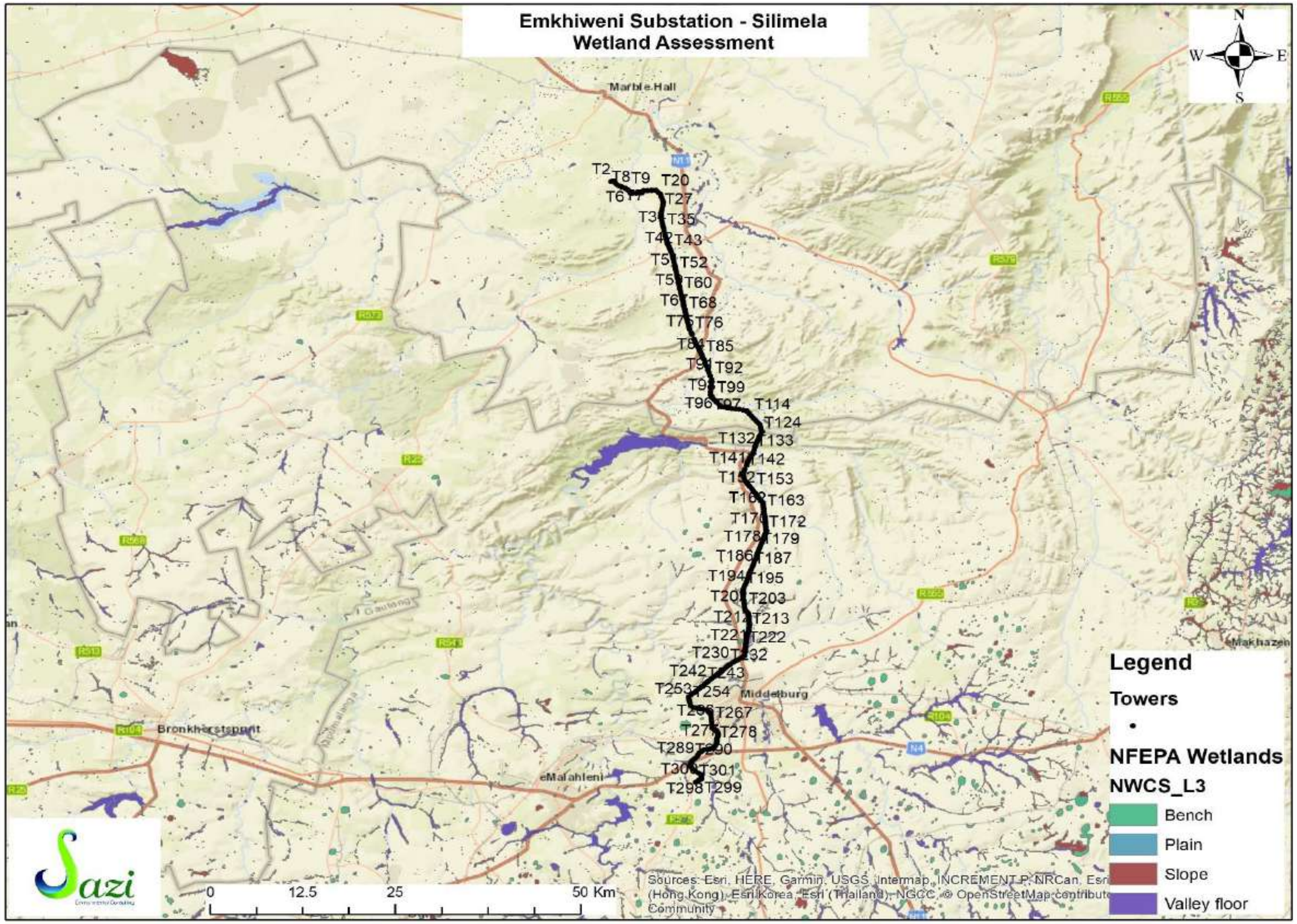


Figure 18: NFEPA wetlands in the study area

7 SENSITIVITY OF THE OVERALL AREA

7.1 CONSERVATION STATUS OF THE LOCAL ECOSYSTEMS

No specific guidelines are given for the Limpopo and Mpumalanga Provinces in terms of habitat sensitivity mapping. The Limpopo Conservation Plan Version 2 (2013) (http://bgis.sanbi.org), however, provides a map of Critical Biodiversity Areas (CBA's) and Ecological Support Areas (ESA's), which has conservation guidelines of different land-use areas in the province. Presently, different management criteria and recommendations for CBA's and ESA's are still under development for the province. It may, however, be expected that these criteria and guidelines will be similar to that of other provinces where agriculture is one of the more important land uses. For this reason and in order to present some data in this regard, and excerpt of the criterion used by the Limpopo Conservation Plan – version 2 (LCPv2, Desmet et al, 2013) is presented below:

- "CBA's within the bioregion are the portfolio of sites that are required to meet the region's biodiversity targets and need to be maintained in the appropriate condition for their category. Based on the LCPv2, 40% of the province is designated as CBA. These CBA's have been split into CBA 1 and CBA 2 on the basis of selection frequency and the underlying characteristics of the biodiversity features which are being protected".
- "An additional 23% of the province is designated as ESA. This category has also been split on the basis of land-cover into ESA 1 (16%) and ESA 2 (7%), with ESA 1 being in a largely natural state while ESA 2 areas are no longer intact but potentially retain significant importance from a process perspective (e.g. maintaining landscape connectivity). Other Natural Areas make up 20% of the province and just over 11% is designated as formal Protected Areas".

The Mpumalanga province has developed the Mpumalanga Biodiversity Sector Plan (MBSP). The main purpose of a biodiversity sector plan is to ensure that the most recent and best quality spatial biodiversity information can be accessed and used to inform land-use and development planning, environmental assessments and authorisations, and natural resource management. A biodiversity sector plan achieves this by providing a CBA map (or maps) of terrestrial and freshwater areas that are important for conserving biodiversity pattern and ecological processes – these areas are called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). According to the MBSP, CBAs are areas that are required to meet biodiversity targets for species, ecosystems or ecological processes. Ecological Support Areas are defined as areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas or CBAs and for delivering ecosystem services. In the terrestrial assessment they support landscape connectivity and strengthen resilience to climate change. They include features such as riparian habitat surrounding rivers or wetlands, corridors, over-wintering sites for Blue Cranes, and so on. At the time of compiling this report, datasets for the MBSP could not be found on the BGIS website. Datasets utilised in this report to illustrate conservation status in Mpumalanga are the Ecological Corridors depicted in Figure 7-3. The Mpumalanga Parks Board has identified key ecological corridors that are intrinsic to the maintenance of the biodiversity within the Mpumalanga Province. Figure 14 shows that these ecological corridors include river systems as they transport species over long distances from region to region. Additional reasons for the importance of ecological corridors are as follows:

- To provide movement corridors to increase and maintain gene flow between populations;
- To minimise demographic stochasticity;
- To stem inbreeding depression; and
- To fulfil an inherent need for movement.

The Figure 19 below presents the distribution of CBAs and ESAs in the study area according to the Limpopo Conservation Plan Version 2.

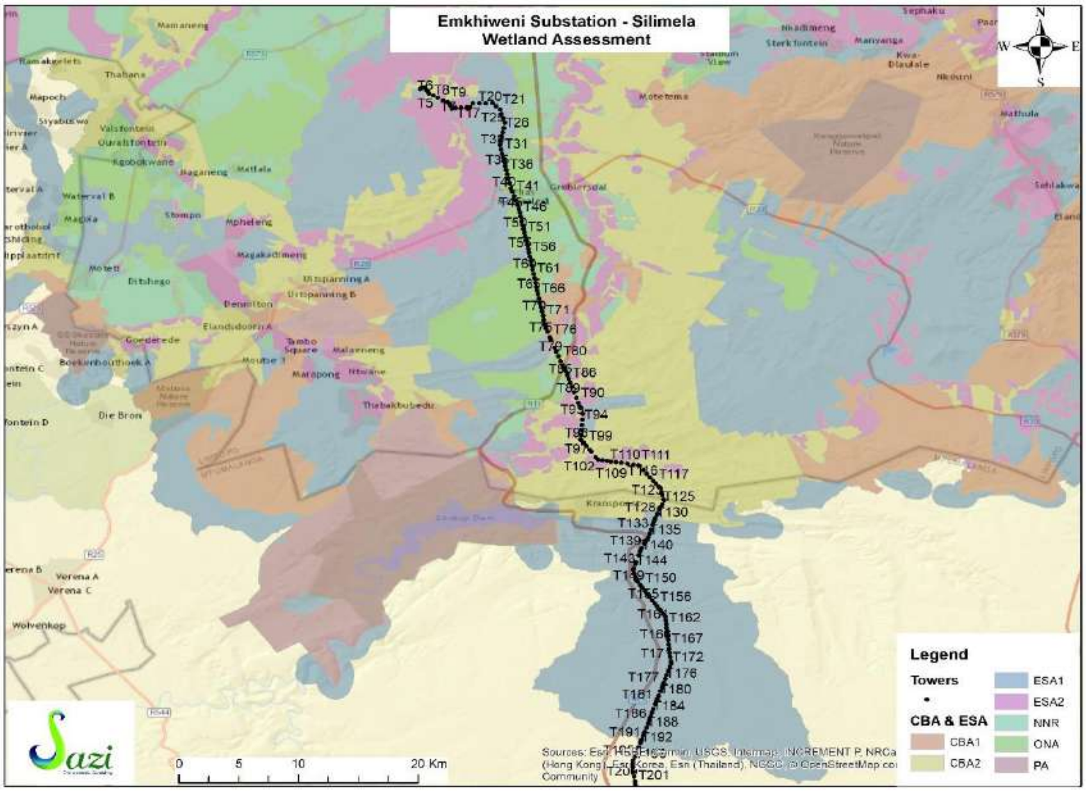


Figure 19: CBA and ESA in Limpopo Province

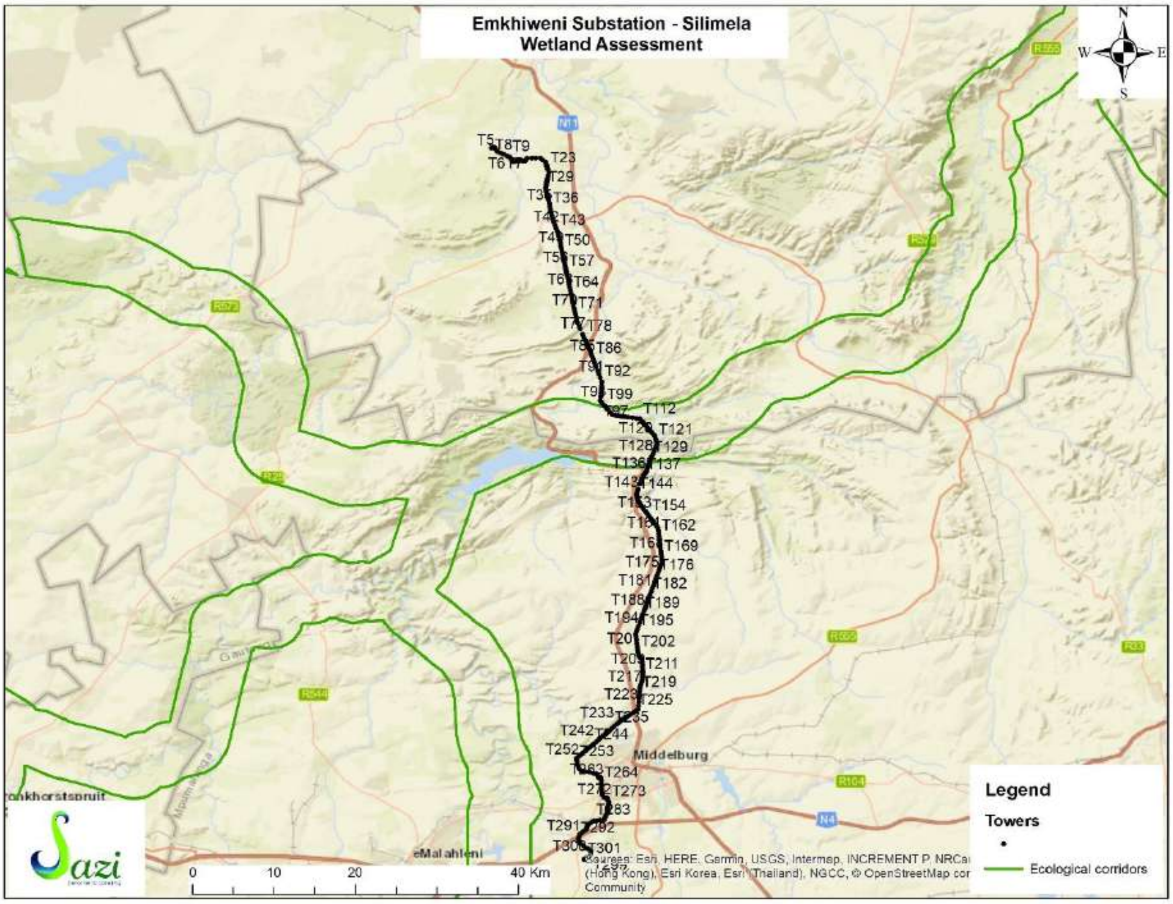


Figure 20: Ecological Corridors for the Mpumalanga Province

7.2 THREATENED ECOSYSTEM STATUS

The proposed development falls within the Rand Highveld Grassland which is categorised as a vulnerable ecosystem. Approximately 60% of the grassland is the remaining natural area of the ecosystem. Approximately 1% of the ecosystem is protected in small patches in the Kwaggavoetpad, Van Riebeeck Park, Bronkhorstspruit and Boskop Dam Nature Reserves. The ecosystem within the assessment area is considered Vulnerable and is indicated on Figure 21 below.

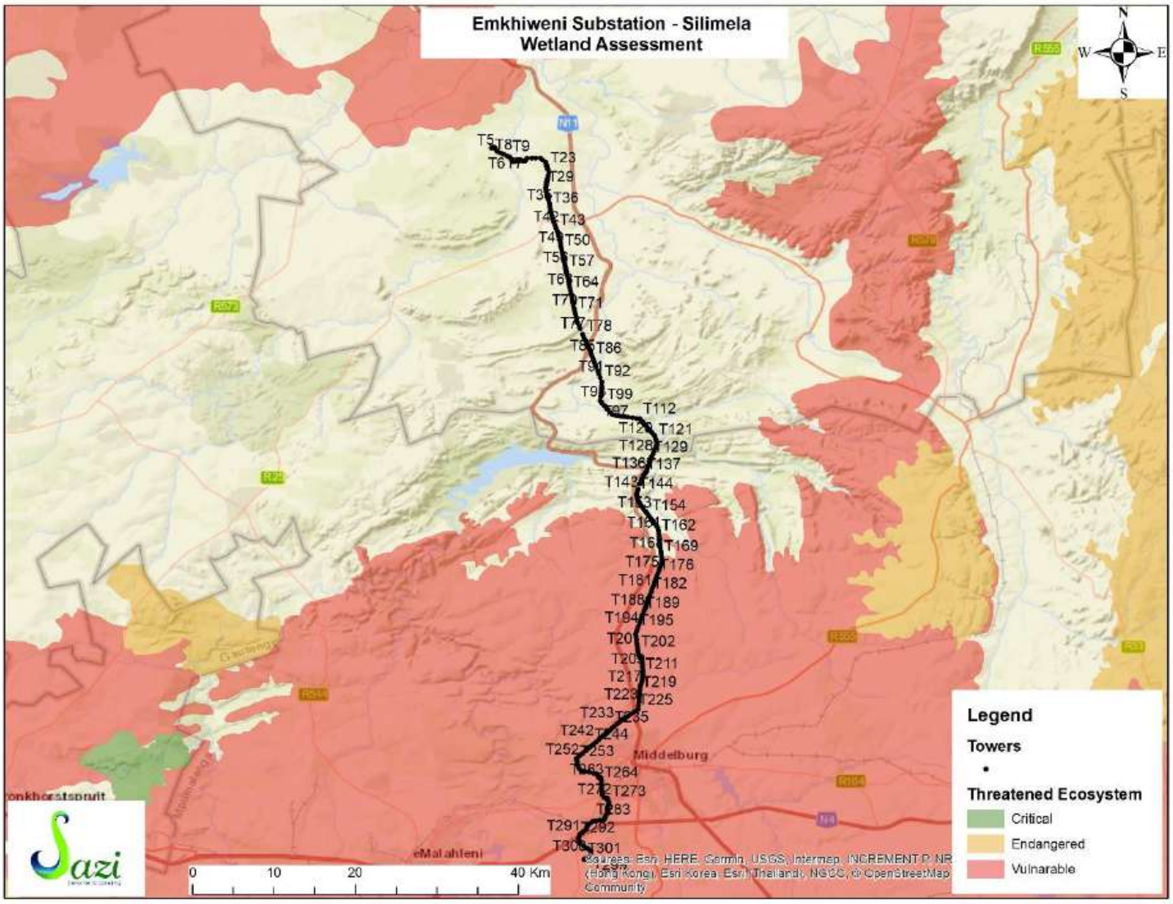


Figure 21: Ecosystem status of the study area

8 ASSESSMENT OF IMPACT

Construction activities within the wetland and riparian zones may cause destruction or alteration of the site's vegetation, hydric soils and hydrology. An impact assessment using the methodology in Table 9 was undertaken, and mitigation measures prescribed for the proposed powerline development.

The expected and observed impacts associated with the wetlands and associated rivers due to the proposed development are summarised as follows:

- Changes in waterflow regime;
- Changes in sediment entering and exiting the systems;
- Introduction and spread of alien vegetation;
- Loss and disturbance of wetland/riparian habitat;

- Changes in water quality due to foreign material and increased nutrients;
- Erosion of stream banks and subsequent sedimentation; and
- Clearing of vegetation habitat.

9 RECOMMENDED MITIGATION MEASURES

The following mitigation measures are proposed when commencing with the development to minimize and compensate for the above-mentioned impacts:

- No activities should take place in the watercourses and associated buffer zone. Where the above is unavoidable, only a tower footprint and no access roads can be considered. This is subjected to authorization by means of a water use license;
- Construction in and around watercourses should be restricted to the dry season;
- A temporary fence or demarcation must be erected around the works area to prevent access to sensitive environs. The works areas generally include the servitude, construction camps, areas where material is stored and the actual footprint of the tower;
- Prevent pedestrian and vehicular access into the wetland areas as well as riparian areas;
- Consider the various methods of stringing and select whichever method(s) that will have the least impact on watercourses e.g. shooting a pilot cable and pull cables with a winch, or flying cables over;
- Stringing should preferably not make use of vehicles in watercourses. If unavoidable, plan stringing activities in wetlands areas to take place within the drier winter months and use equipment with the smallest possible footprint e.g. quad bikes;
- Plan stringing through watercourses to take place at pre-determined points such as where the wetland width (and thus area to be impacted) is the smallest;
- Access roads and bridges should span the wetland area, without impacting on the permanent or seasonal zones;
- Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas;
- Management of on-site water use and prevent stormwater or contaminated water directly entering the watercourses;
- Management of point discharges;

- Planning of construction site must include eventual rehabilitation / restoration of indigenous vegetative cover;
- Alien plant eradication and follow-up control activities prior to construction, to prevent spread into disturbed soils, as well as follow-up control during construction;
- The amount of vegetation removed should be limited to the least amount possible;
- Rehabilitation of damage/impacts that arise as a result of construction must be implemented immediately upon completion of construction;
- Maintenance activities should not take place within watercourses; where unavoidable, the footprint needed for maintenance must be kept to a minimum. This is subjected to authorization by means of a water use license;
- Where possible, maintenance within watercourses must be restricted to the drier winter months;
- Maintenance activities should not impact on rehabilitated areas;
- Maintenance workers should respect and also maintain fences that are in place to prevent livestock from entering rehabilitated areas, until such time that monitoring found that rehabilitation is successful, and the fences removed;
- Maintenance vehicles must stay on dedicated roads/ servitudes;
- During the construction phase measures must be put in place to control the flow of excess water so that it does not impact on the surface vegetation;
- Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas;
- Runoff from the construction area must be managed to avoid erosion and pollution problems;
- Weed control;
- Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area and returning it where possible afterwards;
- Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish;
- The placing of silt fences / silt barriers adjacent to the wetland to prevent discharge of silt into the wetland, and the inclusion of buffer zones in which no stockpiles, machinery, chemicals or construction camps must be included to prevent pollution into the wetland;

- A copy of the Environmental Impact Report and associated Environmental Management Plan must be present at the construction site for easy reference to specialist recommendations in sensitive areas;
- It is recommended that the construction crew be educated about the sensitivities involved in these areas;
- No water should be abstracted from any river / wetland along the powerline route;
- No hazardous materials (such as oil) should be kept within 50m of the edge of a wetland; and
- Rehabilitate or revegetate disturbed areas.

Table 9 below summarises the impacts associated with the proposed development:

Table 9: Summary of wetland impact assessment

Aspect	Impact	Positive/negative impact	Probability	Duration	Scale	Magnitude	Significance/Risk	Impact Significance before mitigation	Mitigation Required	Impact Significance after mitigation
Land clearing	Habitat disturbance	Negative	4	2	1	6	36	Moderate	Yes	Low
Clearing of surface vegetation	Soil loss/soil erosion	Negative	2	2	1	6	18	Low	Yes	Low
Compaction of soil	Changes in water flow regime	Negative	3	2	1	6	27	Low	Yes	Low
Surface water redirection	Changes in water flow regime	Negative	3	3	1	6	27	Low	Yes	Low
Clearing of surface vegetation	Change in water turbidity	Negative	3	3	1	6	30	Moderate	Yes	Low
Clearing of surface vegetation	Alien invasion of native species habitat	Negative	3	5	2	6	52	Moderate	Yes	Low
Clearing of surface vegetation	Loss of wetland/riparian habitat	Negative	3	2	2	6	30	Moderate	Yes	Low
Toxic chemicals from construction vehicles (oil, petrol, brake fluid etc.)	Alteration of water quality and water pollution	Negative	3	2	1	4	21	Low	Yes	Low
Human dispersal of alien seeds/sapling by construction and maintenance vehicles, shoes, clothes.	Alien invasion of native species habitat	Negative	3	3	2	4	27	Low	Yes	Low

10 WATER USE LICENCE APPLICATION

Water uses for which authorisation must be obtained from DWS are indicated in Section 21 of the NWA. Section 21 (c) and (i) are applicable to any activity related to a wetland/aquatic area:

- Section 21(c): Impeding or diverting the flow of water in a watercourse; and
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

Authorisations related to wetlands/aquatic systems are regulated by Government Notices R.1198 and R.1199 of 18 December 2009. GN 1198 and 1199 of 2009 grants General Authorisation (GA) for the above water uses on certain conditions as amended in Notice 506 of 2016:

- GN R.1198: Any activity in a wetland for the rehabilitation of a wetland for conservation purposes; and
- GN R.1199: Any activity more than 500m from the boundary of a wetland.

These regulations also stipulate that these water uses must the registered with the responsible authority. Any activity that is not related to the rehabilitation of a wetland and which takes place within 500m of a wetland/aquatic system are excluded from a GA under either of these regulations. Wetlands/aquatic systems situated within 500m of proposed activities should be regarded as sensitive features potentially affected by the proposed development (GN 1199). Such an activity requires a Water Use Licence (WUL) from the relevant authority.
The proposed Eskom activities trigger a Section 21 (c) and (i) water uses of the NWA and require Water Use Licence authorisation from the Department of Water and Sanitation. The Table below indicates the towers for which a WULA is required. The Table is based on observations of towers at accessible sites as well as towers identified in the 2013 wetland assessment.

Tower	Wetland Type	Comment	WULA Required or not
T6	No wetland	Located within 500m of a wetland	yes
T7	Un-channelled valley bottom wetland	Located within a wetland. Previously cultivated area. A man-made furrow runs through the wetland	yes
T8-T11	Channelled valley bottom wetland	Tower located within a wetland area	yes
T12	No wetland	Tower located within 500m of a water resource	yes
T13-18	No wetland	Towers located within 500m of a non-perennial stream	yes

T44-T46	No wetland	Tower located on Irrigated land along a canal	No
T47	No wetland	Tower located on a drainage line	yes
T49	No wetland	Tower located within 500m of a water resource	yes
T70-T76	No wetland	Tower located within 500m of a water resource	yes
T82	Artificial wetland/farm dam	Within 500m of a farm dam and a furrow	yes
T83	Artificial stream/canal	Within 500m of a furrow	yes
T85	Artificial stream/canal	Within 500m of a farm dam	yes
T87	No wetland	Tower located in non-perennial stream	yes
T88	Artificial wetland/ farm dam	Tower located within 500m of a farm dam	Yes
T89	Channelled valley bottom wetland	Tower located within a wetland	Yes
T90	Channelled valley bottom wetland	Tower located within a temporary zone of a wetland	Yes
T91	No wetland	Within 500m of a water resource	
T92-95	No wetland	Within 500m of a water resource	Yes
T102-109	No wetland	Within 500m of a water resource	Yes
T113	Drainage line	Within 500m of a drainage line	Yes
T116-117	No wetland	Within 500m of a water resource	Yes
T118-119	No wetland	Within 500m of a non-perennial stream. Towers located at crest	Yes
T120-T124	No wetland	Within 500m of a water resource	Yes
T127-134	No wetland	Within 500m of a water resource	Yes
T140-149	No wetland	Within 500m of a water resource	Yes
T145	Drainage line		
T150-156	Away from water resources	n/a	No
T157-161	Drainage line	Within 500m of a non-perennial stream	Yes
T162-164	Away from water resources		No
T165-166	Channelled valley bottom wetland	Within 500m of a stream and a wetland. Agricultural land	Yes
T174-180	No wetland	Within 500m of a non-perennial stream	Yes
T181-186	Channelled valley bottom with seepages	Towers located within 500m of wetland areas	Yes
T199-200	No wetland	Within 500m of a non-perennial stream	Yes
T201-210	Channelled valley bottom wetlands	Within wetland areas	Yes

T211-223	Channelled valley bottom wetlands	Within wetland areas	Yes
T224-225	No wetland	Within 500m of a wetland	Yes
T226	No wetland	Within 500m of a stream	Yes
T227-228	Channelled valley bottom wetland	Within 500m of a wetland	Yes
T229-234	No wetland	Within 500m of a wetland	Yes
T235	Artificial wetland and non-perennial stream	Within 500m of an artificial dam and non-perennial stream	Yes
T236	No wetland	Within 500m of a non-perennial stream	Yes
T237-239	Channelled valley bottom wetland	Within 500m of a wetland	Yes
T240-241	No wetland or river		No
T242-243	Non –perennial stream	Within 500m of a non-perennial stream	Yes
T244-245	No water resource		No
T250-251	Drainage line	Within 500m of a drainage line	Yes
T252	Seepage wetland	Within 500m of a seepage wetland	Yes
T253-256	Seepage wetland	Towers located within a wetland	Yes
T260	Flat/ seasonal pan	Within 500m of a seasonal pan	Yes
T265-270	Non-perennial stream	Within 500m of a non-perennial stream	Yes
T283	Seepage wetland	Within 500m of a seepage wetland	Yes
T284-258	Seepage wetland	Towers within a wetland	Yes
T286-288	Channelled valley bottom wetland	Within 500m of a wetland	Yes
T289	Channelled valley bottom wetland	Tower located in a wetland	Yes
T290-293	Channelled valley bottom	Within 500m of a wetland	Yes
T294	Channelled valley bottom	Within a wetland	Yes
T295	Channelled valley bottom	Within 500m of a wetland	Yes
T296	Channelled valley bottom	Tower located in a wetland	Yes
T297	Channelled valley bottom	Within 500m of a wetland	Yes

11 CONCLUSION

The impact assessment found that the greatest impact that the construction of the 400KV powerline infrastructure and the Loop-in lines are likely to have on the assessed watercourses is the removal of vegetation and compaction of soil around the tower footprint as well as along the servitude. Proper mitigation measures must be put in place when commencing with the activities that might have detrimental negative impact on the wetland. It is believed that impacts with a Moderate significance score, once mitigated will ultimately result in Low impact scores.

From a wetland point of view, there are no major objections against the proposed powerline development activities, as long as mitigation measures and recommendations are seriously considered and implemented, and as long as due diligence is practiced in terms of environmental legislation and other relevant policies and guidelines.

From an aquatic point of view, none of the Eskom powerline towers will be situated within a river ecosystem and during construction, the activities should be localized to where the towers will be situated. This would minimize the impacts on the aquatic ecosystems, if any. It is recommended to ensure that during any construction activity, great care is taken to ensure no construction waste is disposed into the rivers and none of the streams are subjected to any disturbances.

12 REFERENCES

DALLAS, H.F. 2007. River Health Programme: South African Scoring System (SASS) Data Intepretation Guidelines. The Freshwater Consulting Group / Freshwater Research Unit, University of Cape Town.

Davies, B. and Day, J. (1998). *Vanishing waters*. University of Cape Town Press. Rondebosch, Cape Town, South Africa.

DICKENS, C AND GRAHAM, M. 2001. South African Scoring System (SASS) Version 5 Rapid Bioassessment Method for Rivers. River Health Programme Web Page.

DWAF (2008). *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas,* prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Report no. XXXXXXXXX. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

DWAF (2013). Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

Henderson, L. (2001). Alien weeds and invasive plants. Plant. Protection Research Institute Handbook No. 12. Agricultural Research Council, Pretoria.

KEMPSTER, P.L., HATTINGH, W.H.J AND VAN VLIET, H.R. 1982. Summarised water quality criteria. Technical report NR. Tr. 108. Department of Environmental Affairs.

KLEYNHANS C.J, LOUW M.D. 2008. MODULE A: Ecoclassification And Ecostatus Determination in River Ecoclassification: Manual for Ecostatus Determination (Version 2). Joint Water Research Commission and Department of Water Affairs and Forestry Report. Wrc Report No. TT 329/08.

Kotze, D., Beckedahl, H., Ellery,W., Marneweck, G., Bachelor, A., Collins, C., Winstanley, T., Russell, W., Walters, D., Braack, M., Cowden, C. (2001). Planning, implementing and monitoring wetland rehabilitation: Draft Document – Unpublished. Working for Water and Department of Environmental Affairs and Tourism. Pretoria.

Kotze, D.C., Ellery, W.N., Rountree, M., Grenfell, M.C., Marneweck, G., Nxele, I.Z., Breen, D.C., Dini, J., Batchelor, A.L, and Sieben, E., (2008). WET-RehabPlan: Guidelines for planning wetland rehabilitation in South Africa. WRC Report No. TT 336/08. Water Research Commission, Pretoria

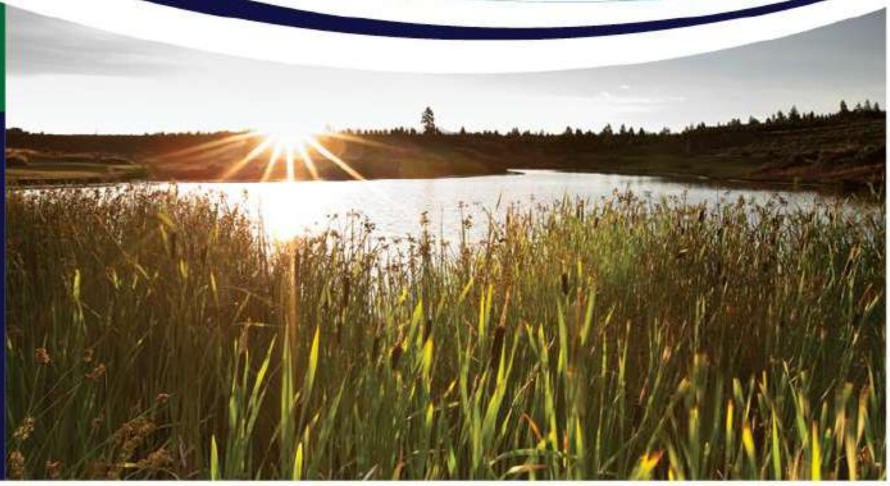
Kotze, D.C., Marneweck, G.C., Batchelor, A.L., Lindley, D.S. and Collins, N.B. (2009). Wet-Ecoservices: A TECHNIQUE FOR RAPIDLY ASSESSING ECOSYSTEM SERVICES SUPPLIED BY WETLANDS.

Macfarlane, D.M., Kotze, D.C., Ellery, W.N., Walters, D., Koopman, V., Goodman, P. & Goge, C. (2008). WET-HEALTH: A TECHNIQUE FOR RAPIDLY ASSESSING WETLAND HEALTH, VERSION 2.

Nel, J.L., Driver, A., Strydom, W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J., Nienaber, S., van Deventer, H. Swartz, E. and Smith-Adao, L.B. (2011). ATLAS OF FRESHWATER ECOSYSTEM PRIORITY AREAS IN SOUTH AFRICA: MAPS TO SUPPORT SUSTAINABLE DEVELOPMENT OF WATER RESOURCES. Water Research Commission, Gezina. WRC Report No. TT 500/11

Operational Guideline: Integrated Water and Waste Management Plan for the preparation of the Water Quality Management Technical Document to support the Application for Licences for Mining and Industries in Terms of the Requirements of the National Water Act, 1998 (Act 36 of 1998).

THIRION, C., MOCKE, A. AND WOEST, R. 1995. Biological Monitoring of Streams and Rivers using SASS4: A User Manual. Final Report, No. N 000/00/REQ/1195. Institute of Water Quality Studies, DWAF.



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Appendix 6H: Specialist Declaration Forms

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Emkhiweni Substation and 400kV Line from Emkhiweni Substation to Silimela

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Nemai Consulting (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)		Percentage Procurement recognition	
Specialist name:	Avhafarei Ronald Phamphe			
Specialist Qualifications:	M.Sc (Botany)			
Professional affiliation/registration:	•Professional Natural Scientist-Ecological Science (Reg no.: 400349/12) with South African council for Natural Scientific Professions (SACNASP) •Professional member of South African Institute of Ecologists and Environmental Scientists (SAIEES) Professional member of South African Association of Botanists (SAAB)			
Physical address:	147 Bram Fischer Drive, Ferndale, Randburg, 2194			
Postal address:	PO Box 1673, Sunninghill,			
Postal code:	2157	Cell:	082 783 6724	
Telephone:	011 781 1730	Fax:	011 781 1731	
E-mail:	AvhafareiP@nemai.co.za			

2. DECLARATION BY THE SPECIALIST

I, AVHAFAREI PHAMPHE, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

NEMAI CONSULTING PTY LTD

Name of Company:

13/08/2019

Date

Details of Specialist, Declaration and Undertaking Under Oath

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Ashaadni Phamohe, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Nomali Consulting Pty Ltd

Name of Company

15/08/2019

Date

M.S Malehaka

Signature of the Commissioner of Oaths

2019/08/15

Date

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2019 -08- 15
C.S.C
LINDEN
SUID-AFRIKAANSE POLISIEDIENS

PERSONAL DATA — **AVHAFAREI RONALD PHAMPHE**

Company	NEMAI Consulting
Position in firm	Biodiversity Specialist
Years of Experience	16
Nationality	South African
Languages	English, IsiZulu, SePedi, Tshivenda, and XiTsonga

EDUCATION AND PROFESSIONAL QUALIFICATIONS

- B.Sc – University of Venda
- B.Sc (Hons) (Botany) – University of Venda
- University Education Diploma – University of Venda
- MSc (Botany) – University of Pretoria

Professional Registration

- Professional Natural Scientist-Ecological Science (Reg number: 400349/12) with South African council for Natural Scientific Professions (SACNASP)
- Professional member of South African Institute of Ecologists and Environmental Scientists (SAIEES)
- Professional member of South African Association of Botanists (SAAB)

RELEVANT EXPERIENCE: ECOLOGICAL MANAGEMENT PLANS

Involved in the following EcoMPs:

- Ithala Game Reserve
- Hluhluwe-Imfolozi Park

RELEVANT EXPERIENCE: BIODIVERSITY PROJECTS IN NORTHERN CAPE

- Proposed Upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 in Northern Cape Province (2019)
- Biodiversity ground truthing for the Frances Baard EMF (Environmental Management Framework (2010))
- Terrestrial Ecology Specialist Study for Waste License and Basic assessment for the rehabilitation of Asbestos contaminated land on Transnet properties – Group A

BIODIVERSITY SPECIALIST INVOLMENET:

Involved in the following projects

- Boskop Dam Resource Management Plan and Business Plan
- Vanderkloof Dam Resource Management Plan and Business Plan
- Biodiversity Offset: Proposed uMkhomazi Water Project Phase 1 - Raw Water Component
- Biodiversity Offset: Spring grove Dam
- Biodiversity Offset: Richards Bay Industrial Development Zone-1F

RELEVANT EXPERIENCE: BIODIVERSITY ASSESSMENTS

- Terrestrial Ecology Specialist Study for the proposed Hout Bay Housing Development in the City of Cape Town Metropolitan Municipality, Western Cape

Province.

- Terrestrial Ecology Specialist Study for the proposed Development of the Makalu B Distribution Line in Sasolburg, Free State
- Terrestrial Ecology Specialist Study for the proposed Mookodi-Mahikeng 400kV Powerline, North West Province
- Terrestrial Ecological Assessment Report: New Wastewater Treatment Works at Lanseria, Gauteng Province
- Terrestrial Ecology Specialist Study: Proposed Surface Water Developments for Augmentation of the Western Cape Water Supply System
- Terrestrial Ecology Specialist Study: Proposed Lanseria outfall sewer in Johannesburg, Gauteng Province
- Terrestrial Ecology Specialist Study: Proposed Duvha Ash Dam Seepage Interception Drains, Mpumalanga
- Botanical Assessment Study: Proposed Zoar Amalienstein Agricultural Development Feasibility Study, Western Cape.
- Biodiversity Assessment: Aliwal North FET College
- Biodiversity Assessment: Balfour FET College
- Biodiversity Assessment: Graaff-Reinet FET College
- Biodiversity Assessment: Sterkspruit FET College
- Biodiversity Assessment: Ngqungqushe FET College
- Ecological Assessment; Proposed Ncwabeni Off-Channel Storage Dam, Department of Water Affairs
- Ecological Assessment; Transnet Freight Rail Asbestos Rehabilitation Group A – De Aar to Uitenhage Main Line and Uitenhage Railway Station
- Flora and fauna Assessment; Proposed Improvement and Upgrade of National Route R23 – Section 1 between Platrand (km 52.0) & Standerton (km 78.27), SANRAL
- Flora and Fauna assessment in Bankfontein farms, BHP Billiton, Breyten, Mpumalanga
- Flora and Fauna assessment in Pamodzi Gold, Welkom, Free State
- Flora and Fauna assessment in Vaalbank, BHP Billiton Carolina, Mpumalanga.
- Flora and Fauna assessment in Arnot, Exxaro Coal, Mpumalanga
- Flora and Fauna assessment in Ogies, HCI Kusela, Mpumalanga
- Fauna assessment near Witbank for HCI Khusela Colliery
- Vegetation assessments after rehabilitation for:
  - I. Goedgevoden Colliery;
  - II. iMpunzi Colliery;
  - III. Spitzkop Colliery; and
  - IV. Tselentis Colliery.
- Flora and Fauna Assessment, BG3 pipeline, Rand Water, Vaal River
- Flora and fauna Assessment, Dinaledi-Anderson powerline, Eskom
- Flora and fauna Assessment, Anderson substation, Eskom
- Flora and Fauna Assessment, Dobsonville BRT Depot
- Flora and Fauna Assessment, Proposed high altitude training centre, Belfast, Mpumalanga
- Flora and fauna Assessment, Klipspruit Catchments, Soweto
- Flora and fauna Assessment, ALSA MARIKANA, North West
- Flora and fauna Assessment, S4 Pipeline, Rand Water
- Flora and fauna Assessment, Dobsonville Housing, Johannesburg Development Agency

RELEVANT EXPERIENCE: BIODIVERSITY SECTOR PLAN

- Compiled Ezemvelo KZN Wildlife Biodiversity Sector Plan for uMkhanyakude District Municipality

RELEVANT EXPERIENCE: ENVIRONMENTAL MANAGEMENT FRAMEWORK (EMF)

Involved in the following EMFs:

- NAMAKWA EMF
- LADYSMITH EMF
- FRANCES BAARD EMF
- REVIEW OF FRANCES BAARD EMF
- uMKHANYAKUDE DM EMF
- uTHUKELA DM EMF
- HARRY GWALA DM EMF
- MAPUNGUBWE EMF
- UMZINYATHI EMF

Declaration:
I confirm that the above CV is an accurate description of my experience and qualifications.

Signature of Staff Member Date: 19 July 2019

2226694

University of Pretoria

The Council and Senate hereby declare that
at a congregation of the University the degree

Magister Scientiae

with specialization in
Botany

with all the associated rights and privileges
was conferred on

AVHAFAREI RONALD PHAMPHE

in terms of the Higher Education Act, 1997 and the Statute of the University

On behalf of the Council and Senate

Vice-Chancellor and Principal

On behalf of the Faculty of
Natural and Agricultural Sciences

Dean

Registrar

2004-04-24

SOUTH AFRICAN POLICE SERVICE
CLIENT SERVICE CENTRE
2019 -07- 23
CSC
RANDBURG
SUID-AFRIKAANSE POLISIEDIENS

...SERTIFISEER DAT HIERDIE DOKUMENT 'N WARE AFDRUK (AFSKRIF) IS VAN ...LIKE DOKUMENT WAT AAN MY VIR WAARNEMING VOORGELÊ ... VERDER DAT, VOLGENS MY WAARNEMINGS, DAAR NIE 'N ...DERING OP DIE OORSPRONKLIKE DOKUMENT AANGE...

...CUMENT IS A TRUE REPRODUCTION (COPY) OF THE ...CH WAS HANDED TO ME FOR AUTHENTICATION ... FROM MY OBSERVATIONS, AN AMENDMENT OR ... THE ORIGINAL DOCUMENT.

...TEKENING/SIGNATURE
M.A. LUTHULI 0619053-7 RANG RANK

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Avhafarei Ronald Phamphe

Registration Number: 400349/12

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Ecological Science

Effective **7 November 2012** Expires **31 March 2020**

SOUTH AFRICAN POLICE SERVICE
CLIENT SERVICE CENTRE
2019 -07- 23
CSC
RANDBURG
SUID-AFRIKAANSE POLISIEDIENS

EK SERTIFISEER DAT HIERDIE ... DIE OORSPRONKLIKE ... SERTIFISEER ... IS ... WYSIGING OF VERANDERING IS NIE.

I CERTIFY THAT THIS ... ORIGINAL DOCUMENT ... FURTHER CERTIFY ... CHANGE WAS NOT ...

... AFDRUK (AFSKRIF) IS VAN ... WAARNEMINGS ... DAAR NIE ... DOKUMENT ...

... REPRODUCTION (COPY) OF THE ... FOR AUTHENTICATION ... IS, AN AMENDMENT OR ... DOCUMENT.

SIGNATURE

MAGSNOMMER
FORCE NUMBER

RANG
RANK

NAAM IN DRUKSKRIF
NAME IN PRINT M.A.

Botha

Chairperson

Chief Executive Officer

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environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

EMKHIWENI SUBSTATION + 400KV LINE FROM EMKHIWENI SUBSTATION TO SILIMELA

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	WILDSKIES ECOLOGICAL SERVICES			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	JON SMALLIE			
Specialist Qualifications:	MSC			
Professional affiliation/registration:	SACNASP			
Physical address:	36 UTRECHT AVE BONNIE DOON EAST LONDON			
Postal address:				
Postal code:	5241	Cell:	082 444 8919	
Telephone:		Fax:		
E-mail:	jon@wildskies.co.za			

2. DECLARATION BY THE SPECIALIST

I, J. SMALLIE, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

WILDSKIES ECOLOGICAL SERVICES
Name of Company:

15/8/2019
Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, J. SMALLIE, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

WILDSKIES ECOLOGICAL SERVICES

Name of Company

15/8/2019

Date

Signature of the Commissioner of Oaths

15 August 2019

Date

KIM SMALLIE
Commissioner of Oaths
HR Professional (HRP)
Member number: 6404
3 Pearce Street
Berea, East London
5201

SABPP™
SA BOARD FOR PEOPLE PRACTICES
Setting HR standards

JONATHAN JAMES SMALLIE
WildSkies Ecological Services (2011/131435/07)
Curriculum Vitae

BACKGROUND

Date of birth:	20 October 1975
Qualifications:	BSC – Agriculture (Hons) (completed 1998) University of Natal – Pietermaritzburg MSC – Environmental Science (completed 2011) University of Witwaterstrand
Occupation:	Specialist avifaunal consultant
Profession registration:	South African Council for Natural Scientific Professions

CONTACT DETAILS

Cell number: 082 444 8919
Fax: 086 615 5654
Email: jon@wildskies.co.za
Postal: 36 Utrecht Avenue, Bonnie Doon, East London, 5210
ID #: 7510205119085

PROFESSIONAL EXPERIENCE

Renewable energy:

Post construction bird monitoring for wind energy facilities:

Dassieklip (Caledon) –initiated in April 2014 (2yrs); Dorper Wind Farm (Molteno) – initiated in July 2014 (2yrs); Jeffreys Bay Wind Farm – initiated in August 2014 (4yrs); Kouga Wind Farm – started Feb 2015 (2yrs); Cookhouse West Wind Farm – started March 2015 (1yr); Grassridge Wind Farm – initiated in April 2015 (2yrs); Chaba Wind Farm – initiated December 2015 (1yr); Amakhala Emoyeni 01 Wind Farm initiated August 2016 (2yrs); Gibson Bay Wind Farm – initiated March 2017 (2yrs); Nojoli Wind Farm initiated March 2017 (2yrs); Sere Wind Farm (2yrs).

Pre-construction bird monitoring & EIA for wind energy facilities:

Golden Valley 1; Middleton; Dorper; Qumbu; Ncora; Nqamakhwe; Ndakana; Thomas River; Peddie; Mossel Bay; Hluhluwe; Richards Bay; Garob; Outeniqua; Castle; Wolf; Inyanda-Roodeplaat; Dassiesridge; Great Kei; Bayview; Grahamstown; Bakenskop; Umsobomvu; Stormberg; Zingesele; Oasis; Gunstfontein; Naumanii; Golden Valley Phase 2; Ngxwabangu; Hlobo; Woodstock; Scarlet Ibis; Albany; Golden Valley 1 2nd monitoring; Umtathi Emoyeni; Serenje Zambia; Unika 1 Zambia; Impofu' and Nuweveld wind energy facilities.

Screening studies for wind energy facilities:

Tarkastad Wind Farm; Quanti Wind Farm; Ruitjies Wind Farm.

Avifaunal walk through for wind energy facilities:

Garob Wind Farm; Golden Valley 1 wind farm; Nxuba Wind Farm.

Pre-construction bird monitoring and EIA for Solar energy facilities:

Bonnievale Solar Energy Facility; Dealesville Solar Energy Facility; Rooipunt Solar Energy Facility; De Aar Solar Energy Facility; Noupoort Solar Energy Facility, Aggeneys Solar Energy Facility; Eskom Concentrated Solar Power

Plant; Bronkhorstspruit Solar Photovoltaic Plant; De Aar Solar Energy Facility; Paulputs Solar Energy Facility; Kenhardt Solar Energy Facility; Wheatlands Solar Energy Facility; Nampower CSP project;

Other Electricity Generation:

Port of Nqura Power Barge EIA; Tugela Hydro-Electric Scheme; Mmamabula West Coal Power Station (Botswana).

Electricity transmission & distribution:

Overhead transmission power lines (>132 000 kilovolts):

Oranjemund Gromis 220kv; Perseus Gamma 765kv; Aries Kronos 765kv; Aries Helios 765kv; Perseus Kronos 765kv; Helios Juno 765kv; Borutho Nzelele 400kv; Foskor Merensky 275kv; Kimberley Strengthening; Mercury Perseus 400kV; Eros Neptune Grassridge 400kV; Kudu Juno 400kV; Garona Aries 400kV; Perseus Hydra 765Kv; Tabor Witkop 275kV; Tabor Spencer 400kV; Moropule Orapa 220kV (Botswana); Coega Electrification; Majuba Venus 765kV; Gamma Grassridge 765kV; Gourikwa Proteus 400KV; Koeberg Strengthening 400kV; Ariadne Eros 400kV; Hydra Gamma 765kV; Zizabona transmission – Botswana; Maphutha Witkop 400kv; Makala B 400kv; Aggeneis Paulputs 400kv; Northern Alignment 765kv; Kappa Omega 765kv; Isundu 400kv and Substation; Senakangwedi B Integration; Oranjemund Gromis;

Overhead distribution power lines (<132 000 kilovolts):

Kanoneiland 22KV; Hydra Gamma 765kV; Komani Manzana 132kV; Rockdale Middelburg 132kV; Irenedale 132 kV; Zandfontein 132kV; Venulu Makonde 132 kV; Spencer Makonde 132 kV; Dalkeith Jackal Creek 132Kv; Glen Austin 88kV; Bulgerivier 132kV; Ottawa Tongaat 132kV; Disselfontein 132kV; Voorspoed Mine 132kV; Wonderfontein 132kV; Kabokweni Hlau Hlau 132kV; Hazyview Kiepersol 132kV; Mayfern Delta 132kV; VAAL Vresap 88kV; Arthursview Modderkuil 88kV; Orapa, AK6, Lethakane substations and 66kV lines (Botswana); Dagbreek Hermon 66kV; Uitkoms Majuba 88kV; Pilanesberg Spitskop 132kV; Qumbu PG Bison 132kV; Louis Trichardt Venetia 132kV; Rockdale Middelburg Ferrochrome 132kV; New Continental Cement 132KV; Hillside 88kV; Marathon Delta 132kV; Malelane Boulder 132kV; Nondela Strengthening 132kV; Spitskop Northern Plats 132kV; West Acres Mataffin 132kV; Westgate Tarlton Kromdraai 132kV; Sappi Elliot Ugie 132kV; Melkhout Thyspunt 132kV; St Francis Bay 66kv; Etna Ennerdale 88kv; Kroonstad 66kv; Firham Platrand; Paradise Fondwe 132kv; Kraal Mafube 132kv; Loeriesfontein 132kv; Albany Mimosa 66kv; Zimanga 132kv; Grootpan Brakfontein; Mandini Mangethe; Valkfontein Substation; Sishen Saldanha; Corinth Mzongwana 132kv; Franklin Vlei 22kv; Simmerpan Strengthening; Ilanga Lethemba 132kv; Cuprum Burchell Mooidraai 132; Oliphantskop Grassridge 132;

Risk Assessments on existing power lines:

Hydra-Droerivier 1,2 & 3 400kV; Hydra-Poseidon 1,2 400kV; Butterworth Ncora 66kV; Nieu-Bethesda 22kV; Maclear 22kV (Joelshoek Valley Project); Wodehouse 22kV (Dordrecht district); Burgersdorp Aliwal North Jamestown 22kV; Cradock 22kV; Colesberg area 22kV; Loxton self build 11kV; Kanoneiland 22kV; Stutterheim Municipality 22kV; Majuba-Venus 400kV; Chivelston-Mersey 400kV; Marathon-Prairie 275kV; Delphi-Neptune 400kV; Ingagane – Bloukrans 275kV; Ingagane – Danskraal 275kV; Danskraal – Bloukrans 275kV

Avifaunal "walk through" (EMP's):

Kappa Omega 765kv; Rockdale Marble Hall 400kv; Beta Delphi 400kV; Mercury Perseus 765kV; Perseus 765kV Substation; Beta Turn 765kV in lines; Spencer Tabor 400kV line; Kabokweni Hlau Hlau 132kV; Mayfern Delta 132Kv; Eros Mtata 400kV; Cennergi Grid connect 132kV; Melkhout Thyspunt 132kv; Imvubu Theta 400kv; Outeniqua Oudshoorn 132kv; Clocolan Ficksburg 88kv.

Strategic Environmental Assessments for Master Electrification Plans:

Northern Johannesburg area; Southern KZN and Northern Eastern Cape; Northern Pretoria; Western Cape Peninsula

Other electrical infrastructure work

Investigation into rotating Bird Flapper saga – Aberdeen 22Kv; Special investigation into faulting on Ariadne-Eros 132kV; Special investigation into Bald Ibis faulting on Tutuka Pegasus 275kV; Special investigation into bird related faulting on 22kV Geluk Hendrina line; Special investigation into bird related faulting on Camden Chivelston 400kV line

Water sector:

Umkhomazi Dam and associated tunnel and pipelines; Rosedale Waste Water Treatment Works; Lanseria Outfall Sewer; Lanseria Wastewater Treatment Works;

Wildlife airport hazards:

Kigali International Airport – Rwanda; Port Elizabeth Airport – specialist study as part of the EIA for the proposed Madiba Bay Leisure Park; Manzini International Airport (Swaziland); Polokwane International Airport; Mafekeng International Airport; Lanseria Airport

Other sectors:

Lizzard Point Golf Estate – Vaaldam; Lever Creek Estates housing development; East Cape Biodiversity Strategy and Action Plan 2017; Cathedral Peak Road diversion; Dube Tradeport; East London Transnet Ports Authority Biodiversity Management Plan; Leazonia Feedlot; Carisbrooke Quarry; Senekal Sugar Development; Frankfort Paper Mill;

Employment positions held to date:

- August 1999 to May 2004: Eastern Cape field officer for the South African Crane Working Group of the Endangered Wildlife Trust
- May 2004 to November 2007: National Field officer for Eskom-EWT Strategic Partnership and Airports Company SA – EWT Strategic Partnership (both programmes of Endangered Wildlife Trust)
- November 2007 to August 2011: Programme Manager – Wildlife & Energy Programme – Endangered Wildlife Trust
- **August 2011 to present: Independent avifaunal specialist – Director at WildSkies Ecological Sevices (Pty) Ltd**

Relevant achievements:

- Recipient of BirdLife South Africa's Giant Eagle Owl in 2011 for outstanding contribution to bird conservation in SA
- Founded and chaired for first two years – the Birds and Wind Energy Specialist Group (BAWESG) of the Endangered Wildlife Trust & BirdLife South Africa.

Conferences attended & presented at:

- May 2011. Conference of Wind Energy and Wildlife, Trondheim, Norway.
- March 2011. Chair and facilitator at Endangered Wildlife Trust – Wildlife & Energy Programme – "2011 Wildlife & Energy Symposium", Howick, SA
- September 2010 – Raptor Research Foundation conference, Fort Collins, Colorado. Presented on the use of camera traps to investigate Cape Vulture roosting behaviour on transmission lines
- May 2010 - Wind Power Africa 2010. Presented on wind energy and birds

- October 2008. Session chair at Pan-African Ornithological Conference, Cape Town, South Africa
- March 27 – 30 2006: International Conference on Overhead Lines, Design, Construction, Inspection & Maintenance, Fort Collins Colorado USA. Presented a paper entitled "Assessing the power line network in the Kwa-Zulu Natal Province of South Africa from a vulture interaction perspective".
- June 2005: IASTED Conference at Benalmadena, Spain – presented a paper entitled "Impact of bird streamers on quality of supply on transmission lines: a case study"
- May 2005: International Bird Strike Committee 27th meeting – Athens, Greece. Presented a paper entitled Bird Strike Data analysis at SA airports 1999 to 2004.
- 2003: Presented a talk on "Birds & Power lines" at the 2003 AGM of the Amalgamated Municipal Electrical Unions – in Stutterheim - Eastern Cape
- September 2000: 5th World Conference on Birds of Prey in Seville, Spain.

Papers & publications:

- Prinsen, H.A.M., J.J. Smallie, G.C. Boere, & N. Pires. (compilers), 2011. Guidelines on how to avoid or mitigate impacts of electricity power grids on migratory birds in the African-Eurasian Region. CMS Technical Series Number XX. Bonn, Germany.
- Prinsen, H.A.M., J.J. Smallie, G.C. Boere, & N. Pires. (compilers), 2011. Review of the conflict between migratory birds and electricity power grids in the African-Eurasian region. CMS Technical Series Number XX, Bonn, Germany.
- Jenkins, A.R., van Rooyen, C.S, Smallie, J.J, Harrison, J.A., Diamond, M.D., Smit-Robinson, H.A & Ralston, S. 2014. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa
- Jenkins, A.R., Shaw, J.M., Smallie, J.J., Gibbons, B., Visagie, R. & Ryan, P.G. 2011. Estimating the impacts of power line collisions on Ludwig's Bustards Neotis ludwigii. Bird Conservation International.
- Jordan, M., & Smallie, J. 2010. A briefing document on best practice for pre-construction assessment of the impacts of onshore wind farms on birds. Endangered Wildlife Trust , Unpublished report
- Smallie, J., & Virani, M.Z. 2010. A preliminary assessment of the potential risks from electrical infrastructure to large birds in Kenya. Scopus 30: p32-39
- Shaw, J.M., Jenkins, A.R., Ryan, P.G., & Smallie, J.J. 2010. A preliminary survey of avian mortality on power lines in the Overberg, South Africa. Ostrich 2010. 81 (2) p109-113
- Jenkins, A.R., Smallie, J.J., & Diamond, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. Bird Conservation International 2010. 20: 263-278.
- Shaw, J.M., Jenkins, A.R., Ryan, P.G., & Smallie, J.J. 2010. Modelling power line collision risk for the Blue Crane *Anthropoides paradiseus* in South Africa. Ibis 2010 (152) p590-599.
- Jenkins, A.R., Allan, D.G., & Smallie, J.J. 2009. Does electrification of the Lesotho Highlands pose a threat to that countries unique montane raptor fauna? Dubious evidence from surveys of three existing power lines. Gabar 20 (2).
- Smallie, J.J., Diamond, M., & Jenkins, A.R. 2008. Lighting up the African continent – what does this mean for our birds? Pp 38-43. In Harebottle, D.M., Craig, A.J.F.K., Anderson, M.D., Rakotomanana, H., & Muchai. (eds). Proceedings of the 12th Pan-african Ornithological Congress. 2008. Cape Town. Animal Demography Unit. ISBN (978-0-7992-2361-3)
- Van Rooyen, C., & Smallie, J.J. 2006. The Eskom –EWT Strategic Partnership in South Africa: a brief summary. Nature & Faunae Vol 21: Issue 2, p25
- Smallie, J. & Froneman, A. 2005. Bird Strike data analysis at South African Airports 1999 to 2004. Proceedings of the 27th Conference of the International Bird Strike Committee, Athens Greece.

- Smallie, J. & Van Rooyen, C. 2005. Impact of bird streamers on quality of supply on transmission lines: a case study. Proceedings of the Fifth IASTED International Conference on Power and Energy Systems, Benalmadena, Spain.
- Smallie, J. & Van Rooyen, C. 2003. Risk assessment of bird interaction on the Hydra-Droërivier 1 and 2 400kV. Unpublished report to Eskom Transmission Group. Endangered Wildlife Trust. Johannesburg. South Africa
- Van Rooyen, C. Jenkins, A. De Goede, J. & Smallie J. 2003. Environmentally acceptable ways to minimise the incidence of power outages associated with large raptor nests on Eskom pylons in the Karoo: Lessons learnt to date. Project number 9RE-00005 / R1127 Technology Services International. Johannesburg. South Africa
- Smallie, J. J. & O'connor, T. G. (2000) Elephant utilization of *Colophospermum mopane*: possible benefits of hedging. African Journal of Ecology 38 (4), 352-359.

Courses & training:

- Successfully completed a 5 day course in High Voltage Regulations (modules 1 to 10) conducted by Eskom – Southern Region
- Successfully completed training on, and obtained authorization for, live line installation of Bird Flappers

THE SOUTH AFRICAN COUNCIL FOR NATURAL SCIENTIFIC PROFESSIONS

herewith certifies that

Jonathan James Smallie

Registration number 400020/06

has been registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice
(Schedule I of the Act)

Ecological Science

7 February 2006

Pretoria

President

Chief Executive Officer

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Emkhiweni Substation and 400kV Line from Emkhiweni Substation to Silimela

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
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Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Nzumbululo Heritage Solutions			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Mc Edward Murimbika			
Specialist Qualifications:	Archaeologist			
Professional affiliation/registration:	ASAPA			
Physical address:	4 Berger Road Vorna valley, Midrand			
Postal address:	4Berger Road Vorna Valley			
Postal code:	1686	Cell:	083423 6388	
Telephone:		Fax:		
E-mail:	info@nzumbululo.com			

2. DECLARATION BY THE SPECIALIST

Dr M. Murimbika

I, _______________________________, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Nzumbululo Heritage solutions

Name of Company:

16 August 2019

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Mc Edward Matshwaka, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

M. MURIMBIKA

Signature of the Specialist

Nzumbululo Heritage Solutions

Name of Company

10/09/2019

Date

Signature of the Commissioner of Oaths

10/09/2019

Date

I certify that the DEPONENT has acknowledged that he/she knows and understands the contents of this affidavit, that he/she does not have any objection to taking the oath, and that he/she considers it to be binding on his/her conscience, and which was sworn to and signed before me and that the administrating oath complied with the regulations contained in Government Gazette No. R1258 of 21 July 1972, as amended.

SIGNATURE | FULL NAMES Meeta Mounga

Commissioner of Oaths ex officio Republic of South Africa

Designation Manager

Date 10/09/2019

Place Norwood post office

Business Address Norwood Mall

BRANCH MANAGER
2192
2019 -09- 10
NORWOOD POST OFFICE

Profile Brief & Professional Curriculum Vitae

For

Dr McEdward Murimbika (Ph.D. (2006); PhD. *cand*.)

2019

PERSONAL INFORMATION

ID NUMBER	7111275797189				
TITLE	Dr.	**SURNAME**	Murimbika	**FIRST NAME**	McEdward
PARTICULARS	**Gender:** Male	**Race:** Black	**Designation & responsibilities:** Academic & Business Executive		
D.O.B.	27 November 1971				
CONTACT	Email: murimbikam@ftt580.com; Tel: +27 (0) 83 4236 388 (Bus) | +27 83 613 6530 (Mobile) | Fax:0866049482				
ADDRESSES	Postal: P.O Box 2202 Halfway House, 1685; Bus. Physical: Office 463 Maple Road Kyalami AH, 1684 (Gauteng); Web Sites: www.ftt580.com | www.nzumbululo.com Blog: www.mcedward.co				
QUALIFICATION: (1) Ph.D. (2006) [Univ. of Witwatersrand], (2) PhD. [Mgmt. *cand.* WBS] (awaiting graduation, 2019)					

Dr McEdward Murimbika Profile

General Brief

Dr. McEdward Murimbika (PhD. 2006; PhD. 2018 *cand.*; M.Mgmt., 2010; M.Phil. 1999) is an academic and corporate executive with 25 years' experience as a business executive and specialist practitioner in the fields of archaeology & Heritage Management, Tourism Entrepreneurship; business, venture creation, and policy research, Executive Training and public and private sectors advisor. He is an acknowledged thought leader in Archaeology, Cultural Resources and Heritage Management as well as Exponential technology and management innovation and organisational strategic entrepreneurship in the 4IR context. Dr Murimbika is a lead Professional at Nzumbululo and a Graduate School of Business Administration, a.k.a. Wits Business School and the (University of the Witwatersrand, Johannesburg) Senior Sessional Lecturer specialising in post-graduate modules in Technology and Innovation; Exponential Entrepreneurialism and the 4IR Technological Convergence, Innovation, Corporate and Global Entrepreneurship and Heritage management modules. He is an Emerging Technology affiliate scholar (subject of his second PhD thesis).

Professional Brief

Dr Murimbika is a Senior Executive Partner at Nzumbululo (www.nzumbululo.com), a Specialist Management consultancy firms based in Johannesburg, South Africa. The firm is a collective of global Heritage management and advisory consultants working from a collaborative platform geared towards developing next generation heritage and development, environmental management and venture strategic management innovation solutions in the 4IR and Exponential Technology era. The firm focuses on convergence suited to client and business complexities delivering organic sustainable results specifically targeted at Emerging African Economies (EAEs) environments. Dr Murimbika has demonstrated multi-discipline first-class research, training, analytical and applied problem-solving skills emanating from Sub-Saharan Africa and international experience in the fields of Exponential Technologies & Emerging Technologies Convergence, Local and Systemic Entrepreneurship, leadership and business advisory and both applied and basic research.

Public Assignment Portfolio Brief

Dr Murimbika a comprehensive consulting and advisory portfolio. Some of his public assignments include successful completion on multiple Heritage Management, Archaeological resources management; Regulatory Impact Assessments (e.g. the Extension of Security of Tenure Amendment Bill (ESTA); the Land Tenure Security (LTS) Policy for Commercial Farming Areas and the Land Restitution policy in the Republic of South Africa); headed national business research delegations, including missions for the Government of Namibia, to European Union institutions and scientific missions to the UNESCO.

International Scholarship Brief

Dr. Murimbika is an accomplished academic with referenced academic publications in Archaeology, Heritage Management, Tourism Development, Business science field of strategy and entrepreneurship and in the scientific and social fields of archaeology and ethnology respectively. He has a portfolio of international institutions guest lectureships including the World Economic Forum, British Institute in East Africa (Zimbabwe, Kenya and Tanzania); the World Bank (Washington, USA) and business missions to the EU.

Auxiliary Academic Activities Brief

Dr Murimbika is a prolific educator. As a senior lecturer at WBS, McEdward is also an Executive Education Courses Convener at WBS and Entrepreneurial Ways Unit of the Wits Commercial Enterprise Proprietary Limited specialising in Exponential Technologies, Innovation, and Convergence, Entrepreneurialism, Leadership, Team Building, and Group Dynamics. In addition to a vast research and publication portfolio and lectureships, he has managed postgraduate students' research as supervisor having successfully supervised research reports, theses, dissertations in the fields of Archaeology, Heritage Management, Innovation, Exponential Technologies and Entrepreneurship of more than two-dozen Masters in Management and Heritage students since 2010. In addition, in 2017/18 academic year alone, he supervised another 15 Masters, Heritage MBA degree students to successful completion and on time graduation through the Wits Business School and University of the Witwatersrand, Johannesburg.

EDUCATION

Institution [Date from - Date to]	Degree(s) or Diploma(s) obtained:
University of Witwatersrand 2000 - 2005	**Doctor of Philosophy** (PhD) [Arch.]
Wit Business School [WBS] University of Witwatersrand: 2016 – 2018	**Doctor of Philosophy** (PhD) [In Management Innovation, 2018 *Candidate.]*
Wit Business School [WBS] 2010 – 2011	**Master of Management (M. Mgmt.)**(Entrepreneurship and New Venture Creation)
University of Bergen, 1997-1999 (Bergen, Norway)	**Master of Philosophy** (M.Phil.)in Archaeology
University of Brussels (1998) (Brussels, Belgium)	**International Graduate Certificate in African Archaeology**
University of Zimbabwe (1994 & 1995	**BA Gen.** & **B.A Honours**

SKILLS MATRIX

Current Skills levels:

Type of Experience	Experience In months	Date Last used	Skill level
Communication and Marketing	+150	Current	4
Inter-personal and inter-governmental liaison	+150	Current	5
Organizational skills	+150	Current	5
Coordination	+150	Current	5
Facilitation	+180	Current	5
Planning	+200	Current	5
People Management	+150	Current	5
Time Management	+180	Current	5
Computer literacy (SAS Statistical Software Program; MS Office, Project Management software, MAC iOS)	+150	Current	5
Project management	+180	Current	5

1 Had appropriate training only	2 Limited practical experience	3 Solid practical experience	4 Well versed, extensive experience	5 Expert, extensive experience

AUXILLIARY SKILLS - COMPUTER COMPETENCY:

- SAS (Statistics Programmes).
- MS Operating System
  - Professional Level Competencies in: MS Word, MS Excel, MS Power-point, MS Access Database, PMS Publisher, and Internet.
- iOS –Apple Mac Operating Systems
  - Professional Level Competencies in Pages, Numbers, Keynote, Aperture.
- SG Project Pro (Project Management System)

- Adobe Photoshop

CURRENT CORPORATE WORK & PROFESSIONAL EXPERIENCE

1. PERIOD: 2003 to Present: Director – Nzumbululo Group (www.nzumbululo.com) multi-discipline research and advisory consulting groups with units in Heritage and Heritage Facilities Management; Environment and Public Health; Socio-Economic and Business Advisory and Mining Advisory divisions. Responsible for overall Organisational Business and Strategic leadership. Dr. Murimbika is a Lead Specialist Responsible for coordination and management of Heritage & Environmental Management and Research & Enterprise Development (RED) division and initiatives on exponential technology convergence. Charged with 4IR geared solutions designs, quality assurance for projects conducted for clients and associate parties. Facilitates multiple portfolios of applied policy and business research; Monitoring & Evaluation, programme strategic planning, and organisational entrepreneurial planning for private and public as well as civic and social enterprises and organisations. Lead Consultant in:
   - Heritage, Environment & Archaeological Resources Management
   - Museology & CRM
   - Organisational Business Research
   - Strategic Renewal and Policy Advisory
   - Corporate Innovation Advisory
   - Knowledge Management
   - Government Policy Research and Advisory.

ACADEMIC POSITIONS & RESPONSIBILITIES

2. PERIOD: January 2010- Present – POSITION: Senior Sessional Lecturer in Entrepreneurship (Masters in Management in Entrepreneurship and New Venture Creation (MM in E&NV); MBA and Post-Graduate Diploma in Management (PDBA) at Wits Business School (WBS), the University of the Witwatersrand, Johannesburg.

Current Responsibilities:

1. Lecturer in Enterprise Development Module to Masters in Management (Entrepreneurship and New Venture Creation) class. Coordinate core course module activities, syndicate assignments, marking and examining the class assignments.
2. Lecturer in Global Entrepreneurship Module to Masters in Management (Entrepreneurship and New Venture Creation) class. Coordinate core course module activities, syndicate assignments, marking and examining the class assignments.
3. Lecturer in Research Theory & Design Module to Masters in Management (Entrepreneurship and New Venture Creation) class. Coordinate core course module activities, syndicate assignments, marking and examining the class assignments
4. Lecturer in Research Methods Module to Masters in Management (Entrepreneurship and New Venture Creation) class. Coordinate core course module activities, syndicate assignments, marking and examining the class assignments
5. Lecturer in Entrepreneurship & Innovation Module to MBA classes. Coordinate core course module activities, syndicate assignments, marking and examining the class assignments.
6. Supervise Master of Management & MBA students research projects – have supervised more than 15 Masters graduates and have an active supervision portfolio of more than 15 Masters candidates in 2017.

Select Executive Education Experience & Facilitation Portfolio (2017-18)

Facilitator and Lecturer in multiple WBS Executive Education and the Wits Commercial Enterprise Proprietary Limited Entrepreneurial Ways Uni programs and Applied Course – 2017-18 Portfolio:

1. Telkom BCX Digital Leadership Programme - Future Leaders: Module: Principles of Business & leadership Entrepreneurship & Innovation Module , 2018
2. MERSETA WBS CfE Design Space Program - Creativity, Innovation & Technology Modules
3. African Rainbow Minerals WBS Executive Education Future Leaders Development, BankSETA – WBS CfE Entrepreneurial Development Program - Group Dynamics, Self- leadership & Design Space - Creativity, Innovation & Technology Modules
4. Rand Water WBS Executive Education New Managers Programme, Innovation and Entrepreneurship Module
5. Eskom SOC - Research, Test and Development Division – WBS Leadership Team Executive Education Program - Self-Leadership & Group Dynamics Modules
6. JCDecaux WBS Accelerated Managerial Leadership for Professionals Program, Managerial Capability Module
7. BIDVest Academy 2018 Action Learning Program Assessments & Project evaluations
8. SPAR Group WBS CfE Entrepreneurial Development Program – Group Dynamics and Business Communication Modules
9. McDonalds WBS CfE Entrepreneurial Development Program –Group Dynamics & Exponential Technology Modules
10. Old Mutual Infinity WBS CfE Entrepreneurial Development Program - Group Dynamics & Exponential Technology Modules

SELECT ACADEMIC WORKS

Reference Publications - Business

1. MURIMBIKA, M. 2013. *STRATEGIC MANAGEMENT AND CORPORATE ENTREPRENEURSHIP: Influence of Strategic Management of Entrepreneurial Orientation of South Africa Financial and Business Service Sector*. Germany: LAP Lambert Academic Publishing. [BOOK] ISBN 978-3-659-31317-2

2. MURIMBIKA, M. and URBAN, B. (2013). Strategic management practices and corporate entrepreneurship: a cluster analysis of financial and business services. *Journal of Business Management,* 7(16), pp. 1522-1535.

3. McEdward MURIMBIKA and Boris URBAN, (2014). Strategic Innovation at The Firm Level: The Impact Of Strategic Management Practices On Entrepreneurial Orientation. International Journal of Innovation Management, 18, 1450016 [38 pages] DOI: 10.1142/S1363919614500169.

4. Nhemachena C, & M MURIMBIKA (2018). Motivations of sustainable entrepreneurship and their impact of enterprise performance in Gauteng Province, South Africa. Journal of *Business Strategy and Development. Forthcoming*

Other Referenced Academic Publications (Archaeology & Heritage Resources)

1. Murimbika, M. & B. Moyo. 2008. Archaeology and donor aid in the Developing World: The case for Local Heritage in Zimbabwe. Managing Archaeological Resources. Ed. F.P McManamon et. al. California: One World Archaeology 58.

2. Murimbika, M. 2013. Violated sepulchres? The quest for a proper space for disinterred indigenous dead and immortal remains in post-colonial South Africa. [Book Chapter]. Pp.: 213-232. In M. Manyanga & S Katsamudanga. Zimbabwean Archaeology in the post-independence era. Sapes Books, Harare.

3. Murimbika, M. 2004. Communing with the dead: an Ethnoarchaeological interpretation of Shona mortuary practices. British Archaeological Reports International Series, 1210: 181 – 188. [MONOGRAPH]

4. Murimbika M. & Schoeman M. H. 2006/07. Vessels for the ancestors: cupules and the annual rain- control cycles in the Shashe-Limpopo confluence area. Southern African Field Archaeology, Vol. 15 & 16: 26 - 34. [JOURNAL]

5. Murimbika, M. & Huffman, T.N. 2003. Shona ethnography and Late Iron Age burials. Journal of African Studies, Vol.1 (2): 237-246. [JOURNAL].

Post-Graduate University Theses & Dissertations:

- PhD. [Management, WBS Candidate 2016-2018] Research Topic: Systemic and local entrepreneurial intentions: Effects on employment growth
- Master of Management (M.M. [E&NVC]) (2012, Wits Business School) Influence of Strategic Management Practices on The Entrepreneurial Orientation of South African Firms in the Financial and Business Services Sector.
- Ph.D. (in Archaeology) (2005, University of the Witwatersrand, Johannesburg):
- Master of Philosophy (M.Phil.). (1999, University of Berger, Norway).

CITIZEN COMMUNITY SERVICE

- Member: **Limpopo Heritage Resources Agency Council** (nominated and appointed to the Provincial Statutory Body from the 2007 – 2009 term).
- Member: **Gauteng Provincial Heritage Resources Agency Council** (nominated and appointed to provincial Statutory Body from the 2006 – 2008 term.
- Member: nominated as Post-Graduate Representative to the University Forum Statutory Body for the Council of the University of the Witwatersrand, 2003-2005.
- President and Council Member of the Post-Graduate Association (PGA) of the University of the Witwatersrand, Johannesburg, 2001-2004.
- Associate (2003): International Committee on Archaeological Heritage Management (ICAHM).
- Member: South African Heritage Resources Agency (SAHRA) Limpopo Provincial Heritage Resources Agency (LIHRA) Review Committee (2005 – 2009).
- Member – 2000 to 2003: Archaeological Task Group (ATG) (Advisory Committee to the Joint Management Committee of the SANParks Board).
- Secretary General, 1997-1999: International Students Association, Bergen Norway.

OTHER CORPORATE POSITIONS AND RESPONSIBILITIES

1. PERIOD: 2005 to Jan. 2016: Position: Non Executive Director & Head of Research – Nzumbululo Holdings Limited [www.nzumbululo.com] (dynamic multi-service consultancy providing innovative solutions in Sustainability, Energy & Environment, Applied Social-Economic Research and Enterprise Development services, Heritage Development, Environmental Health and Safety).
2. 2011 – Present: Executive Director & Board Member Siyathembana Board of Directors, Siyathembana Trading 293 (Pty) Ltd. www.siyathembana.holdings
3. 2011 – Present: Director, Finishing Touch Trading 580 (FTT580) (Pty) Ltd. www.ftt580.com
4. 2010 – 2017: Chairman of Board of Directors, Nzumbululo Holdings (Pty) Ltd. www.nzumbululo.com
5. 2013 – 2016: Director, MPG Aqua Resources (Pty) Ltd.
6. 2003 - 20112: Founding Member and Director & Board member of Nzumbululo Heritage Solutions. www.nzumbululo.com
7. 2013 – Present: Board Member, Hekima Africa Foundation [HAF] –Not For Profit organisation active in African heritage Management space in Sub Saharan Africa.
8. 2005 – 2010: Non-Executive Member of Board of Directors, Tshisele Investments (Pty.) Ltd.
9. 2007 – 2012: Member of Board of Directors, Mukhaha Engineers and Mukhaha Consulting (Ltd. (South Africa and Namibia).

MULTI-DISCIPLINE SPECIALIST PROFFESSIONAL CONSULTANCY HIGHLIGHTS – SAMPLE PORTFOLIO – Public & SOE Sector

1. 2016-2019 City of Tshwane – Stream Team Leaders - Strategic Project and Programme Advisory, Facilitation and Implementation Services Linked to Investment Attraction and Facilitation for The City of Tshwane. Panel of experts to supplement and assist the CoT with turnkey and city sustainability in planning, design Implementation and management of strategic priority investment and policy formulation projects. Program involves: Economic Development and City Planning project and programme management and implementation services, including formulation of governance structures; Investment Environmental Planning services; Economic Incentives – research, policy and strategy formulation services; Evaluation of investment proposals received by the city in line with City's Investment Framework guidelines and supporting documentation.
2. 2007- 2008: Program Director – Addo Elephant National Parks Heritage Mapping Program for SANParks (World Bank Funded program)- Programme Director for the Addo Elephant National Parks Heritage Mapping Program commissioned by SANParks and funded by the World Bank Provided management and administrative leadership to the PMU team; Provided leadership in cultural heritage management initiative under the Heritage Mapping and Research Program.
3. 2012 –2014: Heritage Management Planning for Venetia Diamond Mine Development, Limpopo Province. Project Manager & Principal Investigator - Heritage Impact Assessment for the R60 Billion Venetia Diamond Mine expansion program. The study involves assessing the relationship between the Mapungubwe Cultural Landscape UNESCO World Heritage Site and sustainable mining in the region. The research report and a Heritage Management Plan for the project were developed to guide mining authorisation and sustainable mining development in relation to World Heritage Site cultural landscape in the Limpopo Valley region, Limpopo Province.
4. 2008 to 2011: The Oranjemund Shipwreck Namibia Program Phase I & II – International Maritime Heritage Project - Project Manager for the Oranjemund Shipwreck Namibia Program Phase I & II

– International Rescue Excavation exercise for a 15th Century Treasure Ship off the Oranjemund Coastline, Namibia; Coordinate Conservation Management, Artefact Storage Program, Artefact Catalogue and Database Development for the Namibian Government. Led an international team of heritage experts including Maritime Historians, Archaeologist, maritime heritage conservators, and museum specialist to rescue excavate the shipwreck discovered during diamond mining on the Atlantic coastal mine of Oranjemund in Namibia.

5. <u>2008- 2009: Program Director – Mpumalanga Province Greeting, Heritage and Greening Mpumalanga Flagship Program Management Unit [PMU] Programme Director</u> for the Mpumalanga Provincial Government Flagship Program Management Unit [PMU]. Provided management and administrative leadership to the PMU team until the provincial government re- integrated the services back into its department.
6. <u>2014 – 2018: Environmental and Heritage Impact Assessment Study for Eskom SOC Limited 765kV Powerline Development Northern to Western Cape Provinces</u>. <u>Programme Director:</u> R15 Million Environmental Authorisation (EIA) and Heritage Impact Assessment (HIA) Project for Eskom SOC Transmission Gamma-Kappa & Kappa-Omega 765kV Powerlines Development in Northern & Western Cape Provinces in South Africa. The project management responsibilities involves coordinating a team of independent scientific researchers and specialists ranging from economic impact study, socio-cultural assessment, ecology, Land use and land acquisition, ago- economists, rural and urban planning, environmental and built environment, tourism to terrestrial impact assessment studies. This power transmission project is one of the largest and strategic transmission projects Eskom has ever embarked on in the past two decades.
7. <u>2007 – 2009 World Bank (WB) Lesotho Highlands Development Authority (LHDA) Inflow River (IFR) Audit INR Project Team Specialist</u> responsible for the Social and Economic Impact Assessment Study for World Bank funded LHDA Inflow River Audit Environmental and Socio-economic Impact Assessment Review exercise.
8. <u>2008- 2009: Program Director – Mpumalanga Province Greeting, Heritage and Greening Mpumalanga Flagship Program Management Unit [PMU] Programme Director</u> for the Mpumalanga Provincial Government Flagship Program Management Unit [PMU]. Provided management and administrative leadership to the PMU team until the provincial government re- integrated the services back into its department.
9. <u>2016-2018 Transnet SOC Limited – Specialist Program Director</u> – Sustainability, Environment and Heritage Front End Loading (FEL-2) Feasibility Studies for the proposed R4 Billion Waterfront Marina and Maritime Development at the Port of Port Elizabeth in Eastern Cape.
10. <u>2014 - 2016: UNESCO World Heritage Lead Specialists</u> - Site Nomination Dossier Preparation for Nelson Mandela Legacy Heritage Site Program for National Heritage Council and Department of Environmental Affairs, South Africa. World Heritage Site Nomination Bid Dossier Preparation program involves a multi-disciplinary team assessing the Outstanding Universal Significance of the Mandela Legacy heritage for listing to the UNESCO World Heritage Site list. The specialists teams include world heritage exerts, sustainable development specialists, international convention advisory, local heritage legislations and specialist historians and tourism advisors.
11. <u>2014 – 2018: Environmental and Heritage Impact Assessment Study for Eskom SOC Limited 765kV Powerline Development Northern to Western Cape Provinces</u>. <u>Programme Director:</u> R15 Million Environmental Authorisation (EIA) and Heritage Impact Assessment (HIA) Project for Eskom SOC Transmission Gamma-Kappa & Kappa-Omega 765kV Powerlines Development in Northern & Western Cape Provinces in South Africa. The project management responsibilities involves coordinating a team of independent scientific

researchers and specialists ranging from economic impact study, socio-cultural assessment, ecology, Land use and land acquisition, ago- economists, rural and urban planning, environmental and built environment, tourism to terrestrial impact assessment studies. This power transmission project is one of the largest and strategic transmission projects Eskom has ever embarked on in the past two decades.

12. 2014-2015 - Regulatory Impact Assessment [RIA] Report for Proposed Draft Extension of Security of Tenure Amendment Bill (ESTA) Programme Director: Coordinated a multi-specialist team of firms and subject experts conducting a Regulatory Impact Assessment (RIA) for Extension of Security of Tenure Amendment Bill (ESTA) of 2013. The study included Economic, Legal, Social Developmental, Rural Public and Health Services, Cost Benefit Analysis (CBA) for the cost implications of the Extension of Security of Tenure Amendment Bill (ESTA) the Land Tenure Security (LTS) Policy for Commercial Farming Areas in the Republic of South Africa. The study provided a comprehensive picture of the economic impact of the proposed amendment in terms of economic activity, employment and production, provision of public services in education, health, etc., while the CBA evaluated the discounted costs and benefits of the amendment bill over time.
13. April-November 2013 Lead Researcher & Programme Director: Regulatory Impact Assessment (RIA) Land restitution policy. Regulatory Impact Assessment (RIA) focuses on the feasibility of the re- opening of the 1998 deadline for the lodgment of land claims by various persons and communities who were excluded from the restitution programme under the Restitution of Land Rights Act, 22 of 1994. The impact assessment involved legal assessment, economic impact assessment, social development ranging from public health to education delivery impact assessments. Client: Office of the Chief Director: Policy Research & Development, Department of Rural Development and Land Reform [DRDLR] (Private Bag X 833 Pretoria, 0001), with input and assistance from numerous other components of the DRDLR.
14. March - July 2010: Namibian Government-European Commission Delegation on Study Tour of European Heritage & Museum Institutions Mission Chief Scientist – Namibian Government- Delegation on Study Tour of European Heritage and Museum Institutions – led a study team of ten
(10) professionals from various Namibian government departments, business chambers and NAMDEB Diamond Mining Company on study tour of European Museums and Cultural Tourism institutions in France, Sweden, Spain, Belgium, Portugal, and Germany on fact finding mission to assist Namibian Government on Maritime and Mining Museum Development and tourism initiatives.
15. November 2011: The African Development Bank Review of Eskom Holding Medupi Power Plant Development Compliance Monitoring & Evaluation Mission - Independent Reviewer for the African Development Bank (AfDB) Compliance Monitoring & Evaluation of Eskom Holding Medupi Power Plant Development regarding meeting pre-set compliance target.
16. April-November 2013-14 - Regulatory Impact Assessment Report On The Feasibility Of The Provision Of Exceptions To The 1913 Cut Off Date To Accommodate The Descendants Of The Khoe And San, Heritage Sites And Historical Land Marks. Programme Director for the Regulatory Impact Assessment (RIA) study on the feasibility of the re-opening of lodgment of land claims, and provision of exceptions to the 1913 cut-off date to accommodate the descendants of the Khoe and San, heritage sites and historical landmarks. Focus Area: Regulatory Impact Assessment on provision of exceptions to the 1913 cut-off date to accommodate the descendants of the Khoe and San, heritage sites and historical landmarks.

17. 2009-11: Special Scientific Advisor to the Namibian Government Permanent Delegation to the UNESCO Convention of Under Water Heritage, Paris France. Special Scientific Advisor to the Namibian Government Permanent Delegation to the UNESCO Convention of Under Water Heritage Conference 2009, Paris France. Mission to assist the Namibian Government comply and become a signatory to the convention.

AUXILIARY ACADEMIC EXPERIENCE

2013-17: External Examiner for Master of Management, and Masters in Finance & MBA Students, Wits Business School

2012: Guest Lecturer in Business and Global Archaeology, 3rd Year Archaeology Class, School of Geography, Archaeology and Environmental Management, University of the Witwatersrand, Johannesburg.

2011/2013: Guest Lecturer in Corporate Entrepreneurship, Masters of Management, Wits Business School

2012: Guest Lecturer in Ethno-Archaeology, 3rd Year Archaeology Class, University of Pretoria. 2004-2005: Honorary Academic Staff, UKZN,

2001-2003: Field School Coordinator for The Mapungubwe Archaeology Field Research Project, Archaeology Unit of the School of Geography, Archaeology and Environmental Management, University of the Witwatersrand, Johannesburg.

OTHER - SELECT SEMINARS, LECTURES & CONFERENCE

1. 2017 Profiled Entrepreneurship Consultant – New York Times 2018 Online Publication segment on Invest SADC focusing on emerging entrepreneurial opportunities and dynamics in the southern Africa region.
2. 2017 SAfm National Radio Talk Show Guest hosted by Ashraf Garda on topic Innovation and Entrepreneurship in light of the 2017 Global Entrepreneurship Week Congress held in Johannesburg, SA
3. June, 14th 2016, Facilitator of the Enterprise Development Session – Department of Mineral Resources Youth in Mining: Procurement Transformation Summit, 2016, Indaba Hotel, Johannesburg
4. 2015 World Economic Forum (Africa) Cape Town – Panellist on the Entrepreneurship in Heritage and Arts sector in Africa.
5. 2013, Guest Speaker - Seminar Series Lecture, University of the Witwatersrand, School of Geography, Archaeology & Environmental Studies.
6. Visiting Lecturer, Wits Business School: Lecture Paper Presented: Strategic Management and Corporate Entrepreneurship in South Africa.
7. 2013, Visiting Lecturer, University of Pretoria, Archaeology Department: Lecture to 2nd Yr. Archaeology Students: Ethno-Archaeological Methods and practice: Making sense of Archaeological record.
8. February 12th 2013, Guest Scholar: Department of Rural development and Land Reform
9. 2018 – Guest Speaker - Port & Rail Annual Conference and Key Speaker Mobility Africa Conference 208, Durban ICC, eThekwin, KZN
10. 2017 Profiled Entrepreneurship Consultant – New York Times 2018 Online Publication

segment on Invest SADC focusing on emerging entrepreneurial opportunities and dynamics in the southern Africa region.

11. 2017 SAfm National Radio Talk Show Guest hosted by Ashraf Garda on topic Innovation and Entrepreneurship in light of the 2017 Global Entrepreneurship Week Congress held in Johannesburg, SA
12. June, 14th 2016, Facilitator of the Enterprise Development Session – Department of Mineral Resources Youth in Mining: Procurement Transformation Summit, 2016, Indaba Hotel, Johannesburg
13. 2015 World Economic Forum (Africa) Cape Town – Panellist on the Entrepreneurship in Heritage and Arts sector in Africa.
14. 2013, Guest Speaker - Seminar Series Lecture, University of the Witwatersrand, School of Geography,

    Archaeology & Environmental Studies.
15. Visiting Lecturer, Wits Business School: Lecture Paper Presented: Strategic Management and Corporate Entrepreneurship in South Africa.
16. 2013, Visiting Lecturer, University of Pretoria, Archaeology Department: Lecture to 2nd Yr. Archaeology Students: Ethno-Archaeological Methods and practice: Making sense of Archaeological record.
17. February 12th 2013, Guest Scholar: Department of Rural development and Land Reform Workshop, Kempton Park, Gauteng Province. Presentation Made: Conceptualising Research on Review of Land Reform: Towards sustainable restitution, (Presented jointly with S. Mguni, Rock Art Research Institute, Wits University)
18. March 25 – 29 2008, Bi-annual Conference for the Association of Professional Archaeologist in Southern Africa [ASAPA] Cape Town. Paper presented: Voluntary dormancy of systematic elimination: South African Archaeology in the era of Transformation.
19. June 26 – 29 2004, Bi-annual Conference for the Society for Africanist Archaeologist, Bergen Norway. Paper presented: Shifting kraals and changing uses of central spaces: Site spatial analysis for the K2 site in the Limpopo Valley.
20. April 2004, Southern African Association of Archaeologists (SA3) Biannual Conference, Kimberly: Poster Presentation in absentia – Archaeological Resources Management and Development.
21. June 2003: World Archaeological Congress 5, Washington DC, USA. Papers presented:
    i. Heritage on Target Sanction: Archaeology and donor aid in the Third World Countries: The

       case of Zimbabwe's World Heritage Sites.
    ii. Violated sepulchres? The quest for a proper place for indigenous dead and immortal remains in the new South Africa.
22. May 2003, State and Culture Conference, University of Edmonton, Canada. Paper Presented: Reburial and Repatriation of Human Remains in South Africa.
23. July 2002: Southern African Association of Archaeologists (SA3) Biannual Conference, Cape Town, South Africa. Papers presented:
24. May 2002 Society of Africanist Archaeologists Conference, Tucson, Arizona: Joint paper presentation with Prof. TN Huffman: Ethnography and Late Iron Age Burials in Southern Africa.
25. August-September 2001: African Archaeology in Global Perspective Conference, Bergen, Norway. Paper presented: Communing with the Dead: Shona mortuary practices.

PREVIOUS WORK HISTORY

1. PERIOD: 2003 – 2004: POSITION: Executive Officer – Institute of Resources Management at the Natal Museum, Pietermaritzburg, KZN.
2. PERIOD: February 2000 to 2003: POSITION: Research Consultant – Archaeology Resources

Management, School of Geography, Archaeology and Environmental Studies, University of the Witwatersrand.

3. PERIOD: 1997 to Dec. 1999: POSITION: Junior Lecturer & Graduate Researcher. ORGANISATION: Institute of Archaeology, the University of Bergen, Bergen City, Norway. RESPONSIBILITIES: teaching undergraduate international class in Archaeology, Specialist Researcher African archaeology and ethno- archaeology.
4. PERIOD: 1996 to 1997: POSITION: Junior Lecturer. ORGANISATION: University of Zimbabwe, Junior Lecturer in Archaeology. RESPONSIBILITIES: Lecture and tutor undergraduate classes in archaeology, supervise field research.
5. PERIOD: 1995: POSITION: Curator. ORGANISATION: Museum of Natural History, National Museums and Monuments of Zimbabwe. RESPONSIBILITIES: Junior Curator and Keeper of archaeological and ethno-archaeological collections in the museum's natural history collections.

AWARDS

2001-2004: Post-Graduate Research Award for Archaeological Resources Management, GAES, University of the Witwatersrand.

2001-2004: Mellon Foundation Mentorship Award University of the Witwatersrand.

2001 - 2004: University Postgraduate Merit Award Bursary, University of the Witwatersrand.

2001: British Institute in East Africa Research Grant for Research in Kenya and Tanzania.

1998: Erasmus EU International scholarship – postgraduate study in Belgium at the University of Brussels,

1997-1999: Norwegian Department of Education International Postgraduate Scholarship & International Research Award.

1994-1995 – Swedish Agency for Research and Economic Cooperation Scholarship Award for BA Honours Program at University of Zimbabwe.

FELLOWSHIPS

1997: British Institute in East Africa – Kenya & Tanzania – Visiting researcher, the East African Archaeology Research Program of the BIEA.

PROFESSIONAL AFFILIATIONS

Member: Institute of Directors Southern Africa (IoDSA). Member:

World Archaeological Congress (WAC).

Member: Association of Southern African Professional Archaeologists (ASAPA).

Principal Investigator Professional Member: Cultural Resources Management (CRM) Chapter of Association of Southern African Professional Archaeologists (ASAPA).

AUXILLIARY SPECIALIST SKILLS

- Key Management skills
- Exponential Technology & Entrepreneurialism Business

  Coaching and Mentorship

- Business & Socio-Economic Impact Assessment
- Sustainable development programmes assessment
- Public & Organisational Policy Review & Impact Assessment
- New Venture Creation Development & New Venture Creation Mentorship Corporate Entrepreneurship & Business Mentorship
- Social Entrepreneurship & Social Enterprise Development Leadershift Advocacy & Solutions Architect
- Continuous Professional Development Capacitation

REFEREES

Dr. Weber Ndoro
Director-General –
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Prof. Boris Urban
Chair & Director: Entrepreneurship Program, Graduate School of Business Administration,
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P. O. Box 98, Wits 2050, South Africa; Tel: 011 717-3762 |Email: boris.urban@wits.ac.za | Mobile: 083 793 3069 Website: http://wits.academia.edu/borisurban/about

Prof. Shadreck Chirikure
University of Cape Town, Rondebosch, 7701 E-mail: shadreck.chirikure@uct.ac.za | Mobile: + (27) (0)722421270 |Tel: Work: 021 650 2351

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School of Social Sciences, University of the Witwatersrand Private Bag 3; PO Box Wits 2050; Johannesburg; South Africa
Tel: + 27 (0) 11 717 4435 | Fax: 086 512 3601 | Email: Samuel.Kariuki@wits.ac.za

Ms. Chimene Chetty
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<< archaeologists

THE ASSOCIATION OF SOUTHERN AFRICAN PROFESSIONAL ARCHAEOLOGISTS

Certificate of Membership

is hereby to confirm that

DR MCEDWARD MURIMBIKA

Valid: April 2019 - April 2020

2019

is a professional member (nr 194) of the Association of Southern African Professional Archaeologists (ASAPA) and is in good standing with the organisation.

He also holds the following CRM accreditations:
Principal Investigator: Iron Age

SARAH WURZ
CHAIR

LU-MARIE FRASER
MEMBERSHIP SECRETARY

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Emkhiweni Substation and 400kV Line from Emkhiweni Substation to Silimela

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
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0001

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Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	**Agricultural Research Council-Soil, Climate and Water**			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	**Level 8**	Percentage Procurement recognition	**Unknown**
Specialist name:	**DG Paterson**			
Specialist Qualifications:	**PhD (Soil Science)**			
Professional affiliation/registration:	**SACNASP Registration (Soil Science): 400463/04**			
Physical address:	**600 Belvedere Street, Arcadia, Pretoria 0083**			
Postal address:	**Private Bag X79, Pretoria**			
Postal code:	**0001**		Cell:	**083 556 2458**
Telephone:	**012 310 2601**		Fax:	**012 323 1157**
E-mail:	garry@arc.agric.za			

2. DECLARATION BY THE SPECIALIST

I, **DG Paterson**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

ARC-Soil, Climate and Water

Name of Company:

28th August 2019

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **DG Paterson**, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

ARC-Soil, Climate and Water

Name of Company

28th August 2019

Date

OWEN PULA
Commissioner of Oaths/ Kommissaris van Ede
Ex Officio in terms of Act 16 of 1963
Human Resource Officer
Ex Officio in terme van Wet 16 van 1963
Menslike Hulpbronbeampte
600 Belvedere Street - Belvederestraat 600
Arcadia Pretoria 0083

Signature of the Commissioner of Oaths

29/08/2019

Date

LANDBOUNAVORSINGSRAAD
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2019 -08- 29
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INSTITUTE FOR SOIL CLIMATE AND WATER
AGRICULTURAL RESEARCH COUNCIL

CURRICULUM VITAE: D G Paterson

SURNAME:	PATERSON
FIRST NAME(S):	David Garry
KNOWN AS:	Garry
DATE OF BIRTH:	25-08-1959 in Bellshill, Scotland
NATIONALITY:	South African
I.D. No.:	5908255258088
LANGUAGE PROFICIENCY:	English, Afrikaans (both fluent), French (poor)
MARITAL STATUS:	Married, one son

ADDRESS: ARC-Institute for Soil, Climate and Water
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FAX: 012 323 1157

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ACADEMIC QUALIFICATIONS:

- Matriculated: 1976, Dalziel High School, Motherwell, Scotland
- BSc (Hons) Geography, 1980, University of Strathclyde, Glasgow, Scotland
- MSc (Soil Science) *cum laude*, 1998, University of Pretoria
- PhD (Soil Science), 2014, University of Pretoria

PROFESSIONAL CAREER:

- 1981-1987: Soil Scientist: Soil and Irrigation Research Institute, Pretoria
- 1987-1992: Senior Soil Scientist: Soil and Irrigation Research Institute, Pretoria
- 1992-2017: Senior Soil Scientist: ARC-Soil, Climate & Water, Pretoria
- 2017- : Research Team Manager (Soil Science): ARC-Soil, Climate & Water

FIELDS OF SPECIALITY AND COMPETENCE:

- Soil classification and mapping
- Soil interpretations
- Soil conservation, including biotextiles
- Soil rehabilitation (especially coal mine soils)
- Soil survey project management
- Environmental assessment and land evaluation
- Soil survey and land capability course presentation
- Ground penetrating radar

PUBLICATIONS (see attached list):

- Fifteen refereed articles
- Nine Congress papers/posters
- Two book chapter contributions
- S.A. Soil Classification (1991 and 2018 editions) *(Member of working group)*
- Five 1:250 000 Land Type Maps
- Three Land Type Memoirs
- More than 250 soil survey reports and/or maps

COURSES COMPLETED:

- Course in Project Management (University of Stellenbosch)
- Course in Junior Personnel Management (Dept of Agriculture)
- Course in Handling of Grievances and Complaints (Dept of Agriculture)
- Course in Marketing (ARC-ISCW)
- Course in National Qualifications Framework Assessment, ARC-CO
- Training Course in Ground Penetrating Radar (GSSI, USA)
- Introduction to ArcGIS 8, GIMS, 2004

PROFESSIONAL STATUS:

- Registered Natural Scientist: Soil Science (SA National Council for Natural Scientific Professions) – registration number 400463/04
- Member of South African Soil Classification Working Group, 1990-present
- Convenor of South African Soil Classification Working Group, 2013-2015
- Member of Soil Science Society of South Africa (1982-present)
- President of Soil Science Society of South Africa (2005-2007)
- Member of South African Soil Survey Organisation (2000-present)
- Council Member of South African Soil Survey Organisation (2002-2003)
- Member of International Erosion Control Association
- Scientific Referee, S.A. Journal for Plant and Soil
- External Examiner: University of Pretoria, University of Witwatersrand, University of Venda, University of the Free State

AWARDS:

Best article on Soil Science, South African Journal for Plant and Soil, 2011

MISCELLANEOUS:

- Editor, Soil Science Society newsletter, 1993-present
- Member, Clapham High School (Pretoria) Governing Body, 1998-2002
- Member, Northern Gauteng Football Referee's Association, 2000-2002
- Committee Member, Rosslyn Golf Club (Club Champion 2002 and 2007)

INTERESTS:

Sport, especially golf and soccer; wildlife; reading; music

PUBLICATIONS LIST:

Refereed Articles:

BüHMANN, C., KIRSTEN, W.F.A., PATERSON, D.G. & SOBCZYK, M.E., 1993. Pedogenic differences between two adjacent basalt-derived profiles. 1. Textural and chemical characteristics. *S. Afr. J. Plant & Soil*, 10: 155-161

BüHMANN, C., KIRSTEN, W.F.A., PATERSON, D.G. & SOBCZYK, M.E., 1994. Pedogenic differences between two adjacent basalt-derived profiles. 2. Mineralogical characteristics.*S. Afr. J. Plant & Soil*, 11: 5-11

PATERSON, D.G. & LAKER, M.C., 1999. Using ground penetrating radar to investigate spoil layers in rehabilitated mine soils*. S. Afr. J. Plant & Soil*, 16:131-134.

PATERSON, D.G., BüHMANN, C., PIENAAR, G.M.E. & BARNARD, R.O., 2011. Beneficial effects of palm geotextiles on inter-rill erosion in South African soils and mine dam tailings: a rainfall simulator study. *S. Afr. J. Plant & Soil*, 28: 181-189.

PATERSON, D.G. & BARNARD, R.O., 2011. Beneficial effect of palm geotextiles on inter-rill erosion in South African soils . *S. Afr. J. Plant & Soil*, 28: 190-197.

BHATTACHARRYA, R., FULLEN, M.A., BOOTH, C.A., KERTESZ, A., TOTH, A., SZALAI, Z., JAKAB, G., KOZMA, K., JANKAUSKAS, B., JANKAUSKIENE, G., BÜHMANN, C., PATERSON, D.G., MULIBANA, N.E., NELL, J.P., VAN DER MERWE, G.M.E., GUERRA, A.J.T., MENDONCA, J.K.S., GUERRA, T.T., SATHLER, R., BEZERRA, J.F.R., PERES, S.M., ZHENG YI, LI YONGMEI, TANG LI, PANOMTARANICHAGUL, M., PEUKRAI, S., THU, D.C., CUONG, T.H., TOAN, T.T., 2011. Effectiveness of biological geotextiles for soil and water conservation in different agro-environments. *Land Degradation and Development*, 22: 495-504.

FULLEN, M.A., SUBEDI, M., BOOTH, C.A., SARSBY, R.W., DAVIES, K., BHATTACHARRYA, R., KUGAN, R., LUCKHURST, D.A., CHAN, K., BLACK, A.W., TOWNROW, D., JAMES, T., POESEN, J., SMETS, T., KERTESZ, A., TOTH, A., SZALAI, Z., JAKAB, G., JANKAUSKAS, B., JANKAUSKIENE, G., BÜHMANN, C., PATERSON, D.G., MULIBANA, N.E., NELL, J.P., VAN DER MERWE, G.M.E., GUERRA, A.J.T., MENDONCA, J.K.S., GUERRA, T.T., SATHLER, R., BEZERRA, J.F.R., PERES, S.M., ZHENG YI, LI YONGMEI, TANG LI, PANOMTARANICHAGUL, M., PEUKRAI, S., THU, D.C., CUONG, T.H., TOAN, T.T., JONSYN-ELLIS, F., SYLVA, J.T., COLE, A., MULHOLLAND, B., DERALOVE, M., CORKILL, C. & TOMLINSON, P., 2011. Utilising biological geotextiles: introduction to the Borassus Project and global perspectives. *Land Degradation and Development*, 22: 453-462.

SMETS, T., POESEN, J., BHATTACHARRYA, R., FULLEN, M.A., SUBEDI, M., BOOTH, C.A., KERTESZ, A., SZALAI, Z., TOTH, A., JANKAUSKAS, B., JANKAUSKIENE, G., GUERRA, A.J.T., BEZERRA, J.F.R., ZHENG YI, PANOMTARANICHAGUL, M., BÜHMANN, C. & PATERSON, D.G., 2011. Evaluation of biological geotextiles for reducing runoff and soil loss under various environmental conditions using laboratory and field data. *Land Degradation and Development*, 22: 480-494.

NETHONONDA. L.O., **ODHIAMBO, J.J.O. & PATERSON, D.G.,** 2012. Indigenous knowledge of climatic conditions for sustainable crop production under resource-poor farming conditions using participatory techniques. *Sustainable Agriculture Research,* 2 (1), 26-31.

NETHONONDA, L.O., ODHIAMBO, J.J.O. & PATERSON, D.G., 2012. Assessment of spatial variability of selected soil chemical properties in a communal irrigation scheme under resource-poor farming conditions in Vhembe District of Limpopo Province, South Africa. *African J. Agric. Res.* 7 (39), 5445-5492.

NETHONONDA, L.O., ODHIAMBO, J.J.O. & PATERSON, D.G., 2013. Spatial variability of soil penetrability and distribution of compacted layer as affected by long-term ploughing at shallow depth in Rambuda irrigation scheme in Vhembe district, South Africa. *Bulgarian Journal of Agricultural Science*, 19 (2): 248-254.

SUBEDI, M., FULLEN, M.A., BOOTH, C.A., THU, D.C., CUONG, T.H, TOAN, T.T., JONSYN-ELLIS, F., COLE, A., GUERRA, A.J.T., BEZERRA, J.F.R., YI. Z., LI, T., BüHMANN, C. & PATERSON, D.G., 2012. Contribution of biogeotextiles to soil conservation and socio-economic development. *Outlook on Agriculture*, 41(3).

PATERSON, D.G., SMITH. H.J. & VAN GREUNEN, A., 2013. Evaluation of soil conservation measures on a highly erodible soil in the Free State province, South Africa. *S. Afr. J. Plant & Soil*, 30: 213-217.

PATERSON, D.G., TURNER, D.P., WIESE, L.D., VAN ZIJL, G.M., CLARKE, C.E. & VAN TOL, J., 2015. Spatial soil information in South Africa – situational analysis, limitations and challenges. *S. Afr. J. Science* 111 (5/6). Art. #2014-0178, 7 pages. http://dx.doi.org/10.17159/sajs.2015/20140178.

PATERSON, D.G., MUSHIA, N.M. & MKULA, S.D., 2018. Effects of stockpiling on selected properties of opencast coalmine soils. *S. Afr. J. Plant & Soil*, 36:2, 101-106. DOI: 10.1080/02571862.2018.1493161

EZEOKOLI, O.T., NWANGBURUKA, C.C., ADELEKE, R.A., ROOPNARAIN, A., PATERSON, D.G., MABOETA, M.S. & BEZUIDENHOUT, C.C., 2018. Assessment of arbuscular mycorrhizal fungal spore density and viability in soil stockpiles of South African opencast coal mines. *S. Afr. J. Plant & Soil*, 36:2, 91-99. DOI: 10.1080/02571862.2018.1537011

Books & Reports:

PATERSON, D.G & MUSHIA, N.M., 2012. Chapter 32. Soil databases in Africa. *In: Handbook of Soil Science: Resource Management and Environmental Impacts (2nd Edn). Eds. P.M. Huang, Y Li & M.E. Sumner.* CRC Press, Boca Raton FL.

ZGŁOBICKI, W., POESEN, J., DANIELS, M., DEL MONTE, M. GUERRA, A.J.T., JOSHI, V., PATERSON, D.G., SHELLBERG, J., SOLÉ-BENET, A. & ZHENG'AN SU, 2018. Chapter 9. Geotouristic value of Badlands. *In: Badland dynamics in the context of global change. Eds. E. Nadal-Romero, J.F. Martinez-Murillo, N.J. Kuhn.* Elsevier, Amsterdam.

SOIL CLASSIFICATION WORKING GROUP*, 1991. Soil classification. A taxonomic system for South Africa. ARC-Institute for Soil, Climate & Water, Pretoria.

SOIL CLASSIFICATION WORKING GROUP*, 2018. Soil classification. A natural and anthropogenic system for South Africa. ARC-Institute for Soil, Climate & Water, Pretoria.

* Co-author as member of Working Group

JOB, N.M., LE ROUX, P.A.L., TURNER, D.P., VAN DER WAALS, J.H., GRUNDLING, A.T., VAN DER WALT, M., DE NYSSCHEN, G.P.M. & PATERSON, D.G., 2018. Developing wetland distribution and transfer functions from land type data as a basis for the critical evaluation of wetland delineation guidelines by inclusion of soil water flow dynamics in catchment areas. *Volume 1: Improving the management of wetlands by including hydropedology and land type data at catchment level.* Report No. 2461/1/18, Water Research Commission, Pretoria.

Theses:

PATERSON, D.G., 1998. The use of ground penetrating radar to investigate subsurface features in selected South African soils. Unpublished MSc Thesis, University of Pretoria.

PATERSON, D.G., 2014. The use of palm leaf mats in soil erosion control. Unpublished PhD Thesis, University of Pretoria.

Congress Papers:

PATERSON, D.G., 1987. The relationship between geology and soil type in the northern Kruger National Park. 14th Congress of the Soil Science Society of S.A. Nelspruit, 14-17 July 1987.

PATERSON, D.G., 1990. A study of black and red clay soils on basalt in the northern Kruger National Park. 16th Congress of the Soil Science Society of S.A. Pretoria, 9-12 July 1990.

PATERSON, D.G., 1992. The potential of ground penetrating radar as an aid to soil investigation. 17th Congress of the Soil Science Society of S.A. Stellenbosch, 28-30 January 1992.

PATERSON, D.G., 1995. The complex soil mantle of South Africa. ARC Wise Land Use Symposium, Pretoria, 26-27 October 1995

PATERSON, D.G. & LAKER, M.C., 1998. Locating subsoil features with ground penetrating radar. 21st Congress of the Soil Science Society of S.A. Alpine Heath, 20-22 January 1998.

PATERSON, D.G., 2000. Mapping rehabilitated coal mine soils in South Africa using ground penetrating radar. Eighth International Conference on Ground Penetrating Radar, Gold Coast, Australia, 23-26 May 2000.

PATERSON, D.G. & VAN DER WALT, M., 2003. The soils of South Africa from the Land Type Survey. 24th Congress of the Soil Science Society of S.A., Stellenbosch, 20-24 January 2003.

PATERSON, D.G., 2015. Geotextiles – applications for soil conservation. Congress of the Soil Science Society of S.A., George, 19-22 January 2015.

Land Type Maps:

PATERSON, D.G., 1990. 1:250 000 scale land type map 2230 Messina. Dept. Agriculture, Pretoria.

PATERSON, D.G. & HAARHOFF, D., 1989. 1:250 000 scale land type map 2326 Ellisras. Dept. Agriculture, Pretoria.

PATERSON, D.G., PLATH, B.L. & SMITH, H.W., 1987. 1:250 000 scale land type map 2428 Nylstroom. Dept. Agriculture, Pretoria.

PATERSON, D.G. & ROSS, P.G., 1989. 1:250 000 scale land type map 2330 Tzaneen. Dept. Agriculture, Pretoria.

PLATH, B.L. & PATERSON, D.G., 1987. 1:250 000 scale land type map 2426 Thabazimbi. Dept. Agriculture, Pretoria.

Land Type Memoirs:

PATERSON, D.G., PLATH, B.L. & SMITH, H.W., 1988. Field Investigation. In: *Land types of the maps 2426 Thabazimbi & 2428 Nylstroom. Mem. Agric. Nat. Res. S. Afr.* No. 10. Dept. Agriculture, Pretoria.

PATERSON, D.G., SCHOEMAN, J.L., TURNER, D.P., GEERS, B.C. & ROSS, P.G., 1989. Field Investigation. In: *Land types of the maps 2330 Tzaneen & 2430 Pilgrim's Rest. Mem. Agric. Nat. Res. S. Afr.* No. 12. Dept. Agriculture, Pretoria.

PATERSON, D.G., 1999. 1:250 000 land type survey of the former Ciskei (Unpublished). ISCW Report GW/A/99/24.

Also:

PATERSON, D.G., 1992. Ground penetrating radar applications in USA and South Africa. Report on an official study tour to USA, 13-29 July, 1991. ISCW Report GW/A/92/8.

PATERSON, D.G., 2000. Report on official overseas visit to GPR2000 Conference, Broadbeach, Australia, 23-26 May, 2000. ISCW Report GW/A/2000/40.

Plus: numerous ARC-ISCW Reports on soil surveys, soil interpretations, environmental impact assessments, soil suitability studies.

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Emkhiweni Substation and 400kV Line from Emkhiweni Substation to Silimela

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

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473 Steve Biko Road
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Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Eco- Elementum			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)		Percentage Procurement recognition	
Specialist name:	Neel Breitenbach			
Specialist Qualifications:	Bsc Geography			
Professional affiliation/registration:				
Physical address:	442 Rodericks Road, Lynwood, Pretoria, 0081			
Postal address:				
Postal code:		Cell:	083 419 2249	
Telephone:	012 807 0383	Fax:		
E-mail:	neel@ecoe.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Neel Breitenbach**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Eco-Elementum

Name of Company:

15-08-2019

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Neel Breitenbach**, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Eco-Elementum

Name of Company

15-8-2019

Date

Signature of the Commissioner of Oaths

15/08/19

Date

Kelly McTaggart
Commissioner of Oaths
Practising Attorney R.S.A.
9B Norman Street
Silverlakes
Pretoria

Name	:	Mr Neel Breitenbach
Profession	:	Environmental Consultant
Date of Birth	:	1984/11/29
Parent Firm	:	Eco Elementum
Position in Firm	:	Environmental Scientist
Years with firm	:	3 years
Nationality	:	South African
BI & Male/Female Status	:	White Male
Professional Qualification	:	B.Sc (Geography) University of Pretoria 2008

LANGUAGE	SPEAK	READ	WRITE
English	Y	Y	Y
Afrikaans	Y	Y	Y

Countries of Work Experience	:	**South Africa,**
Proposed Position on Team	:	**Air Quality and Visual Impact Assessments**

SUMMARY

Neel has a BSc in Geography with 7 years of experience in air quality related projects and 3 years in visual related projects, which include air quality modelling. He also has extensive experience in GIS.

RELEVANT EXPERIENCE

- Ergosat Air Quality impact assessment.
- Afrimat Gravel Air Quality impact assessment
- Umnothowe Sizwe Air Quality impact assessment
- Buaba Platinum Air Quality impact assessment
- Madonsi Coal Air Quality impact assessment
- Roman Catholic Church Visual impact assessment
- Northern Light Welkom Gold Air Quality impact assessment
- Carocode Air Quality impact assessment
- Mahikeng Substation and Powerline Visual impact assessment
- Kleinfontein Air Quality impact assessment
- Kleinfontein Visual impact assessment
- Glenover Phosphate Air Quality impact assessment
- Glenover Phosphate Visual impact assessment
- Manungu Air Quality impact assessment
- Welgedacht Colliery Air Quality impact assessment
- Welgedacht Colliery Visual impact assessment
- Clydesdale Air Quality impact assessment
- Mookodi-Mahikeng Powerline Visual impact assessment
- Bloemendal Coal Air Quality impact assessment
- Bloemendal Coal Visual impact assessment
- Rondevly Mining Permit Air Quality impact assessment
- Rondevly Mining Permit Visual impact assessment
- Diepsoils Vaalbank Coal Air Quality impact assessment
- Diepsoils Vaalbank Coal Visual impact assessment
- Yakani Lanfill Visual impact assessment
- Tala Bethal Coal Air Quality impact assessment
- Tala Bethal Coal Visual impact assessment

SUMMARY OF OTHER EXPERIENCE

2016 to Date Eco-Elementum, Air Quality, Visual Impact and GIS Specialist

2012 to 2014 SME –Project manager, ISO 9001 implementation
2009 to 2012 Airshed – Air Quality Specialist
2008 to 2009 TGIS – GIS specialist

DECLARATION

I confirm that the above information contained in the CV is an accurate description of my experience and qualifications and that, at the time of signature.

__________________________ 22 January 2018

Signature of Staff Member Date

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Emkhiweni Substation and 400kV Line from Emkhiweni Substation to Silimela

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:				
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)		Percentage Procurement recognition	
Specialist name:	Ciaran Chidley			
Specialist Qualifications:	B.A. (Economic), MBA			
Professional affiliation/registration:				
Physical address:	147 Bram Fischer Drive, Ferndale			
Postal address:	P.O.Box 1673, Sunninghill			
Postal code:	2157	Cell:	082 788 1298	
Telephone:	011 781 1730	Fax:	011 781 1731	
E-mail:	CiaranC@nemai.co.za			

2. DECLARATION BY THE SPECIALIST

I, ___Ciaran Chidley________________________, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

____

Signature of the Specialist

Nemai Consulting (PTY) Ltd

Name of Company:

2019-09-10

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, __Ciaran Chidley______________________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

____
Signature of the Specialist

Henri Consulting (PTY) Ltd
____
Name of Company

2019-08-15
____
Date

1511539 o/o
____
Signature of the Commissioner of Oaths

____
Date

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2019 -09- 16
C.S.C
LINDEN
SUID-AFRIKAANSE POLISIEDIENS

CURRICULUM VITAE – Ciaran Chidley

1. Personal Particulars

Name:	Ciaran Chidley
Date and place of birth:	1970-12-18, South Africa
Place (s) of tertiary education and dates associated therewith:	University of Witwatersrand - 1989 to 1992; UNISA - 1993 to 1995; University of Witwatersrand - 2000 to 2002
Professional awards:	

2. Qualifications

Institution (Date from – Date to)	Degree(s) or Diploma(s) obtained
University of Witwatersrand 1989 to 1992	BSc Eng (Civil)
UNISA 1993 to 1995	BA (Economics)
University of Witwatersrand 2000 to 2002	MBA

Membership of professional bodies:	IAIA, SAICE

3. Name of current employer and position in enterprise

Name of current employer:	Nemai Consulting
Position in enterprise:	Environmental Engineer

4. Overview of post graduate / diploma experience (year, organization and position)

Date (From – To)	1993 to 1997
Organisation	Murray and Roberts
Position	Engineer

Date (From – To)	1997 to 2000
Organisation	Bergman Ingerop
Position	Engineer

Date (From – To)	01/01 to date
Organisation	Nemai Consulting
Position	Manager

5. Outline of recent assignments / experience that has a bearing on the scope of work

EIA for the Sun City to Phokeng Provincial Road, for North West Province Department of Transport and Roads
EIA for Empangeni Bulk Outfall Sewer, 40km pipeline, for local municipality
EIA for Hazelmere Dam Raising in KwaZulu-Natal, for Department of Water Affairs
EIA for Mhlabatshane Dam EIA in Southern KwaZulu-Natal, for Umgeni Water

Project management of EIA for the upgrade of roads in Lethabong and Maumong, for the Rustenburg Local Municipality
Project management of EIA for the P2/4 road , for the North West Province Department of Roads, Transport and Community Safety
Namakwa District Municipality Environmental Management Framework and Strategic Environmental Management Plan, for Department of Environment and Nature Conservation
Emnambithi / Ladysmith Local Municipality Environmental Management Framework and Strategic Environmental Management Plan
Mthonjaneni Municipality Strategic Environmental Assessment
Social impact study of defunct mine water in the Loskop Dam Catchment area including some comments on the catchment study for the area.
Socio-economic study for the Tweefontein Optimisation Project
Detailed public participation to identify surface holings between ERM and Durban Roodepoort Deep
Social facilitation for the relocation of informal settlements for the Municipality of Rustenburg.

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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0001

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Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Sazi Environmental Consulting cc			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	1	Percentage Procurement recognition	135%
Specialist name:	Nonkanyiso Zungu			
Specialist Qualifications:	BSc Biological Science ,BSc Honours (Ecology), and MSc Environmental Management			
Professional affiliation/registration:	South African Council for Natural Scientific Professions (SACNASP, Pr. Nat. Sci. (Practice no.400194/10): Ecological Science Member of the Gauteng Wetland Task Group Member of WISA (Gauteng Region)			
Physical address:	2 Morris street West Woodmead Sandton 2191			
Postal address:	P.O. Box 201 Carlswald 1684			
Postal code:	2191	Cell:	084 800 0187	
Telephone:	010 442 4795	Fax:	-	
E-mail:	nzungu@sazienvironmental.co.za			

2. DECLARATION BY THE SPECIALIST

I, _________ Nonkanyiso Zungu ________________________, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Sazi Environmental Consulting cc

Name of Company:

15-August-2019

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, ________Nonkanyiso Zungu____________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Sazi Environmental Consulting cc

Name of Company

15-August-2019

Date

Signature of the Commissioner of Oaths

15/08/2019

Date

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner

SIGNATURE

Commissioner of Oaths: [illegible] Khumalo

Designation: Certified [illegible] Accountant [illegible] (SA) 4804292

Date: 15/08/2019

107 [illegible] Street, [illegible] City, [illegible], 2188

Nonkanyiso Zungu
ID-82030905700088
Female, South African
Cell-084 800 0187

Profile Summary

Nonkanyiso Zungu is a Professional Natural Scientist (Pr.Sci.Nat) with 13 years' experience in the environmental field, including GIS. She is currently a PhD candidate at the University of Cape Town doing research on climate change effects on freshwater ecology. She obtained her Masters Degree in Environmental Management from the University of Pretoria with a specialty in Water Resource Management. She has extensive experience in water resource management, waste management, and obtaining environmental authorisations (air, water, waste) across sectors that include: Power generation, infrastructure (Construction), transportation (rail), waste disposal, water purification & sewage works. The projects she has undertaken include: Environmental Impact Assessments, Basic Assessments, Environmental Feasibility Studies, Environmental scoping studies, Environmental legal compliance audits, Waste management licences, Water use licences, and Baseline risk assessments.

Nonkanyiso Zungu is a Health & Safety and Environmental (SHE) auditor and is knowledgeable on internal integrated SHEQ auditing. She has experience on development and implementation of ISO 14001: 2004 management system and undertaking internal audits.Nonkanyiso is also a wetland specialist with experience in wetland delineation, determination of present ecological status, ecological importance and sensitivity evaluations, and wetland rehabilitation planning using packages that include Wet-Health, Wet-EcoServices, and Wet-RehabEvaluate.

Tertiary Education:

Qualification: Phd Ecology
Institute: University of Cape Town
Year: 2017-Current

Qualification: MSc Environmental Management
Institute: University of Pretoria
Year: 2011

Qualification: BSc Honours (Ecology)
Institute: University of KwaZulu-Natal
Year: 2005

Qualification: BSc Biological Science
Institute: University of KwaZulu-Natal
Year: 2003

Professional Registration

- South African Council for Natural Scientific Professions (SACNASP, Pr. Nat. Sci. (Practice no. 400194/10): Ecological Science
- Member of the Gauteng Wetland Task Group
- Member of WISA (Gauteng Region)

Short Courses

- ISO 14001 IMPLEMENTATION AND INTERNAL AUDITING
- ISO 18001 IMPLEMENTATION AND INTERNAL AUDITING
- ISO 9001 IMPLEMENTATION AND INTERNAL AUDITING
- LEAD AUDITING (SAATCA)
- INCIDENT AND ACCIDENT INVESTIGATIONS
- QUALIFIED WETLAND ASSESSMENT PACTITIONER (WET-HEALTH; WET IHI, SPATSIM)
- ESRI GIS MAPPING, ARCMAP 10

Key Skills

- ESRI GIS MAPPING, ARCMAP 10
- ISO 14001: 2004 internal auditing
- Legal compliance auditing
- Wetland delineation and assessment
- Environmental Impact Assessment
- Waste Management Licence Applications
- Water Use Licence Applications
- Basic Assessments
- Feasibility Studies (Fatal flaw analysis)

Employment History

- 2014 – Current SAZI Environmental Consulting cc
- 2011 - 2014 Sebata Group of Companies
- 2009 - 2011 Department of Water Affairs
- 2007 - 2009 Wetland Consulting Services
- 2005 - 2006 University of KwaZulu-Natal (Maluti Transfontier Conservation Program)

Nonkanyiso Zungu
ID-82030905700088
Female, South African
Cell-084 800 0187

- 2004 – 2005 University of KwaZulu-Natal (Welgevonden Elephant Program)

PROJECT EXPERIENCE

PROJECT NAME	YEAR	RESPONSIBILITY	CONTACT DETAILS	REFERENCE NUMBER
SITE CONSERVATION MANAGEMENT				
COJ Alien Invasive Species monitoring, control and eradication plan	2017	• Inception Report • Literature review • Communication plan • AIS database • AIS management and monitoring plan	Company: Lebone Enginnering Pty Ltd Contact: Kevin Radebe Tel: 082 850 6893	
KwaMaphumulo	2014-2015	• Compiling and Implementation of a Land Management Plan • Alien species eradication • Alien species management and monitoring plan	Company: PowerRush Trading Pty Ltd Contact Person: Zamani Msomi Tel: 011 312 5980	

Amakhosi Game Farm	2013-2015	• Environmental Education
		• Daily inspection of the fence
		• Daily Inspection of Alien invasive species and eradication
		• Draft quotations for environmental work that needs to be implemented.
		• Management of third party environmental projects
		  • Wetland assessments
		  • Fauna and Flora studies
		  • Erosion control
			Company: Zufi Engineering
			Contact Person: Ntokozo Ndwandwe
			Tel: 071 687 6359	

Land management services for a game farm in Mpumalanga	2016-2017	• Alien vegetation clearing and management • Surface water assessment and management • Game census • Mapping of sensitive areas for conservation • Drafting of environmental reports	Company: Waterleau Group Contact Person: Ntutuko Mkhize Tel: 082 411 0432	

Fort West alien invasive species eradication, management and monitoring plan	2015	• Alien invasive species eradication plan • Alien species removal monitoring plan	Company: Arengo6 Contact Person: Kagiso Mohlamme Tel: 072 591 5237	
An integrated asset management assessment study for various Rand Water pipelines for Eikenhof system, Johannesburg	2015-2015	• Provision of Environmental Control Officer • Development of an Environmental Management Plan	Company: Waterleau Group Contact Person: Ntutuko Mkhize Tel: 082 411 0432	
COMPLIANCE AUDITS				
THABA CRONIMET ANNUAL INTEGRATED WATER USE LICENCE AUDIT	June 2015	Lead Auditor	Company: Thaba Cronimet (Pty)Ltd Contact person: Lekau Hlabolwa Tel: 079 7038487	03/A24F/ACGIJ
GLENCORE WONDERKOP SMELTER EXTERNAL WASTE MANAGEMENT LICENCE AUDIT	May 2015	Lead auditor	Company: Glencore Contact person: Bertha Mohapi Tel: 014 572 0393	No. 12/9/11/L510/7
THABA CRONIMET ANNUAL INTEGRATED WATER USE LICENCE AUDIT	August 2014	Lead Auditor	Company: Thaba Cronimet (Pty)Ltd Contact person: Lekau Hlabolwa Tel: 079 7038487	03/A24F/ACGIJ
Eskom Tutuka Power Station ISO14001:2004 Internal Audit	December 2014	Lead auditor	Company: Envirobro Contact person: Nndangi Musekene Tel: 072 748 0292	
Sebata Group ISO 14001: 2004 development and implementation	2013-2014	ISO 14001:2004 Implementation and internal auditing	SEBATA General manager: SHE Mr McDonald Mutsvangwa Contact: 0100600355	
Kusile water use licence quarterly audits	2013 – 2014 (quarterly for 12 months)	Lead auditor/wetland specialist	Company: Kusile Power station Contact person: Siphiwe Mahlangu Tel: 013 699 7097	No.: 04/B20F/CI/2235
Transnet incident management	2013	Accident and Incident Management	Company Name: Isivuvu Technical Solutions Contact Person: Nhlanhla Maphalala Tel: 073 417 0438	
ZUFI Engineering safety systems audit	2013	OHSA 18001 audit	Company Name: ZUFI Engineering Contact Person: Sikholiwe Zungu Tel: 084 475 0509	

ENVIRONMENTAL IMPACT ASSESSMENT/ EMP/ BA PROJECTS

Nonkanyiso Zungu
ID-82030905700088
Female, South African
Cell-084 800 0187

Environmental Impact Assessment for Durban Deep Primary School Project	2018	Environmental Assessment Practitioner	Company: SECO Projects Contact person: Jabulile Mbatha Tel: 084 793 9221	
Basic Assessment Report for Reiger Park Primary School .Asbestos Replacement Project	2018	Environmental Assessment Practitioner	Company: Nzingwe Consulting Contact person: James Muindisi Tel: 074 350 3066	
Proposed augmentation and maintenance of the Rand Water K2 and K3 pipeline within the Ekurhuleni Metropolitan municipality, Gauteng province:	2018	Environmental Assessment Practitioner	Company: Rand Water Contact Person: Nomkhosi Mohlahlo Tel: 011 724 9191	
Environmental legal review and scoping report for Esselen Park and Lindelani Village, Ekurhuleni Metropolitan Municipality, Gauteng Province..	2018	Legal Review Scoping report	Company Complete Cycle Contact: Sibusiso Hadebe Tel: 065 911 1527	
Madadeni Environmental Scoping Report	2017	Scoping report	Company: Sydwalt Pty Ltd Contact: Dumisani Nxumalo Tel: 076 342 5797	
Eldorado Park Screening Report	2017	Screening	Company: Arengo 6 Built Environment Consultants Contact: Kagiso Mohlamme Tel: 072 591 5237	
Waste Management Licence Application for the Thaba Cronimet Chrome Mine	2016	Environmental Impact Assessment Practitioner	Company: Thaba Cronimet (Pty) Ltd Contact: Lekau Hlabolwa Tel: 079 703 8487	
Basic Assessment for the construction of Ekurhuleni Metro Police Precinct In Kempton Park	2016	Environmental Assessment Practitioner	Company: Takgalang Consulting Contact: Thabo Molefi Tel: 082 444 9773	
Basic Assessment for the Reconstruction of Transnet Collapsed Bridge at Vanderbijlpark	2015-Present	Environmental Impact Assessment Practitioner	Company: Transnet Capital Projects Contact: Yolandi Robbetze Tel: 083 703 7922	

Basic Assessment for the construction of the Rand Water 210ML reservoir future planned 200ML reservoir in Vlakfontein	2015	Environmental Impact Assessment Practitioner.	Company: Rand Water Contact: Luzuko Kalimashe Tel: 078 6590462	14/12/16/3/3/1/1463
Waste management licence application associated with the proposed construction of Rand Water 200ML reservoir in Brakpan.	2015	Environmental Assessment Practitioner	Company: Rand Water Contact: Thokozani Masilela Tel: 072 495 0097	14/12/16/3/3/1/1423
Basic Assessment: Proposed construction of culvert upgrade works and sewer pipeline crossing through a watercourse, Eskom Holdings SOC Ltd. Ingula Pumped Storage Scheme	2014	• Environmental Assessment Practitioner • Project Management	Company: Eskom Ingula Pumped Storage Scheme Contact: Marcel Meso Tel: 036 342 3031	Ref: 14/12/16/3/3/1/1019
Waste Management Licence Application for the Eskom Witbank Clinker Ash Dump	2013-2014	• Environmental Assessment Practitioner	Company: Eskom SHE Management Division Contact: Gabriel Ngorima Tel: 076 9014006	
Eskom Academy of Learning Feasibility study for a Waste Treatment Plant	2013	• Project Management/EAP	Company: Eskom Real Estate Division Contact: Chinga Gwiza Tel: 083 7626030	
PKX Cableway Environmental Impact Assessment: Scoping study	2013	• Scoping report: environmental feasibility of the Cableway Development	Company: Arup Contact: Shupikai Chihuri Tel: 011 2187600	
Eskom Witbank Clinker Ash Dump Pre-feasibility Study	2011 - 2012	• Project Management • Review of environmental specialist technical reports • Consolidation of technical reports and presenting feasibility of the project to the client.	Company: Eskom SHE Management Division Contact: Gabriel Ngorima Tel: 076 9014006	
Environmental Impact Assessment for proposed coal mining activities: Mining Environmental Management Plan	2012	• Environmental Assessment Practitioner • Project Management	Company: Silver Unicorn Trading Contact: Bonginkosi Curnick Njeke Tel: 082 464 6489	
WETLAND ASSESSMENTS				
Natalspruit river rehabilitation	2018	• Wetland delineation • Wetland PES and EIS description • Wetland classification • Rehabilitation	Company: Silver Horns Contact: Thabo Munyai Tel: 076 126 8387	
Brakpan automotive hub wetland assessment	2018	• Wetland delineation • Wetland PES and EIS description • Wetland classification	Company: Vungandze Projects Contact Person: Khosi Mngomezulu Tel: 083 256 1292	

K2 and K3 pipeline wetland assessment	2018	• Wetland delineation • Wetland PES and EIS description • Wetland classification	Company: Rand Water Contact Person: Nomkhosi Mohlahlo Tel: 011 724 9191	
Desktop wetland assessment on portion 10 on Reserve 16 of Farm no 15638 in Ngwavuma, KwaZulu-Natal Province, South Africa	2018	• Desktop study	Company: Beyond Greening Environmental Services Pty (Ltd) Contact Person: Nonkululeko Khumalo Tel: 072 172 8374	
Lanseria business park wetland delineation and assessment report	2017	• Wetland delineation • Wetland PES and EIS Description • Wetland classification	Company: Arengo 6 Contact Person: Kagiso Mohlamme Tel: 072 591 5237	
Vuka Africa Randfontein wetland delineation and assessment	2017	• Wetland delineation • Wetland PES and EIS description • Wetland classification	Company: Myezo Environmental Services Contact Person: Casper Neluheni Tel: 082 637 6081	
Berenice Wetland delineation and assessment	2017	• Wetland delineation • Wetland PES and EIS description • Wetland classification	Company: Headwaters water and environmental consultant Contact Person: Lekau Hlabolwa Tel: 079 703 8487	
Hendrina Wetland delineation and assessment	2017	• Wetland delineation • Wetland PES and EIS description • Wetland classification	Company: DIGES Contact Person: Brenda Makanza Tel: 082 075 6685	
Duvha-Speekfontein wetland assessmet	2017	• Wetland PES and EIS • Wetland impact assessment	Company: Geovicon Environmental (Pty) Ltd Contact: Riana Tel: 082 4981847	
Johannesburg City Parks and Zoo Wetland Rehabilitation Plan for the Upper and Middle Klip River Management Units:	2016	• Wetland Assessment • PES and EIS description Wetland classification	Company: Myezo Environmental Services Contact Person: Casper Neluheni Tel: 082 637 6081	
Fortwest Wetland assessment and delineation	2016	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Arengo6 built environment consultants	

			Contact: Kagiso Mohlamme Tel: 072 591 5237	
Flamwood Ext 24 wetland delineation and assessment	2016	• Wetland Assessment • PES and EIS description • Wetland classification • Impact assessment and mitigation	Company: Instratin Development Contact person: Sindiswa Nombexeza Tel: 072 339 8599	
Wetland Delineation and Assessment for the Reconstruction of the Transnet Collapsed Bridge in Vanderbijlpark	2016	• Wetland delineation • Wetland Assessment • PES and EIS description • Wetland Classification	Company: Transnet Capital Projects Contact: Yolandi Robbetze Tel: 083 703 7922	
City Of Johannesburg Wetland Rehabilitation Plan For The Braamfonteinspruit, Kyalami, And Natalspruit Management Units: Draft Report	2016	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Headwaters water and environmental consultant Contact Person: Lekau Hlabolwa Tel: 079 703 8487	
Blesboklaagte wetland delineation and assessment for the proposed Eyethu Coal mining activities, Middleburg, Mpumalanga	2015	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Geovicon Environmental (Pty) Ltd Contact: Riana Tel: 082 4981847	
Watercourse Assessment Report For The Proposed Construction of a 15km 50kV Power Line From Eskom Helios Substation To The Proposed New Transnet Helios Traction Feeder Substation	2015	• Watercourse assessment	Company: Nsovo Environmental consulting Contact Person: Munyadziwa Rikhotso Tel: 071602 2369	
Nietgedacht Wetland Delineation And Assessment Report	2015	• Wetland Assessment • PES and EIS Description • Wetland Classification	Company: Phuka Tsa Nong Contact Person: Kele Tel: 0834785753	
Wetland Delineation And Assessment Report For The Proposed Development Of An Eskom Straatdrift Madikwe 22 Kv Powerline	2015	• Wetland Assessment • PES and EIS Description • Wetland Classification	Company: Baagi Environmental Consulting Contact person: Marita Oosthuizen Tel: 082 378 4903	
Wetland Assessment Report For The Bredell Wetland In Kempton Park, Gauteng Province	2015	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Watercube Services: Molefe Morokane Contact Person: Tel: 076 806 4293	
Wetland Delineation And Assessment Report For The Proposed Development Of A	2015	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Central Development Contact Person: Pierre Reyneke	

Retirement Center And Bridge Construction Activities In Montana Tuine Ext 49 & 50 In Pretoria			Email: pierrer@centraldev.co.za	
Transhex Operations (Pty) Ltd wetland delineation and assessment report for the proposed diamond mining operations between Baken and Reuning, Northern Cape Province	2015	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Envirobro Contact Person: Nndangi Musekene Tel: 072 748 0292	
Wetland delineation and assessment for Eyethu Coal mining activities, Middleburg, Mpumalanga	2015	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Geovicon Environmental (Pty) Ltd Contact: Tshepo Shakwane Tel: 082 4981847	
Wetland Delineation and Assessment Report for the Proposed Eskom 400kv Transmission Line From Ariadne to Venus Substations in Kwazulu-Natal Province.	2014	• Wetland Assessment • PES and EIS description • Wetland classification • Water Use licence Application	Company: DIGES Contact Person: Brenda Makanza Tel: 082 075 6685	
Randwater M11 pipeline wetland delineation and assessment, Gauteng Province	2014	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Asande Projects Contact Person: Grace Magaya Tel: 081 494 1611	
Wetland delineation and assessment for the proposed Dithakwaneng bridge construction, North-West Province	2014	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Southern Hills Engineering (Pty) Ltd Contact Person: Johnson Matangi Tel: 084 663 8199	
Ongezien Wetland assessment, Witbank Mpumalanga Province	2013	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Silver Unicorn Trading Contact Person: Bonginkosi Njeke Tel: on request	
Leeuwfontein wetland assessment	2013	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Geovicon Environmental (Pty) Ltd Contact: Tshepo Shakwane Tel: 082 4981847	

Platreef-Borutho wetland assessment, Limpopo Province	2013	• Wetland Assessment • PES and EIS description • Wetland classification	Company: Nzumbululo Heritage Solutions Contact Person: Nonhlanhla Ncube Tel: on request	
Duvha-Minerva Transmission line wetland assessment and WULA	2013	Wetland assessment and water use licence application	Company: Nzumbululo Heritage Solutions Contact Person: Nonhlanhla Ncube Tel: on request	
Rockdale-Marble hall transmission line wetland assessment and WULA	2013	Wetland assessment and water use licence application	Company: Nzumbululo Heritage Solutions Contact Person: Nonhlanhla Ncube Tel: 015 291 3661	
Protea Glen wetland function assessment study.	2011	• Wetland assessment • PES and EIS description • Wetland classification	Company: Wetland Consulting Services Contact Person: Bhuti Dlamini Tel: on request	
Randwater Pipeline wetland assessment	2011	• Wetland assessment • PES and EIS description • Wetland classification	Company: Asande Projects Contact Person: Joshua Oluokun Tel: 073 4068051	
ECOLOGICAL ASSESSMENTS (FAUNA AND FLORA)				
K2 and K3 pipeline ecological assessment	2018	• Flora and fauna assessment • Sensitivity areas	Company: Rand Water Contact: Nomkhosi Mohlahlo Tel: 011 724 9191	
Brakpan automotive hub ecological assessment	2018	• Flora and fauna assessment • Sensitivity areas	Company: Vungadze Projects Contact: Khosi Mngomezulu Tel: 083 256 1292	
Amandebult Section biodiversity assessment	2017	• Flora and fauna assessment • Sensitivity areas	Company: Phuka tsa Nong Contact: Kelebogile Mogajane Tel: 083 478 5753	
Leliefontein biodiversity assessment	2017	• Flora and fauna assessment • Sensitivity areas	Company: Ndlelenhle Mining and consulting Contact: Abraham Maphoso Tel: 082 088 3283	
Roodepoortjie ecological assessment	2017	• Flora and fauna assessment • Sensitivity areas	Company: Ndlelenhle mining and consulting Contact: Abraham Maphoso Tel: 082 088 3283	
Biodiversity assessment report for the proposed Doornfontein Mine development	2017	• Flora and Fauna assessment • Sensitivity areas	Company: Ndlelenhle Mining and Consulting Contact: Abraham Maphoso	

			Tel: 082 088 3283	
Rand water Zwartkopjes red data species survey	2017	• Fauna and Flora assessment • Red data species survey • Vegetation management Plan	Company: Rand Water Contact: Samanta Stelli Tel: 011 724 9371 Email:sstelli@randwater.co.za	
Rand water Zwartkopjes red data species survey	2017	• Fauna and Flora assessment • Red data species survey • Vegetation management Plan • Fauna management plan	Company: Rand Water Contact: Samanta Stelli Tel: 011 724 9371 Email:sstelli@randwater.co.za	
Rand water Zwartkopjes red data species survey	2017	• Fauna and Flora assessment • Red data species survey • Vegetation management Plan • Fauna management Plan	Company: Rand Water Contact: Samanta Stelli Tel: 011 724 9371 Email:sstelli@randwater.co.za	
Rand water Zwartkopjes red data species survey	2017	• Fauna and Flora assessment • Red data species survey • Vegetation management Plan • Fauna management plan	Company: Rand Water Contact: Samanta Stelli Tel: 011 724 9371 Email:sstelli@randwater.co.za	
Fortwest Ecological assessment	2016	• Flora and Fauna assessment • Sensitivity areas	Company: Arengo6 built environment consultants Contact: Kagiso Mohlamme Tel: 072 591 5237	
Flamwood Ext 24 ecological assessment	2016	• Flora and Fauna assessment • Sensitivity areas	Company: Instratin Development Contact person: Sindiswa Nombexeza Tel: 072 339 8599	
Ecological Assessment For The Proposed Reconstruction Of The Collapsed Bridge Which Forms Part of The Servie Road Located along the Houtheuwel-Potchefstroom Railway	2015-Present	Flora and Fauna Assessments	Comapany: Transnet Capital Projects Contact Person: Yolandi Robbetze Tel: 083 703 7922	

Line, Vanderbijlpark, Gauteng				
Ecological Assessment Report For The Proposed Tweedracht 5.5km 88 Kv Power Line Development	2015	Flora and Fauna Assessments	Company: Nsovo environmental consultin Contact person: Munyadziwa Rikhotso Tel: 071602 2369	
Ecological Assessment Report For The Construction Of An Additional 200ml Rand Water Reservoir In Meredale	2015	Flora and Fauna Assessments	Company: Asande projects Contact person: Avhutetshelwi Mashau Tel: 011 315 6794	
Ecological Assessment Report For The Proposed Rand Water Additional 200ml Reservoir In Brakpan, East Rand, Gauteng Province	2015	Flora and Fauna Assessments	Company: Rand Water Contact Person: Thokozani Masilela Tel: 011 724 9140	
Ecological Assessment Report For The The Proposed Replacement Of Both The Existing A6 And A8 Pipelines With Two New Pipes (One Pipe At A Time) Running From Vereeniging Pumping Station To Zwartlopjes Pump Station With A Length Of 44 Km And A Diameter Of 1300	2015	Flora and Fauna Assessments	Company: Asande projects Contact person: Rolivhuwa Nemakonde Tel: 011 315 6794	
Ecological Assessment Report For The Construction Of The Rand Water Additional 210ml And Future Planned 200ml Reservoir On Vlakfontein Farm 69ir, Crystal Park, Ekurhuleni Metropolitan Municipality	2015	Flora and Fauna Assessment	Comapany: Rand Water Contact Person: Luzuko Kalimashe Tel: 083 4250 455	
Ecological Assessment For The Construction And Maintenance Of The Rand Water 17, 5km H43 Pipeline With An Internal Diameter Of 1200mm, And It's Associated Structure (Valve Chambers And Cathodic Protection) Between Graham Street, Centurion And Lyttelton, Gauteng Province	2015	Flora and Fauna Assessment	Company: Asande projects Contact person: Faith Chigwanhire Tel: 011 315 6794	

Randwater Brakpan Reservoir to Selcourt Reservoir M 11 Pipeline Fauna And Flora Assessment	2014	Flora and Fauna Assessments	Company: Asande Projects Contact Person: Freddy Milambo Tel: 074 181 8292	
WATER USE LICENCE APPLICATIONS				
WULA for Groblers Bridge/Beit Bridge/Pafuri Port	2018	EAP and project manager	Company: Dreykon Trust Contact: Thomas Bezuidenhout Tel: 082 876 4942	
WULA for Ingudlane Lodge, Endumeni Local Municipality	2018	EAP and project manager	Company: Mangethe Group Contact: Sihle Zwane Tel: 073 417 8813	
Water Use Licence Application For The Proposed Reconstruction Of The Collapsed Bridge Which Forms Part of The Service Road Located along the Houtheuwel-Potchefstroom Railway Line, Vanderbijlpark, Gauteng	2015	EAP and project manager	Company: Transnet Capital Projects Contact Person: Yolandi Robbetze Tel: 083 703 7922	
Department of Health Water Use Licence Application for Enviroloo system	2015	EAP and project manager	Company: DIGES Contact Person: Brenda Makanza Tel: 082 075 6685	
Construction of an Additional Rand Water 210ml Reservoir On Vlakfontein 69ir Farm In Crystal Park, Ekurhuleni Metropolitan Municipality, Gauteng Province	2015	EAP and project manager	Company: Rand Water Contact Person: Thokozani Masilela Tel: 0720495 0097	14/12/16/3/3/1/1431
Construction of a Rand Water 200ml Reservoir In Brakpan, Ekurhuleni Metropolitan Municipality, Gauteng Province	2015	EAP and project manager	Company: Rand Water Contact Person: Thokozani Masilela Tel: 0720495 0097	14/12/16/3/3/1/1423
Proposed Eskom 400kv Transmission Line From Ariadne to Venus Substations in Kwazulu-	2014 – 2015	EAP and project manager	Company: DIGES Contact Person: Brenda Makanza Tel: 082 075 6685	12/12/20/1755

Natal Province: Water Use Licence Application				
Duvha-Minerva 400kv Powerline deviation water use licence application	2013	EAP and project management	Company: Eskom Transmission Contact: Vuledzani Thanyane Tel: 011 800 5601 Ref: 16/2/7/B100/C983	16/2/7/B100/C983
Rockdale-Marble hall transmission line wetland assessment and WULA	2013	EAP and project manager	Company: Nzumbululo Heritage Solutions Contact Person: Nonhlanhla Ncube Tel: 015 291 3661	
Water Use Licence for the construction of the Rockdale to Wolwekraal 400kv powerline and associated secondary infrastructure, Mpumalanga and Limpopo Provinces	2013	EAP and project management	Company: Eskom Transmission Contact: Vuledzani Thanyane Tel: 011 800 5601 Ref: 16/2/7/B300/B03	12/12/20/1340
BIOMONITORING				
Aquatic assessment report for the proposed Manungu Colliery, Mpumalanga.	2018	• Aquatic assessment (SASS5) • Macro-invertebrate assessment • Fish Assessment • Habitat Integrity	Company: Letsolo Water and Environmental Services Contact Person: Ishmael Phalane Tel: 082 821 6621	
Aquatic assessment report for the proposed social housing township in Soshanguve SS Extension 7 and 8, north of Pretoria, Gauteng	2018	• Aquatic assessment (SASS5) • Macro-invertebrate assessment • Fish Assessment • Habitat Integrity	Company: Lambeu Consulting and Training Services (Pty) Ltd Contact Person: Mashudu Siphugu Tel: 011 069 6527	
City of Johannesburg State of the Rivers 2017	2017	• Aquatic assessment (SASS5) • Macro-invertebrate assessment • Fish Assessment • Habitat integrity	Company: Ikamva Consulting Contact: Mahadi Mabea Tel: 061 499 2577	
WATER QUALITY MONITORING				
City of Johannesburg State of the Rivers 2017	2017	• River water sampling and analysis	Company: Ikamva Consulting Contact: Mahadi Mabea Tel: 061 499 2577	
DESKTOP SURFACE WATER STUDIES				

Nonkanyiso Zungu
ID-82030905700088
Female, South African
Cell-084 800 0187

Surface Water Resources Study for the farm Rosseauspoort 319 KQ in Thabazimbi, Limpopo Province, South Africa	2017	• Desktop assessment of water resources	Company: Kimopax Pty Ltd Contact: Charles Chigurah Tel: 011 312 9765	
FLOOD LINE ASSESSMENTS				
Akanani Floodline	2016	• Peak flow calculations • Flood line delineation • Storm rainfall depths	Company: DIGES Contact person: Brenda Makanza Tel: 082 075 6685	
Ariadne to Venus 400kv transmission line floodline assessment.	2015	• Peak flow calculations • Flood line delineation • Storm rainfall depths	Company: DIGES Contact person: Brenda Makanza Tel: 082 075 6685	
Straatdrift 22kv powerline construction 1:100 year floodline assessment	2015	• Peak flow calculations • Flood line delineation • Storm rainfall depths	Company: BAAGI Environmental Contact Person:Marita Oosthuizen: Tel: 082 378 4903	
Groot-Vei Floodline Assessment	2015	• Peak flow calculations • Flood line delineation • Storm rainfall depths	Company: BAAGI Environmental Contact Person:Marita Oosthuizen: Tel: 082 378 4903	