Syferkuil – Rampheri Project

BIODIVERSITY ASSESSMENT

Terrestrial Ecological Assessment and Aquatic (Wetland) Assessment of the Syferkuil-Rampheri Power Line, Rampheri CNC, Syferkuil Substation and CNC and Thabamoopo-Syferkuil Line Upgrade

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1 EXECUTIVE SUMMARY

Background

Eskom is currently busy with the upgrade of various electrical networks in the Limpopo Province. The Syferkuil-Rampheri Project forms part of this vision and upgrade. The Syferkuil-Rampheri Project consists of a few sub-sections. These include the proposed Syferkuil-Rampheri 132kv line; proposed Rampheri CNC; proposed new Syferkuil Substation and CNC; dismantling of the existing Syferkuil Substation; and the upgrade of the existing Syferkuil-Thabamoopo Line.

Setala Environmental (Pty) Ltd was appointed as the independent consultancy to conduct a biodiversity assessment, which includes a terrestrial ecological assessment and an aquatic (wetland) assessment.

Field investigations were conducted during May 2016.

Location of the study area

The study site is situated approximately 25km east of central Polokwane, along the R71 route. The proposed Syferkuil-Rampheri 132kV powerline servitude lies predominantly in a north-south direction, across an area of about 16km, from Mankweng in the north to Rampheri in the south. The study area is within the Polokwane Municipality, Capricorn District of the Limpopo Province.

Three route alternatives for the proposed Syferkuil-Rampheri powerline were investigated, each with a study area width of 1km.

TERRESTRIAL ECOLOGY

Vegetation

The vegetation of the study area is typical of that of Polokwane Plateau Bushveld. The undulating plains are covered with a short, open upper tree layer and with a well-developed lower grassy layer. Acocks (1953) classified the vegetation unit as a grass veldtype and not a bush veldtype.

The open grassveld areas are covered with open short trees, typically that of acacia thorn tree species. Dominant tree species are those of *Acacia caffra* and *Acacia tortillis*. The vegetation in the north is largely disturbed and transformed. This is to be expected because it is situated within a high-density urban area. The most pristine

bushveld in the study area is to the south where the investigated corridors run north of Rampheri within a broad valley area. However, even here there is low- to medium-density urbanisation. As well as impacts on the veld by grazing by free-roaming cattle and goats.

Numerous granite koppies, typical of Mambolo Mountain Bushveld are spread throughout the 1km corridor of the study area. The vegetation of the koppies, which are very rocky, tends to be dominanted by small trees and shrubs. The rock slabs or domes are sparsely vegetated, and then mostly with a mixture of xerophytic or resurrection plants, with several succulents, such as *Euphorbia* tree-species.

Priority species

No Red Data plant species (endangered, threatened or vulnerable) were observed during field investigations. According to the SANBI database a few Red Data species have been recorded in the region of the QDS quadrants, but it is unlikely that any of these species are present in actual powerline servitudes within the study area. This however, is not to say for certain that none occur, as some may well occur in the rocky areas and on the granite koppies, such as the *Euphorbia* species. For these and other reasons the granite koppies are viewed as sensitive, 'no-go' areas.

Protected trees in the study area

The marula (*Sclerocarya birrea subsp. caffra*) is a protected tree and was observed in the study area. This included near the Thabamoopo Substation, within the powerline corridor.

AQUATIC ECOLOGY

Watercourses in the study area

The main perennial and/or large rivers of the region are not within the study area. The Diep River is approximately 7,5km due west of Sykerkuil Substation, while the Turfloop River is approximately 1 km northwest from the study area at is closest point. The Mphogodima River is about 2,5km east of the study area and the Thlabasane about 3,8km south of the Rampheri Substation and CNC sites. The Diep and Turfloop Rivers flow north and eventually into the Limpopo River, while the Mphogodima and Thlabasane Rivers flow south and eventually into the Olifants River.

A main tributary of the Turfloop River is within the northern section of the study area. In the southern section of the study area is a tributary of the Thlabasane River. Both these tributaries are unnamed on maps and are semi-perennial streams.

Besides the two main tributaries mentioned above, there are a few small drainage lines in the study area. These are seasonal in nature and tend to flow for a few days only after good rainfalls. There are no wetlands in the study area.

Erosion and donga formation is a bit of a problem, especially in the southern half of the study area where the topography at times can be steeper. The donga and surface erosion is linked to surface rainwater run-off near streams or steep ravines. These dongas / erosion lines in affect become drainage lines and as such need to be avoided were possible.

Drainage areas

The study area is situated within the Primary Drainage Areas (PDAs) of A and B and the Quaternary Drainage Areas (QDA) of A71B and B52H.

The northern half of the study area is within the Limpopo Water Management Area (WMA 1) and under the jurisdiction of the Limpopo Catchment Management Agency (CMA 1). While the southern half of the study area is within the Olifants Water Management Area (WMA 4) and under the jurisdiction of the Olifants Catchment Management Agency (CMA 2).

Drivers of ecological change

The main drivers of ecological change on the watercourses and water ecosystems in the study area are:

- Cultivation;
- Impoundment by means of in-channel farm dams;
- Urbanisation; and
- Over-utilisation of natural resources.

Although powerlines generally have a small impact on watercourses, especially in terms of impeding and/or diverting waterflow, their potential impact in the study area is not a major driver of ecological change on the water environment.

Sensitivity analyses

The ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in nature.

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity	Development Go-ahead
Bushveld	Medium	Medium	Medium	Go-But
Cultivated lands & Urban areas	Low	Medium/Low	Medium/Low	Go-Slow
Granite Koppies	Medium/High	High	High	No-Go
Watercourses	Medium	Medium/High	Medium/High	Go-But

Fatal flaws

There are no fatal flaws.

Priority areas

The study area is predominantly outside of any priority areas. None of the substations or CNCs are within any priority areas. However, in three cases the study area imposes on priority areas in terms of NFEPA 'wetlands' or open waterbodies. The Syferkuil-Rampheri powerliine corridor imposes on demarcated priority areas, this according to the datasets of the SANBI database. The north-east corner of the study area (i.e. the Syferkuil-Rampheri powerline servitude) goes through a formal protected area, while in the middle of the Syferkuil-Rampheri powerline Alt.1 crosses over a NFEPA 'wetland area', which is actually a farm dam. In the extreme south, east of the Rampheri Substation and CNC area is a watercourse area within the 1km corridor of the study area.

Syferkuil-Rampheri Line Route Recommendations

Taking all issues into account, the Ecological recommended line variant for the proposed Syferkuil-Rampheri Line is: PREFERRED ROUTE ALTERNATIVE.

Recommendations

Below is a summary of some of the most important findings and recommendations:

- There are no fatal flaws.
- The Substations and CNCs are not within any sensitive areas or priority areas.
- There are three main sensitive areas within the study area and these are all along the Syferkuil-Rampheri Powerline route alternatives.
- The Syferkuil-Rampheri Powerline route alternatives pass through a formal nature reserve area, the Turfloop Dam Nature Reserve.
- All granite koppies are viewed as sensitive, no-go areas.
- There are two areas along the Syferkuil-Ramheri Powerline Preferred Route and Alternative 1 Route where care needs to be taken with pole positions due to watercourses and erosion areas.
- There are protected trees (marula) within the powerline corridors.
- It is recommended that a final walk-though be undertaken to fine-tune final line alignment and pole positions for the powerlines to avoid sensitive areas and protected trees.
- All mitigating measures as recommended in this report need to be implemented to make the findings and analyses relevant.
- It is possible that a GA process might need to be undertaken, depending on final pole positions for the Syferkuil-Rampheri Line.

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2 ACRONYMS

CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
CNC	Customer Network Centre
DEA	Department of Environment Affairs
DWA	Department of Water Affairs (Old name for DWS)
DWS	Department Water and Sanitation
EIS	Ecological Importance & Sensitivity
EMC	Environmental Management Class
EWR	Ecological Water Requirements
HGM	Hydrogeomorphic
IBA	Important Bird Area(s)
IUCN	International Union for Conservation of Nature
MAP	Mean Annual Precipitation
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
PES	Present Ecological State
PDA	Primary Drainage Area
QDA	Quaternary Drainage Area
REC	Recommended Ecological Category (or Class)
REMC	Recommended Ecological Management Category (or Class)
RVI	Riparian Vegetation Index
SANBI	South African National Biodiversity Institute
SWSA	Strategic Water areas of South Africa
WMA	Water Management Areas
WUL	Water Use Licence
WULA	Water Use Licence Application

3 BACKGROUND

3.1 Project overview

Eskom is currently busy with the upgrade of various electrical networks in the Limpopo Province. The Syferkuil-Rampheri Project forms part of this vision and upgrade. The Syferkuil-Rampheri Project consists of a few sub-sections. These include the proposed Syferkuil-Rampheri 132kv line; proposed Rampheri CNC; proposed new Syferkuil Substation and CNC; dismantling of the existing Syferkuil Substation; and the upgrade of the existing Syferkuil-Thabamoopo Line.

Setala Environmental (Pty) Ltd was appointed as the independent consultancy to conduct a biodiversity assessment, which includes a terrestrial ecological assessment and an aquatic (wetland) assessment.

Field investigations were conducted during May 2016.

4 METHODOLOGY

4.1 Desktop assessment

A literature review was conducted regarding the main vegetation types and fauna of the general region and of the specific study area. The primary guidelines used were those of Mucina & Rutherford (eds) (2006), Low & Rebelo (1996) and Acocks (1988). Background data regarding soils, geology, climate and general ecology were also obtained from existing datasets and relevant organisations. These are useful in determining what species of fauna and flora can be expected or possibly present within the different habitats of the study area.

Lists of plant species for the relevant 1:50 000 base map grid references within which the proposed project is situated, were obtained from the database of the South Africa National Biodiversity Institute (SANBI). The lists represent all plant species that have been identified and recorded within the designated grid coordinates. The main aim was to determine if any protected species or Red Data species were know to occur in the study area or in the immediate vicinity of the study area.

Red data and protected species listed by the National Environmental Management: Biodiversity Act (Act No. 10 of 2004), as well as in other authoritative publications were consulted and taken into account. Alien invasive species and their different

Categories (1, 2 & 3) as listed by the Conservation of Agricultural Resources Act (Act No. 43 of 1983) and the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) were also consulted.

4.2 Field surveys

During field surveys, cognisance was taken of the following environmental features and attributes:

- Biophysical environment;
- Regional and site specific vegetation;
- Habitats ideal for potential red data fauna species
- Sensitive floral habitats;
- Red data fauna and flora species;
- Fauna and flora species of conservation concern; and
- Water courses and water bodies.

Digital photographs and GPS reference points of importance where recorded.

4.3 Floristic Sensitivity

The methodology used to estimate the floristic sensitivity is aimed at highlighting floristically significant attributes and is based on subjective assessments of floristic attributes. Floristic sensitivity is determined across the spectrum of communities that typify the study area. Phytosociological attributes (species diversity, presence of exotic species, etc.) and physical characteristics (human impacts, size, fragmentation, etc.) are important in assessing the floristic sensitivity of the various communities.

Criteria employed in assessing the floristic sensitivity vary in different areas, depending on location, type of habitat, size, etc. The following factors were considered significant in determining floristic sensitivity:

- Habitat availability, status and suitability for the presence of Red Data species
- Landscape and/or habitat sensitivity
- Current floristic status
- Floristic diversity
- Ecological fragmentation or performance.

Floristic Sensitivity Values are expressed as a percentage of the maximum possible value and placed in a particular class or level, namely:

- High: 80 – 100%
- Medium/high: 60 – 80%
- Medium: 40 – 60%
- Medium/low: 20 – 40%
- Low: 0 – 20%

High Sensitivity Index Values indicate areas that are considered pristine, unaffected by human influences or generally managed in an ecological sustainable manner. Nature reserves and well-managed game farms typify these areas. Low Sensitivity Index Values indicate areas of poor ecological status or importance in terms of floristic attributes, including areas that have been negatively affected by human impacts or poor management.

Each vegetation unit is subjectively rated on a sensitivity scale of 1 to 10, in terms of the influence that the particular Sensitivity Criterion has on the floristic status of the plant community. Separate Values are multiplied with the respective Criteria Weighting, which emphasizes the importance or triviality that the individual Sensitivity Criteria have on the status of each community.

Ranked Values are then added and expressed as a percentage of the maximum possible value (Floristic Sensitivity Value) and placed in a particular class or level, namely:

- High: 80% – 100%
- Medium/high: 60% – 80%
- Medium: 40% – 60%
- Medium/low: 20% – 40%
- Low: 0% – 20%

4.4 GO, NO - GO Criteria

The sensitivity analyses are also expressed in terms of whether the "Go Ahead" has or has not been given for development in a specific area or ecological unit, with regards to the ecological sensitivity along with mitigating measures. The criteria are directly linked to all the other analyses used in the study and can be expressed as follows:

- GO: Areas of low sensitivity

These would typically be areas where the veld as been totally or mostly transformed.

- GO-SLOW: Areas of medium/low sensitivity

These would typically be areas where large portions of the veld has been transformed and/or is highly infested with alien vegetation and lacks any real faunal component. Few mitigating measures are typically needed, but it is still always wise to approach these areas properly and slowly.

- GO-BUT: Areas of medium and medium/high sensitivity

These are areas that are sensitive and should generally be avoided if possible. But, with the correct implementation of mitigating and management measures can be entered if need be.

- NO-GO: Areas of high sensitivity

These are areas of high sensitivity and should be avoided at all cost. In these areas mitigating measures are typically futile in limiting impacts.

The Precautionary Principle is applied throughout this investigation.

4.5 Floral Assessment – Species of Conservation Concern

Baseline data for the quarter degree grids in which the study area is situated were obtained from the SANBI database and were compared to the Interim Red Data List of South African Plant Species (Raimondo D. *et.al*., 2009) to compile a list of Floral Species of Conservation Concern (which includes all Red Data flora species) that could potentially occur within the study area.

A snapshot investigation of an area presents limitations in terms of locating and identifying Red Data floral species. Therefore, particular emphasis is placed on the identification of habitats deemed suitable for the potential presence of Red Data species by associating available habitat to known habitat types of Red Data floral species. The verification of the presence or absence of these species from the study area is not perceived as part of this investigation as a result of project limitations.

4.6 Faunal Sensitivity

Determining the full faunal component of a study area during a short time scale of a few field trips can be highly limiting. Therefore, the different habitats within the study area and nearby surrounding areas were scrutinised for attributes that are deemed to be suitable for high diversity of fauna, as well as for Red Data species. Special consideration was given to habitats of pristine condition and high sensitivity.

Areas of faunal sensitivity were calculated by considering the following parameters:

- Habitat status – the status or ecological condition of the habitat. A high level of habitat degradation will often reduce the likelihood of the presence of Red Data species.
- Habitat linkage – Movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to surrounding habitats and adequacy of these linkages are evaluated for the ecological functioning of Red Data species within the study area
- Potential presence of Red Data species – Areas that exhibit habitat characteristics suitable for the potential presence of Red Data species are considered sensitive.

The same Index Values, Sensitivity Values and Categories used for the floral sensitivity ratings are used for the faunal sensitivity ratings. The same Go, No-Go criteria and ratings used for the flora component are also used for the faunal component.

4.7 Faunal Assessment – Species of Conservation Concern

Literature was reviewed and relevant experts contacted to determine which faunal species of conservation concern (which include all Red Data species) are present, or likely to be present, in the study area.

A snapshot investigation of an area presents limitations in terms of locating and identifying Red Data fauna species. Particular emphasis was therefore placed on the identification of habitat deemed suitable for the potential presence of Red Data fauna species by associating available habitat to known habitat types of Red Data species. The verification of the presence or absence of these species from the study area is not perceived as part of this investigation as a result of project limitations.

4.8 Biodiversity Impact Assessment

The impact assessment takes into account the nature, scale and duration of the effects on the natural environment and whether such effects are positive (beneficial) or negative (detrimental).

A rating/point system is applied to the potential impact on the affected environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each issue the following criteria are used and points awarded as shown:

- Extent: National - 4; Regional – 3; Local – 2; Site – 1.
- Duration: Permanent – 4; Long term – 3; Medium term – 2; Short term – 1.
- Intensity: Very high – 4; High – 3; Moderate – 2; Low – 1.
- Probability of Occurrence: Definite – 4; Highly probable – 3; Possible – 2; Impossible – 1.

4.9 Criteria for the classification of an impact

Nature

A brief description of the environmental aspect being impacted upon by a particular action or activity is presented.

Extent (Scale)

Considering the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact.

- Site: Within the construction site
- Local: Within a radius of 2 km of the construction site
- Regional: Provincial (and parts of neighbouring provinces)
- National: The whole of South Africa

Duration

Indicates what the lifetime of the impact will be.

- Short-term: The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase.

- Medium-term: The impact will last for the period of the construction phase, where after it will be entirely negated.
- Long-term: The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter.
- Permanent: 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 can be considered transient.

Intensity

Describes whether an impact is destructive or benign.

- Low: Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.
- Medium: Effected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way.
- High: Natural, cultural and social functions and processes are altered to extent that they temporarily cease.
- Very high: Natural, cultural and social functions and processes are altered to extent that they permanently cease.

Probability

Probability is the description of the likelihood of an impact actually occurring.

- Improbable: Likelihood of the impact materialising is very low.
- Possible: The impact may occur.
- Highly probable: Most likely that the impact will occur.
- Definite: Impact will certainly occur.

Significance

Significance is determined through a synthesis of impact characteristics. It is an indication of the importance of the impact in terms of both the physical extent and the time scale and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Using the scoring from the previous section, the significance of impacts is rated as follows:

- Low impact: 4-7 points. No permanent impact of significance. Mitigating measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
- Medium impact: 8-10 points. Mitigation is possible with additional design and construction inputs.
- High impact: 11-13 points. The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
- Very high impact: 14-16 points. The design of the site may be affected. Intensive remediation as needed during construction and/or operational phases. Any activity, which results in a "very high impact", is likely to be a fatal flaw.

Status

Status gives an indication of the perceived effect of the impact on the area.

- Positive (+): Beneficial impact.
- Negative (-): Harmful or adverse impact.
- Neutral Impact (0): Neither beneficial nor adverse.

It is important to note that the status of an impact is assigned based on the *status quo.* That is, should the project not proceed. Therefore not all negative impacts are equally significant. The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented.

5 RECEIVING ENVIRONMENT

5.1 Study Site Location

The study site is situated approximately 25km east of central Polokwane, along the R71 route. The proposed Syferkuil-Rampheri 132kV powerline servitude lies predominantly in a north-south direction, across an area of about 16km, from Mankweng in the north to Rampheri in the south. The study area is within the Polokwane Municipality, Capricorn District of the Limpopo Province.

Three route alternatives for the proposed Syferkuil-Rampheri powerline were investigated, each with a study area width of 1km.

5.2 GPS Coordinates of the Main Landmarks

The GPS coordinates of the main landmarks within the project area are as follows:

- Existing Syferkuil Substation: 23°53'0.12"S; 29°42'9.90"E.
- Existing Thabamoopo Substation: 23°53'28.83"S; 29°42'10.66"E.
- Approved Rampheri Substation: 24° 1'27.55"S; 29°43'51.05"E.
- Proposed Rampheri CNC: 24° 1'27.28"S; 29°43'55.51"E.
- 1:50 000 map grid references: 2329DC & 2429BA.

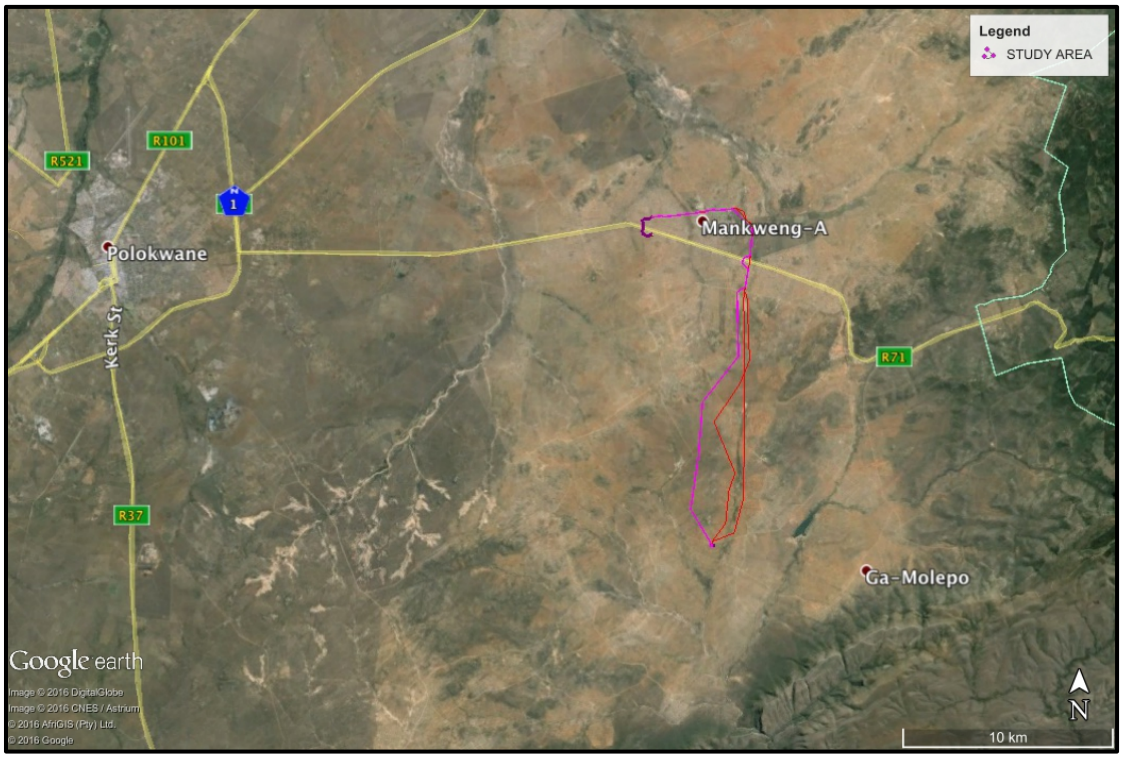

Figure 1: Site location (Google Earth)

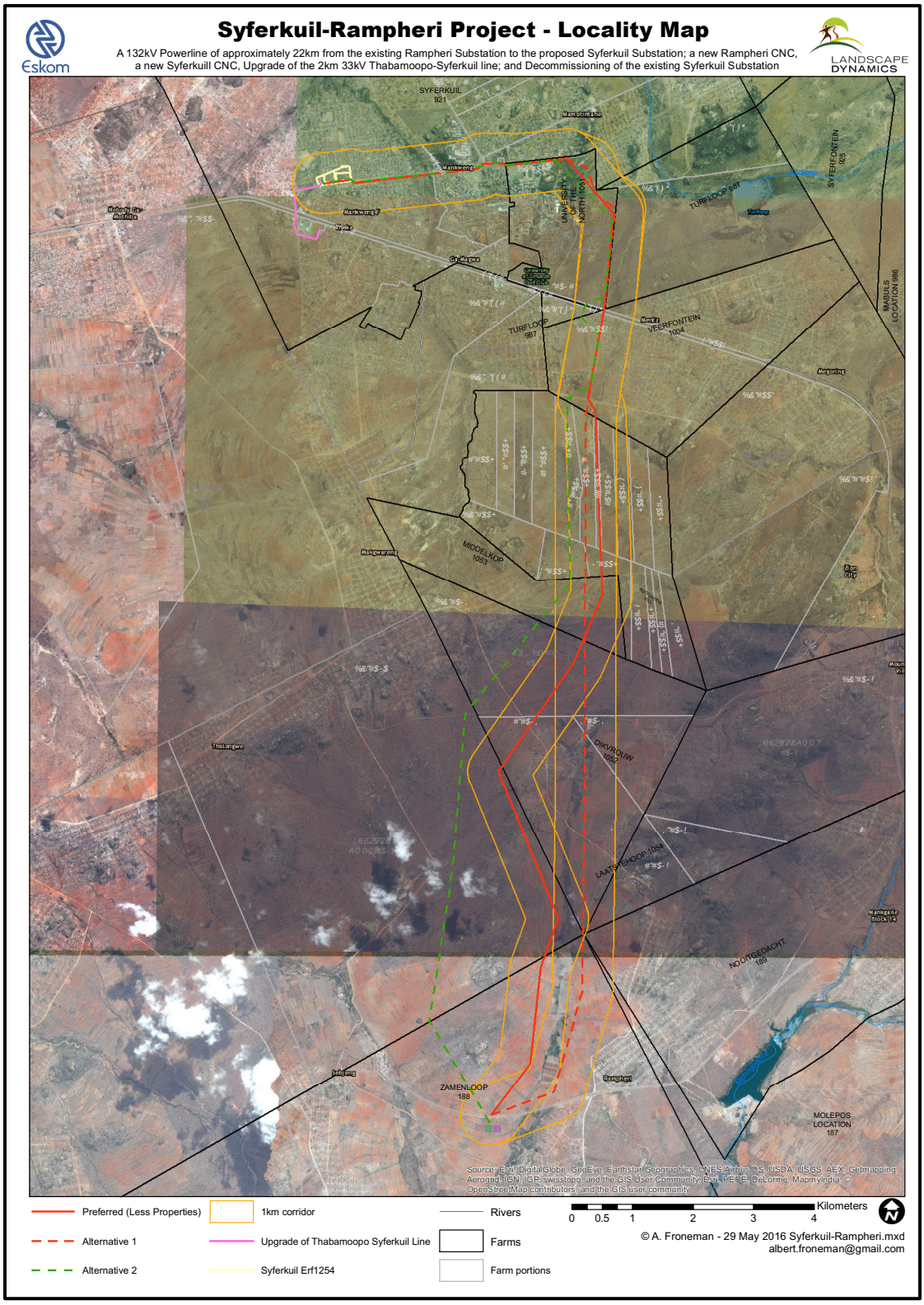

Figure 2: Site location of the Study Area

5.3 Topography

The topography of the region and study area is predominantly that of moderately undulating plains with granite koppies (rocky outcrops) scattered throughout the landscape. Kloofs, ravines and valleys are scare within the area, with the Strydpoort Mountain range to the south and various other mountains visible to north and east.

The region and the study area are relatively flat with granite koppies (rocky outcrops) scattered across the landscape. The height above sea level varies from about 1300m to 1100m, with an average of about 1200m. In general, the northern half of the study area slopes downwards in a northerly direction, while the southern half slopes downwards in a southerly direction. The gradient and slopes are steeper along the southern third of the study area.

5.4 Geology and Soils

Migmatites and gneisses of the Hout River Gneiss and the Turfloop Granite (both of Randian Erathem) are dominant in the region and study area. Some ultramafic and mafic metavolcanics, quartzite and chlorite schist of the Pietersburg Group (Swazian Erathem) are also found. These predominantly being the koppies scattered throughout the landscape. The soils tend to be variable, with freely drained soils with high base status, some dystrophic/mesotrophic and eutrophic plinthic catenas. Glenrosa and Mispah soil forms. Land types found in the area are mainly Ae, Bd, Ah, Ab, Bc and Fa (Mucina & Rutherford, 2006). Short descriptions of the different landtypes are found in the table below (Table 1).

Table 1: Description of the Land Types found in the Region

Code	Description
Ab	Red-yellow apedal, freely drained soils (Red, dystrophic and/or mesotrophic). Dominantly (> 40%) red, freely drained, apedal (= structureless) soils. Normally associated with high rainfall areas, where soils are subjected to moderate (= mesotrophic) to intense (= dystrophic) leaching of nutrients from the soil profile. Soils are thus mostly low in base elements (K, Ca, Mg, Na). A broad range of textures may occur.
Ae	Red-yellow apedal, freely drained soils (Red, high base status soils, > 300 mm deep, without dunes). Moderately deep (average 500-1200 mm) red, freely drained, apedal (= structureless) soils. Soils occur in areas associated with low to moderate rainfall (300-700 mm per annum) in the interior of South Africa and have a high

	fertility status. A wide range of texture occurs (usually sandy loam to sandy clay loam).
Ah	Red-yellow freely drained soils (Red and yellow, high base status soils, usually < 15% clay). These red and yellow, apedal (= structureless), freely drained soils have a low clay content (< 15%) and thus a low fertility status. The soils usually have a sand or loamy sand texture and occur in moderately low rainfall areas (400-600 mm per annum). Wind-blown dunes may occasionally be present.
Bc & Bd	Plinthic catena: Upland duplex and margalitic soils rare (Eutrophic; red and/or yellow soils). Mainly red (Bc) or yellow (Bd), apedal (= structureless) soils, which are eutrophic (= high base status). They have a moderate to high fertility status and a wide textural range, mostly sandy loam to sandy clay loam. Soils contain a greyish subsoil layer (plinthic) where iron and manganese accumulate in the form of mottles, due to a seasonally fluctuating water table. With time these mottles may harden (or even cement) to form concretions. These plinthic layers will cause restricted water infiltration and root penetration. In drier areas, however, they may help to hold water in the soil that plants can use.
Fa	Glenrosa and/or mispah forms (other soils may occur); lime rare or absent in the entire landscape. Generally shallow soils consisting of a topsoil directly underlain by weathered rock (Glenrosa form) or hard rock (Mispah form), sometimes with surface rock and steep slopes. Found in moister areas or areas with acidic parent materials, where little lime exists.

5.5 Climate

The study area is within a summer rainfall region of South Africa. The winter months of June and July tend to be very dry with little to no rainfall. The mean annual precipitation (MAP) of the region varies from about 400 mm in the northwest to about 600 mm where it borders on the foot of mountains to the east and south. Frost is uncommon, but can occur albeit infrequently. The study area is situated just outside of the higher (600mm+) rainfall areas of Limpopo. The high mountains define these areas in particular. The study area is within the lower 400mm – 500mm rainfall area (Figure 3).

The mean monthly maximum and minimum temperatures for Polokwane range from 33,2°C to 0,6°C in October and June, respectively. While the city's average annual rainfall is about 400mm. The study area's climate is very similar to that of Polokwane.

The study area is situated within the Temperature Interior Climatic Zone of the country (Figure 4).

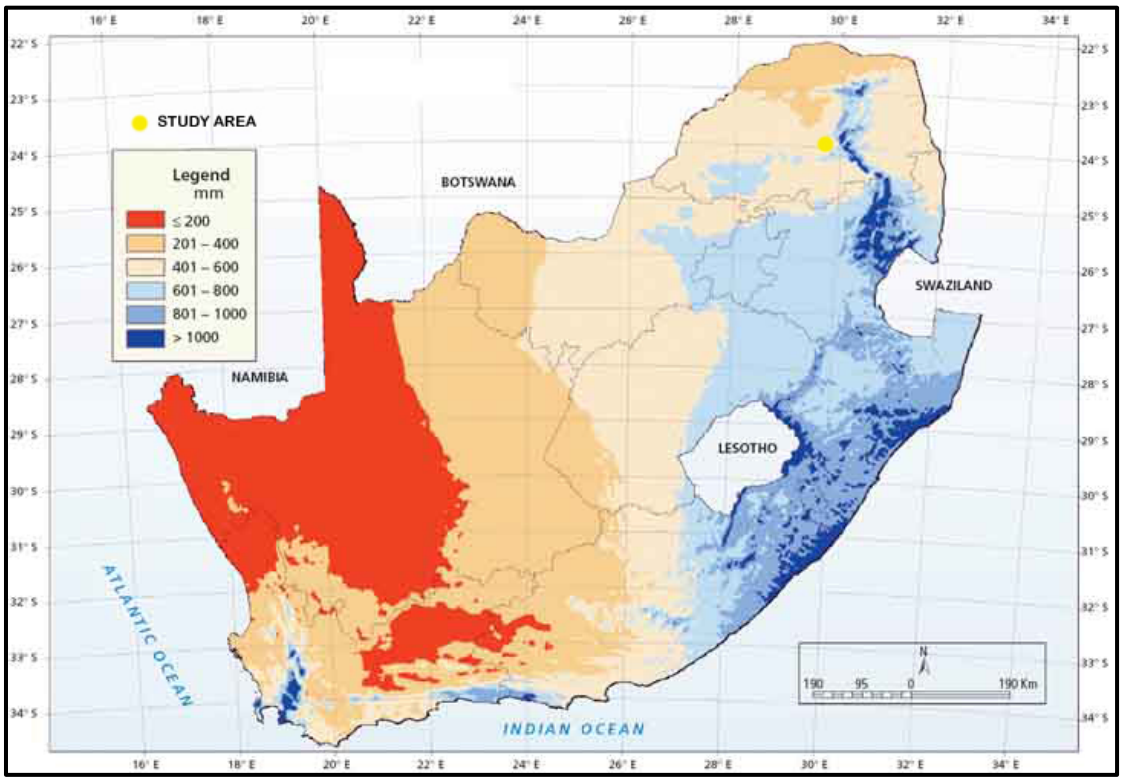

Figure 3: Rainfall averages for South Africa

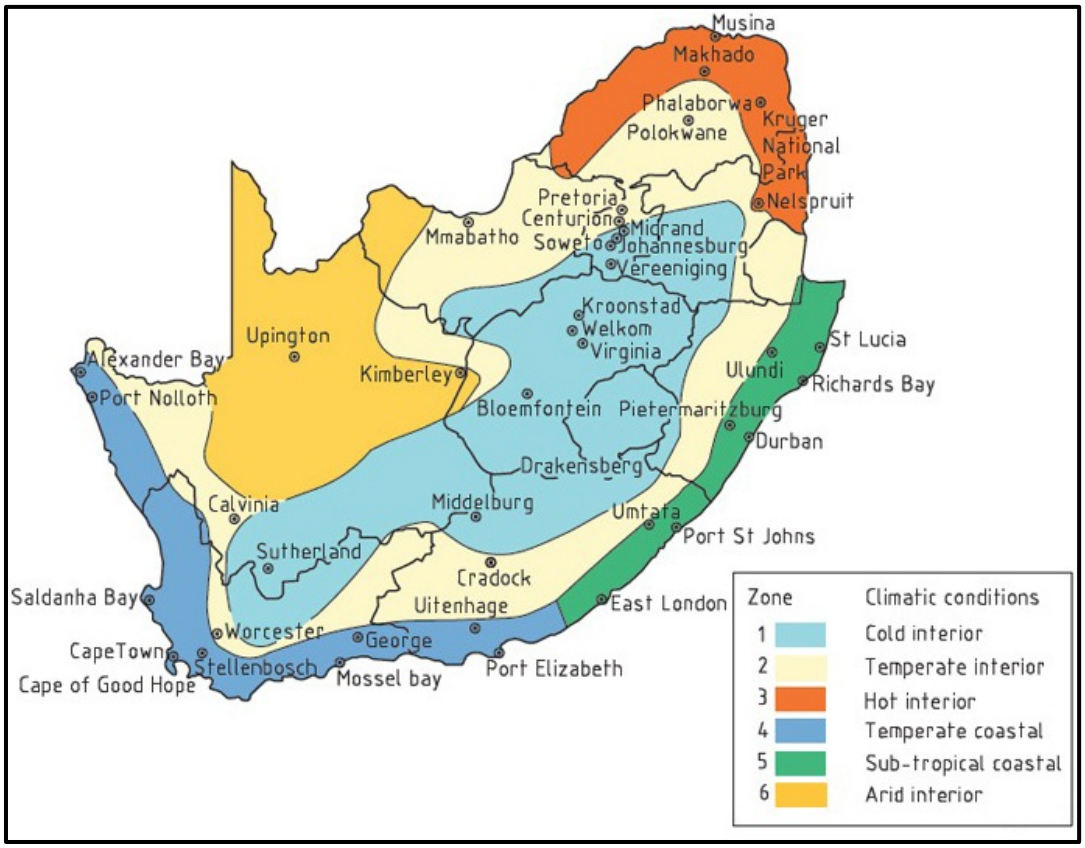

Figure 4: Broad climatic zones of South Africa

5.6 Landcover

The landcover or landuse of the study area is a mix of high-density urbanisation; low-density urbanisation; cultivated lands; grazing lands; degraded veld; open natural veld and granite koppies (Figure 5).

The Syferkuil Substation, Thabamoopo Substation and Syferkuil-Thabamoopo Powerline are within high-density urbanised areas. That is basically within the city environment. The approved Rampheri Substation and proposed Rampheri CNC are situated within old, cultivated fields that have gone back impart to bushveld. Most of the Syferkuil-Rampheri Powerline route is within built-up areas (high and low density) and cultivated lands. However, there are areas of open bushveld and small streams as well. Most of the bushveld is degraded or over-utilised with small patches of near-pristine bushveld. There are no high or commercial agricultural areas within the study area. A section of the study area is within a nature reserve by the Northwest University. The bushveld is in a good condition in the reserve and university area.

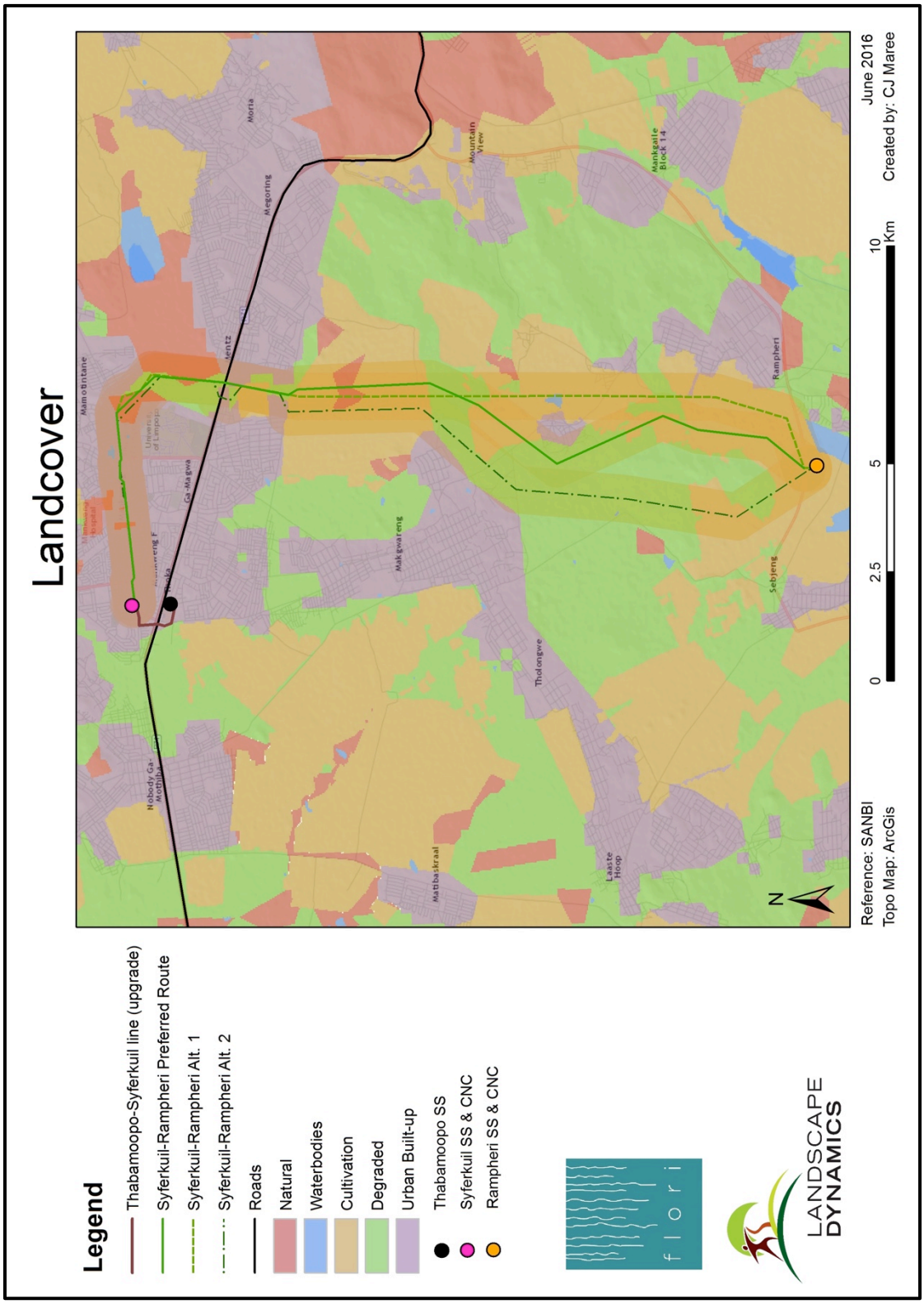

Figure 5: Landcover of the region

6 TERRESTRIAL ECOLOGY

6.1 Vegetation

South Africa is divided up into nine Biomes. The study area is situated within the Savanna Biome, which is also known as the Bushveld Biome (Figure 6). Savanna vegetation types tend to have a mix of a lower grassy layer and an upper woody layer, with the occurance of a middle shrub layer. The mix and ratio of the three layers varies from veldtype to veldtype within the Savanna Biome.

Mucina & Rutherford (2006) have divided the Savanna Biome into six main bioregions, namely, Central Bushveld; Mopane; Lowveld; Sub-Escarpment Savanna; Eastern Kalahari Bushveld; and Kalahari Duneveld. The study area occurs within the Central Bushveld Bioregion (Figure 7).

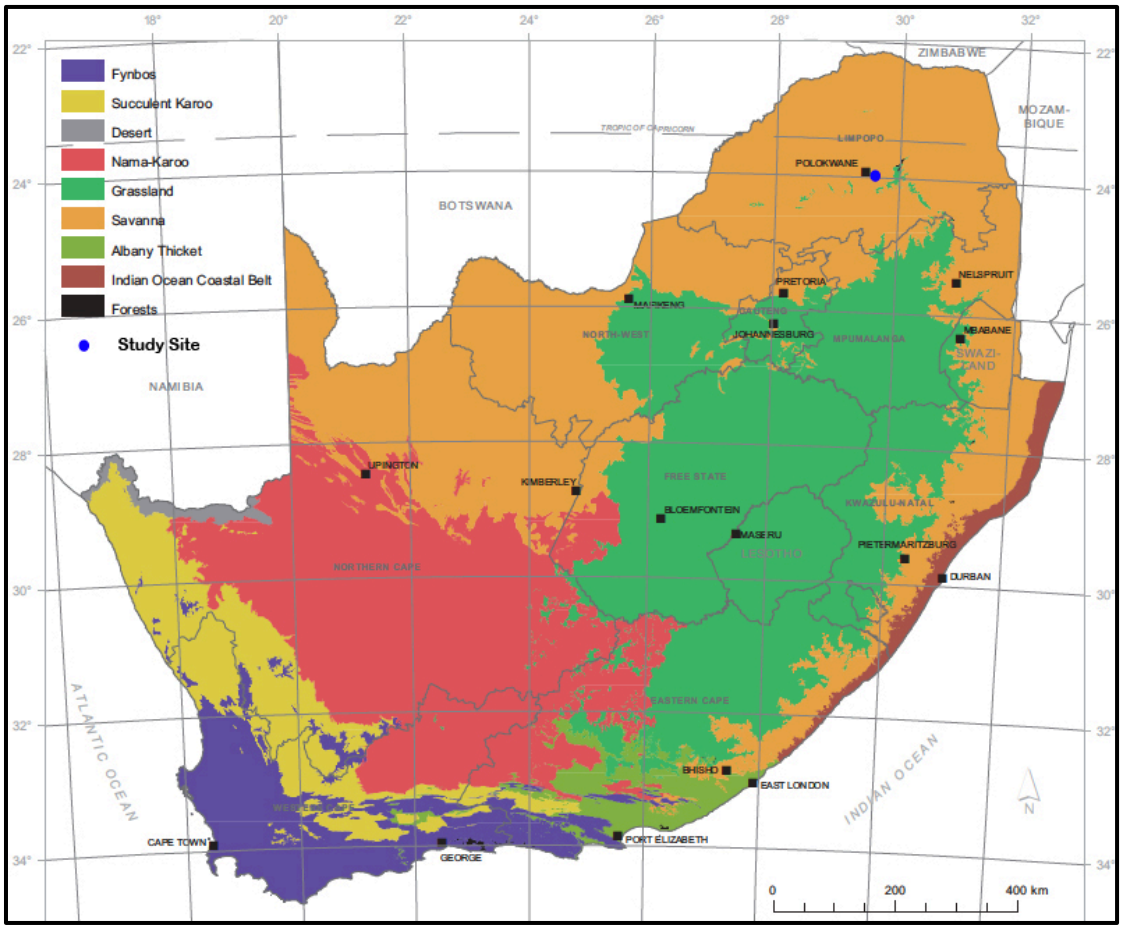

Figure 6: Biomes of South Africa

The study area is situated within a single vegetation unit, known as Polokwane Plateau Bushveld. Areas of Mamabolo Mountain Bushveld occur in the mountainous areas to the south and east of the study area, but not within the proposed powerline servitudes themselves (Figure 8). The granite koppies scattered throughout the landscape and in the study area (1km corridor) are examples of Mambolo Mountain Bushveld vegetation as well. Table 2 shows the hierarchy of the vegetation of the study area, while Table 3 gives other classification names also commonly used for the same veldtypes.

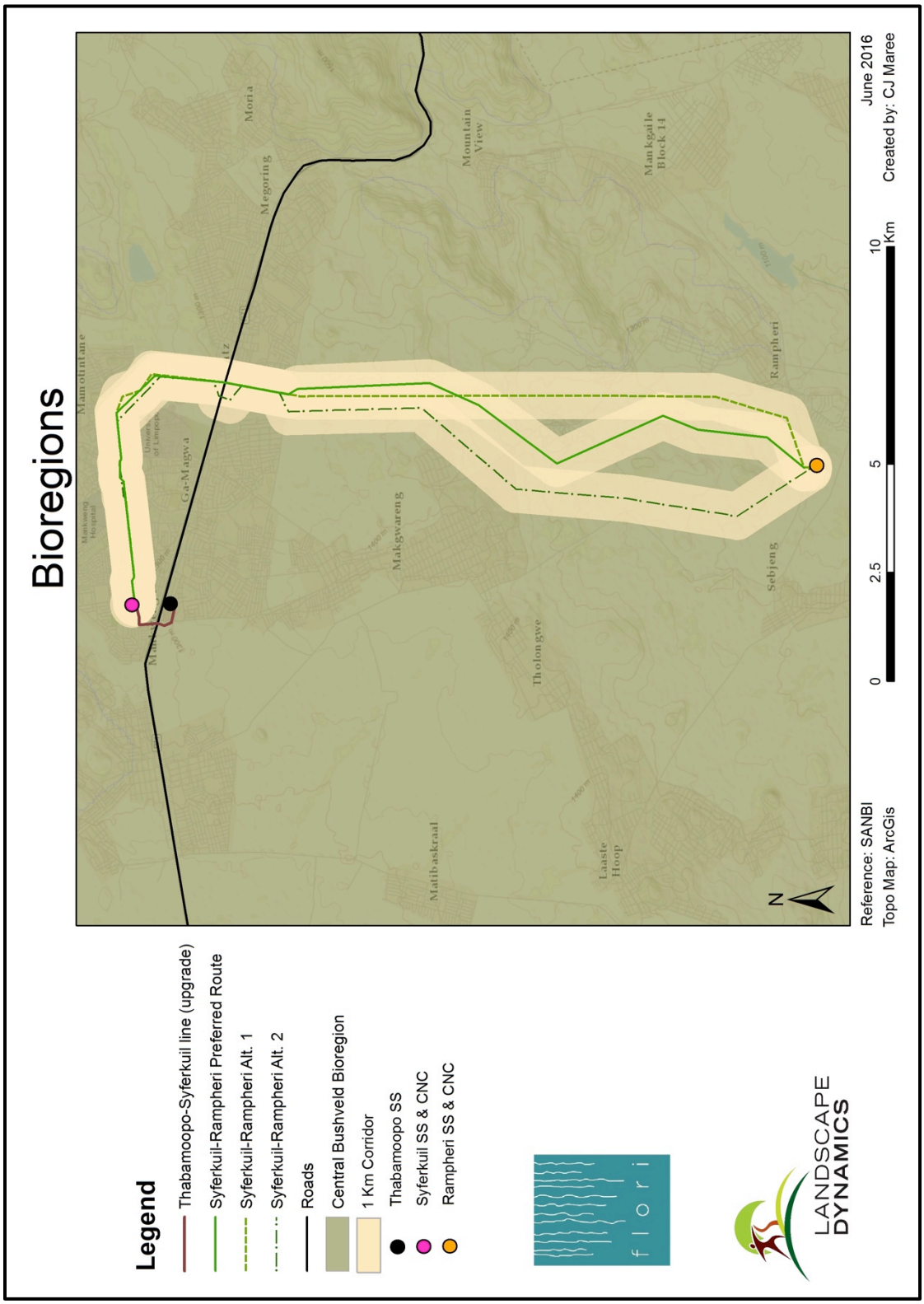

Figure 7: Bioregions

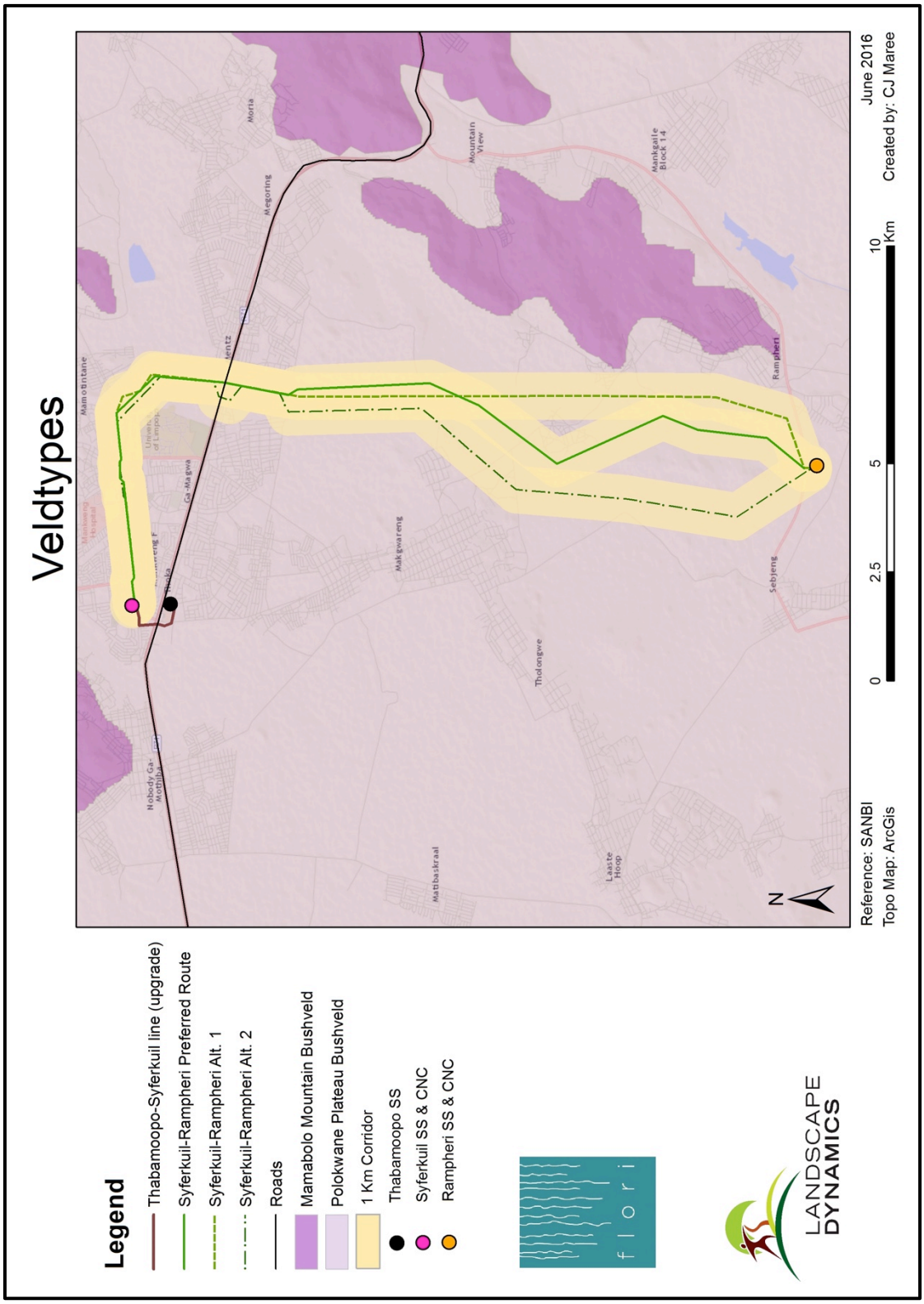

Figure 8: Veld types

Table 2: Vegetation classification of the study site

Category Description	Classification
Biome	Savanna (Bushveld)
Bioregion	Central Bushveld
Vegetation Types	Polokwane Plateau Bushveld Mamabolo Mountain Bushveld

Table 3: Comparison of veldtype names

Mucina & Rutherford (2006)	Low & Rebelo (1996)	Acocks (1953)
Mamabolo Mountain Bushveld	N-E Mountain Grassland	N-E Mountain Sourveld
Polokwane Plateau Bushveld	Mixed Bushveld	Pietersburg Plateau Grassveld

6.1.1 Vegetation of the study area

The vegetation of the study area is typical of that of Polokwane Plateau Bushveld. The undulating plains are covered with a short, open upper tree layer and with a well-developed lower grassy layer. Acocks (1953) classified the vegetation unit as a grass veldtype and not a bush veldtype (Table 3). This is true of the study area in that in many ways it is a grassveld with a tree component. Some specialists classify the vegetation unit as a transitional one between grassveld and bushveld.

The open grassveld areas are covered with open short trees, typically that of acacia thorn tree species. Dominant tree species are those of *Acacia caffra* and *Acacia tortillis*. The vegetation in the north is largely disturbed and transformed. This is to be expected because it is situated within a high-density urban area. The most pristine bushveld in the study area is to the south where the investigated corridors run north of Rampheri within a broad valley area. However, even here there is low- to medium-density urbanisation. As well as impacts on the veld by grazing by free-roaming cattle and goats.

Numerous granite koppies, typical of Mambolo Mountain Bushveld are spread throughout the 1km corridor of the study area. The vegetation of the koppies, which are very rocky, tends to be dominanted by small trees and shrubs. The rock slabs or domes are sparsely vegetated, and then mostly with a mixture of xerophytic or resurrection plants, with several succulents, such as *Euphorbia* tree-species.

A list of dominant plant species observed during field investigations can be found in the appendices.

6.1.2 Priority Floral Species

No Red Data species (endangered, threatened or vulnerable) were observed during field investigations. According to the SANBI database a few Red Data species have been recorded in the region of the QDS quadrants, but it is unlikely that any of these species are present in actual powerline servitudes within the study area (Table 4). This however, is not to say for certain that none occur, as some may well occur in the rocky areas and on the granite koppies, such as the *Euphorbia* species. For these and other reasons the granite koppies are viewed as sensitive, 'no-go' areas. The summaries of priority floral species per grid reference are tabled below (Table 4). The map below (Figure 9) shows the extent of the QDS areas discussed in Table 4.

Table 4: Priority Floral Species per 1:50 000 Grid Reference

Grid reference & Priority Category	No. of species	Name of species
2329DC		
Critically endangered (CR)	2	*Euphorbia clivicola, Euphorbia groenewaldii*
Endangered (EN)	1	*Ledebouria crispa*
Vulnerable (VU)	0	-
Near threatened (NT)	1	*Adenia fruticosa*
2429BA		
Critically endangered (CR)	0	-
Endangered (EN)	0	-
Vulnerable (VU)	1	*Ledebouria dolomiticola*
Near threatened (NT)	2	*Lydenburgia cassinoides, Adenia fruticosa*

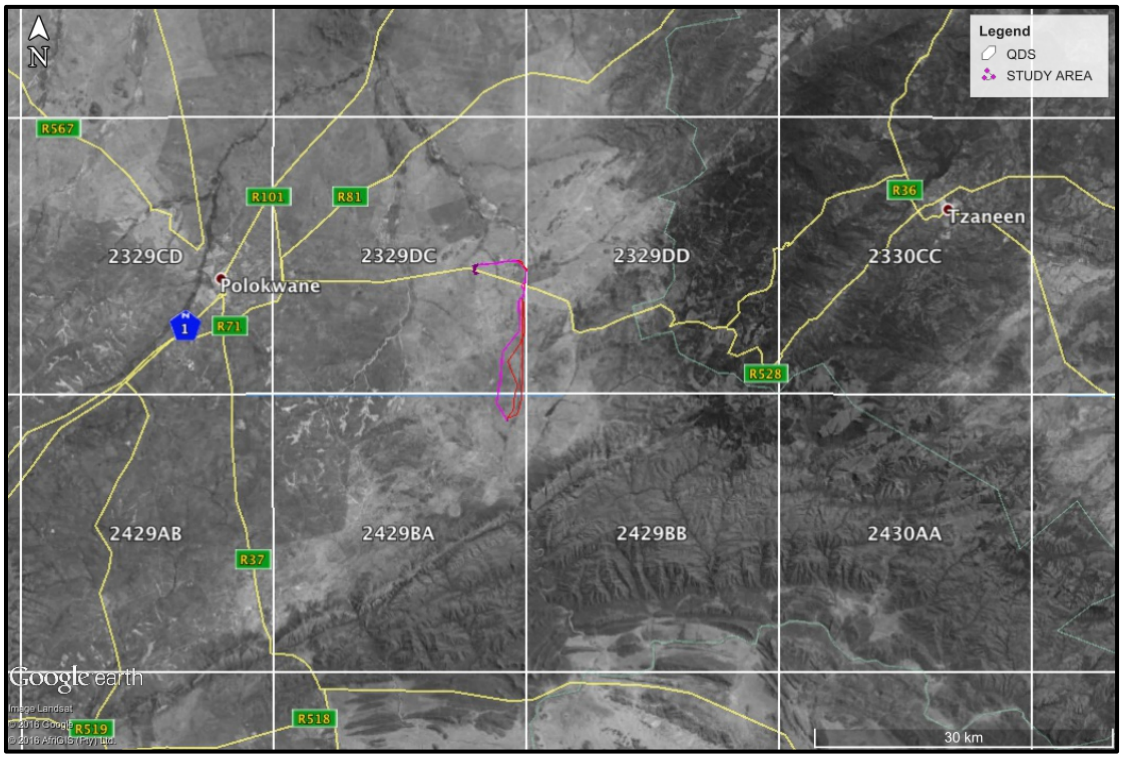

Figure 9: Quaternary Degree Squares (QDS) in which the study area is situated

6.2 Conservation status

The threatened status or conservation status of Polokwane Plateau Bushveld is Least Concerned (LT). The veldtype is not viewed as threatened. The study area is therefore not situated within a threatened ecosystem or veldtype unit. The status of Polokwane Plateau Bushveld is shown in the table below (Table 5).

Table 5: Veldtype status

Veldtype	Status	Info
Mamabolo Mountain Bushveld	LT (LC)	Least threatened. Target 24%. Almost 8% statutorily conserved mainly in the Witvinger and Bewaarkloof Nature Reserves. About 6% transformed, including about 2% each of urban and built-up areas, plantations and cultivated land. Land uses include grazing, wood harvesting and medicinal plant collecting. Alien plants include *Nicotiana glauca*, *Opuntia* species and *Zinnia peru- viana*.
Polokwane Plateau Bushveld	LT (LC)	Least threatened according to remote sensing sources, but with over one third of the remaining vegetation regarded as degraded, it should probably be regarded

		as susceptible. Less than 2% statutorily conserved mainly in the Percy Fyfe and Kuschke Nature Reserves. In addition, 0.7% conserved in other reserves, for example the Polokwane Game Reserve (Mucina & Rutherford, 2006). Some 17% transformed, including about 10% cultivated and 6% urbanised. Dense concentrations of rural human settlements are found particularly in the eastern and northwestern parts of the vegetation unit.

Table 6 below gives a basic description of each of the status categories, while Figure 10 shows the categories in a hierarchical format (IUCN Redlist, 2010).

A general overview map of the threatened ecosystems of South Africa is shown below in Figure 11. From the map in Figure 11 it can be seen that the study area is situated within threatened ecosystems or veldtypes. The map in Figure 11 is taken from SANBI's website (www.bgis.sanbi).

The Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or protected. The main purpose for the listing of threatened ecosystems is an attempt to reduce the rate of ecosystem and species destruction and habitat loss, leading to extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems (SANBI).

Table 6: Ecosystem Status: Simplified explanation of categories used

STATUS	% Transformed	Effect on Ecosystem
Least Threatened (LT)	0-20% (<20% loss)	No significant disruption of ecosystem functions
Vulnerable (VU)	20-40% (>20% loss)	Can result in some ecosystem functions being altered
Endangered (EN)	40-60% (>40% loss)	Partial loss of ecosystem functions
Critically Endangered (CR)	>60% or BT Index for that specific veldtype	Species loss. Remaining habitat is less than is required to represent 75% of species diversity

Source: South African National Spatial Biodiversity Assessment Technical Report. Volume 1: Terrestrial Component. 2004. SANBI. Mucina & Rutherford (eds) (2010).

Note: BT stands for the Biodiversity Threshold and is an index value that differs for each veldtype. In other words, because the composition, recovery rate, etc. differs for each veldtype there will be a different threshold (in this case percentage transformed) at which species become extinct and ecosystems breakdown. That is, at which point the veldtype is critically endangered. For the grassland vegetation units discussed the index value (BT) is broadly given as 60% and greater.

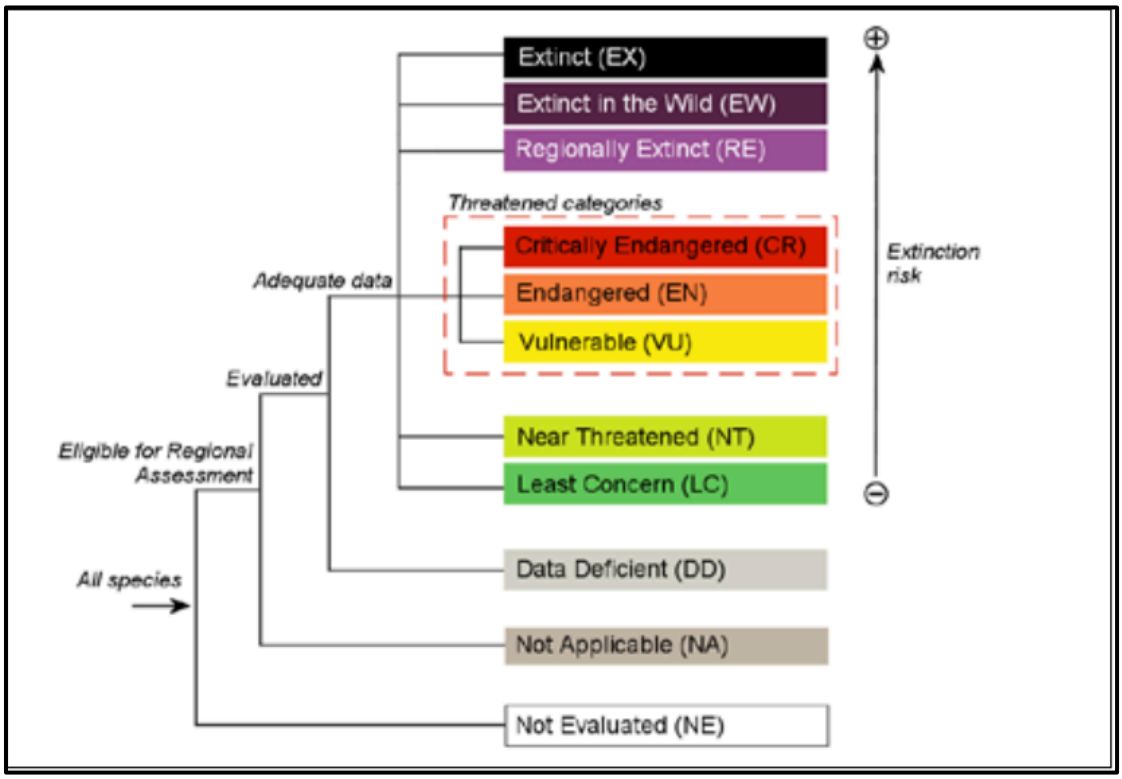

Figure 10: Structure of categories used at the regional level

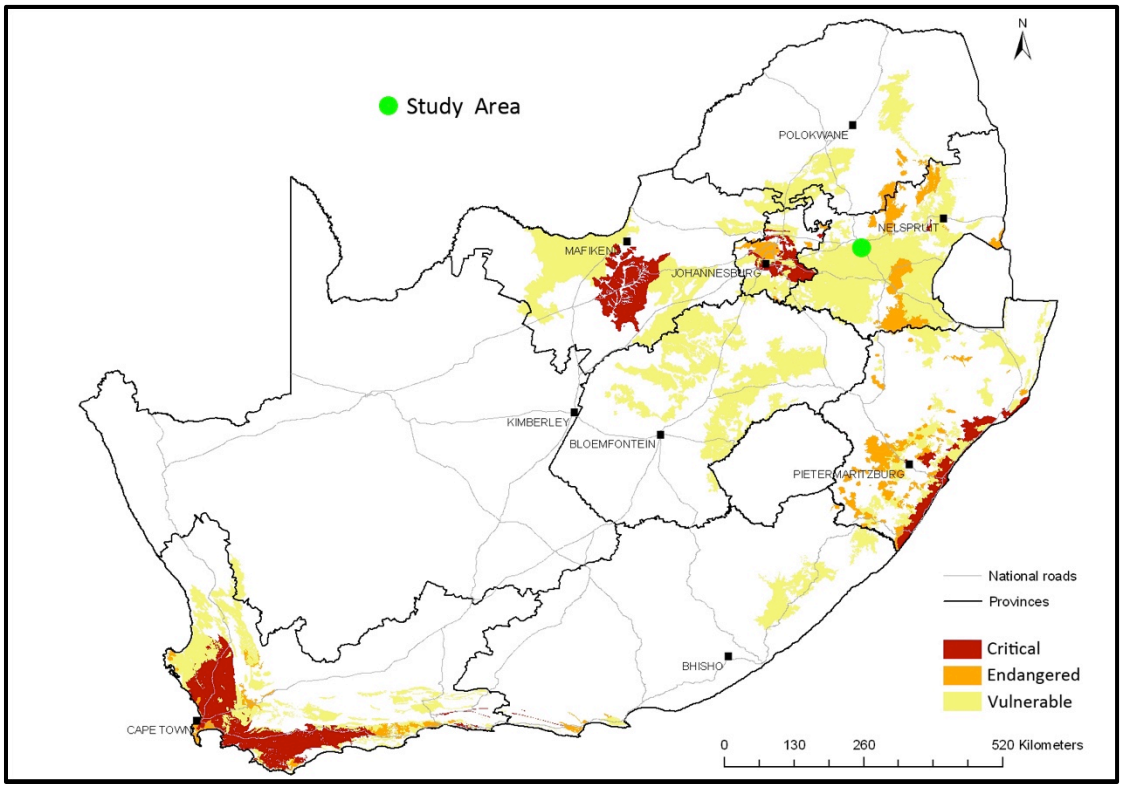

Figure 11: Threatened ecosystems of South Africa

According to the Red List of South African Plants (Raimondo, *et.al*. 2009) the number of plant taxa of conservation concern (Priority species) per QDS for South Africa is shown in the map below (Figure 12). The study area is situated within two QDS quadrants that have a low number, namely 1 – 5.

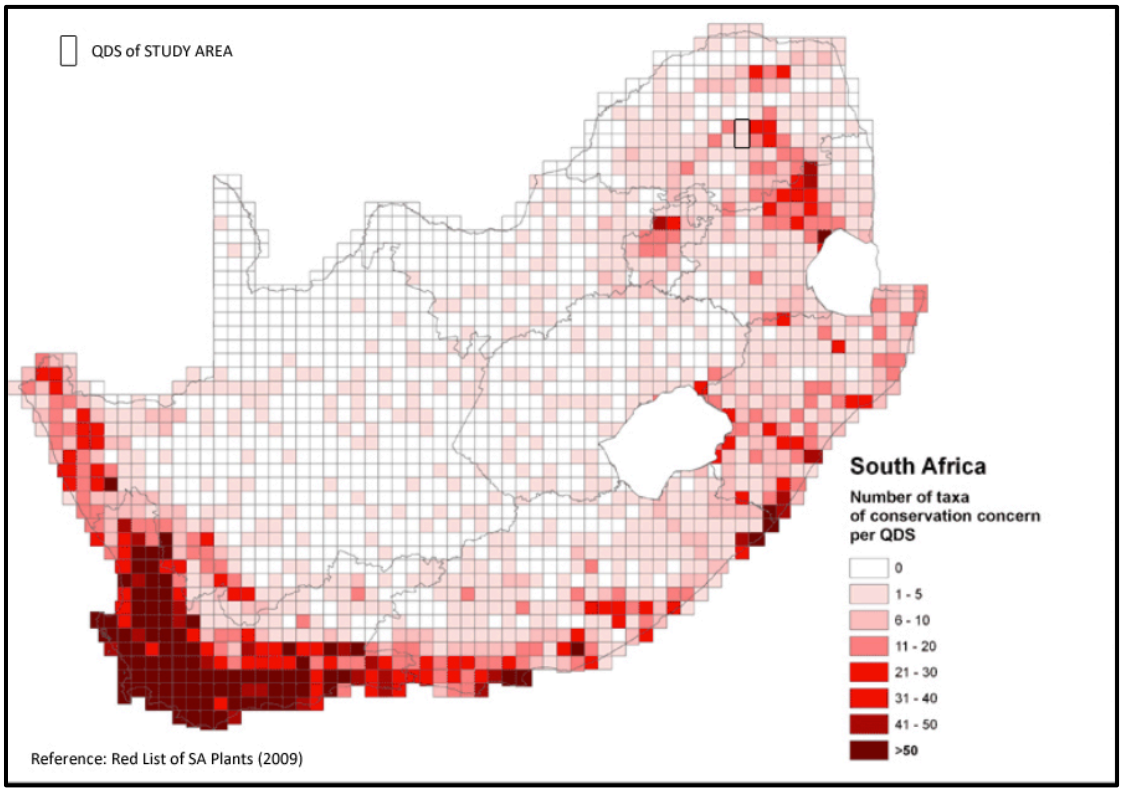

Figure 12: Number of Priority Taxa per QDS of South Africa

6.3 Plants identified during field investigations

The dominant plant species identified during field investigations are listed in the appendices. Field investigations were limited to a few days only and plant lists can therefore not be considered comprehensive.

No red data plant species were observed during field investigations. However a few species of conservation concern were observed. These include *Aloe marlothii*, *Euphorbia cooperi* and S*clerocarya birrea* subsp. *caffra.*

6.3.1 Alien plants identified in the Study Area

There are a number of alien plants in the study area. The herbaceous plants are especially prevalent in disturbed areas and cultivated areas. Few alien tree species are present with species predominantly being of a herbaceous / herb nature. The alien plant species encountered in the study area are recorded, along with their category rating, in Table 7. The categories are as set out in the Conservation Act of Agricultural Resources Act, 1983 (CARA) (Act 43 of 1983).

Table 7: Alien plants identified in the study area

Botanical Name	Common Name	Category
Acacia mearnsii	Blackwattle	2
Agave americana	Century plant	X2
Agave sisalana	Sisal	2
Argemone ochroleuca	White-flowered Mexican poppy	1
Bidens pilosa	Blackjacks	-
Caesalpinia decapetala	Mauritius thorn	1
Cereus jamacara	Queen-of-the-night	1
Conyza canadensis	Horseweed fleabane	-
Datura ferox	Large thorn-apple	1
Eucalyptus spp & cultivars	Gum trees; Eucalyptus	2
Guilleminea densa	Mat weed	-
Jacaranda mimosifolia	Jacaranda	3
Melia azedarach	Syringa	3
Malva verticillata	Mallow	-
Onopordum acanthium	Scotch thistle	-
Opuntia ficus-indica	Prickly pear	1
Ricinus communis	Castor-oil plant	2
Solanum elaeagnifolium	Silverleaf bitter apple	1
Tagetes minuta	Khakibos, kahki weed	-
Tarazacum officinale	Common dandelion	-
Verbena bonariensis	Vervain	-
Xanthium strumarium	Large cocklebur	-

6.4 Protected tree species identified in the study area

During field investigations marula trees (*Sclerocarya birrea* subsp. *caffra*) were observed in the study area. No other protected trees were observed within the powerline servitudes, but a few possibly occur in the study area itself (That is, the 1km corridor) as shown in the appendices (Table 27).

A final walk-through will be required before the actual construction of the Syferkuil-Rampheri powerline begins, to ensure no protected trees are directly within the 8m servitude under the powerline itself, or within the position of pole (pylon) structures. Usually pole positions can be shifted slightly to avoid protected trees. However, in the case of the 8m wide servitude under the line, where trees and shrubs need to be

removed and kept clear, it may not be possible to re-align the route to avoid any potential protected trees. In such as case a tree permit process will then be required.

6.5 Fauna

Field observations were limited to a few days, which always limits the observation and identification of fauna in the field. Due to the transformed nature of the study area the species richness will be low. Ideal habitats for most large or priority faunal species are rare to non-existent, with the exception of the pans, wetlands and streams. However, even these are under pressure with lack of adequate bufferzones and corridors and none are in a pristine condition.

6.5.1 Mammals

No large- or medium-sized mammals were observed during field investigations, with the exception of some common bird species and a few signs of porcupine, field mice and mongoose. Medium- to large-mammals are not expected to occur regularly, although some might possibly move through the study area occasionally from the more inaccessible mountainous areas.

6.5.2 Avifuana

A few common bird species were observed during field investigations such as laughing dove, cape turtle dove, pied crow and black-capped bulbul. The study area is within a region that is home to a number of priority bird species. Avifauna falls outside the scope of this report and will be dealt with by a avifaunal specialist.

6.5.3 Reptiles

No reptiles were observed during field investigations, with the exception of a few plated lizards. The maps below show the hotspots for priority snake and lizard species for South Africa (Figure 13 & Figure 14). The study area is not within a snake hotspot, although it is highly possible that rock python (*Python natalensis*) could occur in the greater region. From Figure 14 it would appear that the study area is within a region of lizard hotspots. Lizards tend to prefer rocky habitats and it is more than likely that most lizards and priority species will occur in the granite koppies of the area and not so much on the open, grassy bushveld plains of the study area.

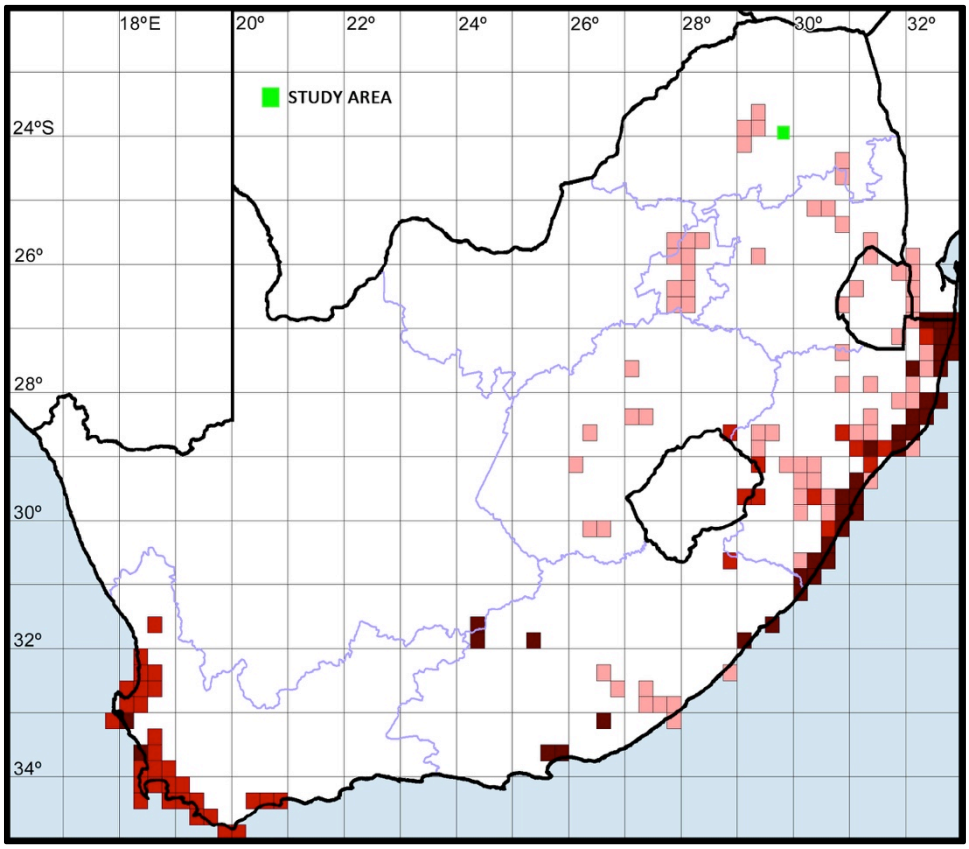

Figure 13: Snake hotspots

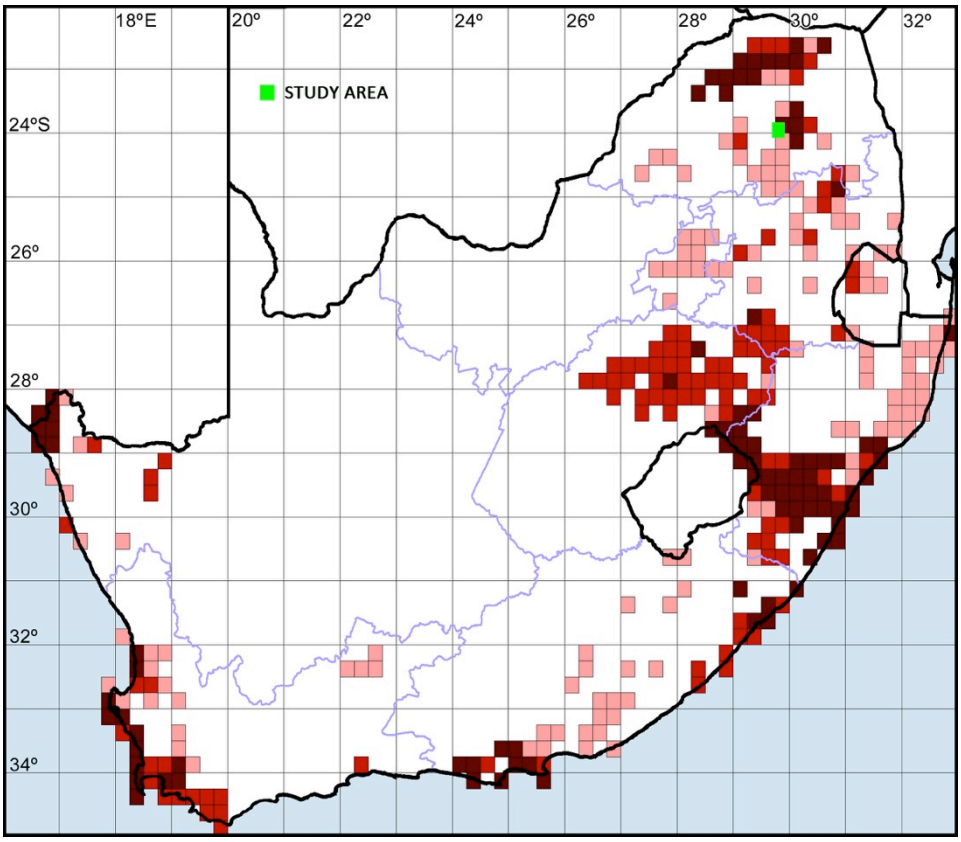

Figure 14: Lizard hotspots

6.5.4 Invertebrates

Invertebrates such as spiders, scorpions and butterflies are important faunal groups, but are difficult to fully assess within a short time period. During field investigations specific attention was given to priority species such as Mygalomorphae arachnids (Trapdoor and Baboon spiders) and red data butterflies. Fortunately, the nature and scope of the project is such that it will have very little negative impact, if any, on these species. No priority species were observed.

The map below shows the hotspots for priority butterflies and species-rich areas for South Africa (Figure 15). The study area is situated within known hotspots, although the central regions of these hotspots are the mountainous areas outside of the actual 1km to the south and east of the study area. The main butterfly hotspot in Limpopo for Red Data species is the Wolkberg, Makapan and Strydpoort Mountains.

The most likely red data butterfly species to potentially occur in the region are:

- Alaena margaritacea;
- *Aloeides stevensoni;*
- Dingana clara; and
- *Lepidochrysops lotana.*

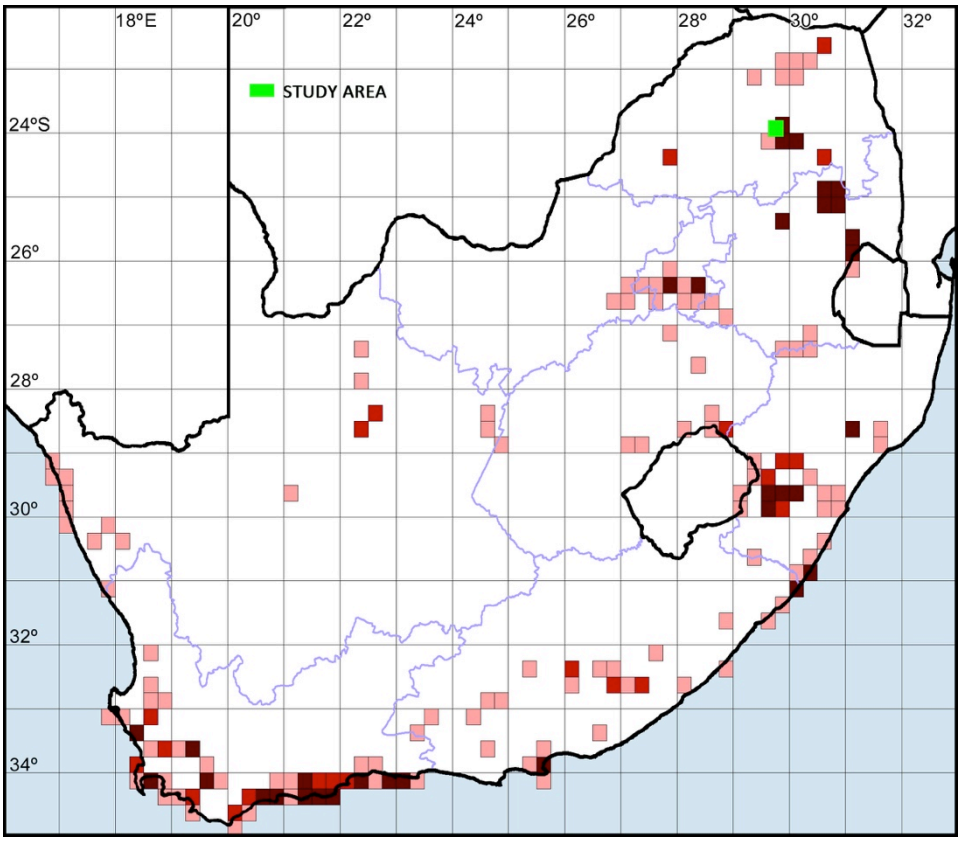

Figure 15: Butterfly hotspots

6.5.5 Faunal species of conservation concern

The general habitats present within the 1km corridor of the study area are for the most part not ideal habitats for most potentially occurring Red Data faunal species. However, due to some ideal, nearby habitats care should be taken to avoid impacting on any animals, nests, borrows, etc. encountered, especially during the construction phase of the project.

The table below highlights the faunal species of conservation concern (which includes Red Data species) that potentially might occur in the study area and surrounding areas from time to time (Table 8). Fortunately, most of the species shown in Table 8 are mainly found in the higher, mountainous areas or rocky granite koppies and not in the main powerline servitudes, or allocated substation and CNC areas of the study area.

Table 8: Red Data Faunal Species likely to occur in the area

Scientific Name	Common Name	Conservation Status	Preferred Habitat	Habitat Restrictions
Birds				
Ciconia nigra	Black stork	NT	Broad, open waterbodies	Cliff ledges for breeding
Elanus caeruleus	Black-shouldered kite	LC	Broad	Open savanna and grassland
Butterflies				
Alaena margaritacea	Wolkberg Zulu	CR	Grassland	Steep grassy, rocky slopes
Aloeides stevensoni	Stevenson's Copper	VU	Grassland	Mountainous areas
Dingana clara	Wolkberg widow	VU	Grassland	Montane, rocky grassland areas
Lepidochrysops lotana	Lotana Blue	CR	Grassland	Mountainous areas
Frogs				
Pyxicephalus adspersus	Giant bulfrog	LC	Grassland, Savanna	Temporary floodplains, pans
Mammals				
Atelerix frontalis	SA hedgehog	NT	Most, broad	None
Manis temmincki	Pangolin (Scaly anteater)	VU	Grassland, savanna	Woody savanna, ants, termites
Pipistrellus rusticus	Rusty bat	NT	Most, broad	Savanna woodland, large trees
Snakes				
Python natalensis	Rock python	VU	Ridges, wetlands	Rocky areas, open water

7 AQUATIC ECOLOGY

The aquatic ecology focuses on the open waterbodies within the study area. These watercourses include wetlands, rivers, streams, pans, lakes and manmade dams. In reality a pan is actually a type of wetland and must be approached as such. The focus is to delineate watercourses and limit any impact the project might have on these watercourses.

7.1 Wetlands

'Wetland' is a broad term and for the purposes of this study it is defined according the parameters as set out by the Department of Water & Sanitation (DWS) in their guideline (A practical field procedure for identification and delineation of wetlands and riparian areas, 2005). The classification of wetlands (which is a type of watercourse) is summarised below (Figure 16).

According to the DWS document and the National Water Act (NWA) a wetland is defined as, "*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near 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*."

Furthermore, the guidelines stipulate that wetlands must have one or more of the following defining attributes:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation;
- The presence, at least occasionally, of water loving plants (hydrophytes); and
- A high water table that results in saturation at or near surface, leading to anaerobic conditions developing in the top 50cm of the soil.

During the site investigations the following indicators were used to determine whether an area needed to be defined as a wetland or not, namely:

- Terrain unit indicator;
- Soil form indicator;
- Soil wetness indicator; and
- Vegetation indicator.

Hydrogeomorphic types		Description	Source of water maintaining the wetland[1]	
			Surface	Sub-surface
Floodplain		Valley bottom areas with a well defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel		Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/ ***
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/ ***
Hillslope seepage linked to a stream channel		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 stream channel.	*	***
Isolated Hillslope seepage		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes 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, and therefore this type is usually isolated from the stream channel network.	*/ ***	*/ ***

[1] Precipitation is an important water source and evapotranspiration an important output in all of the above settings

Water source: * Contribution usually small

*** Contribution usually large

*/ *** Contribution may be small or important depending on the local circumstances

*/ *** Contribution may be small or important depending on the local circumstances.

 Wetland

Figure 16: Classification of wetlands

7.2 Riparian zones

Riparian vegetation is typically zonal vegetation closely associated with the course of a river or stream and found in the alluvial soils of the floodplain. According to the National Water Act (NWA) riparian habitat is defined as including "*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."

It is important to note that the NWA states that the riparian zone has a floral composition distinct from those of adjacent areas. The NWA also defines riparian zones as areas that "c*ommonly reflect the high-energy conditions associated with the water flowing in a water channel, whereas wetlands display more diffuse flow and are lower energy environments*."

7.3 Rivers and streams

A stream or river is a watercourse that is characterised by a very distinct channel. Most, but not all streams and rivers have an associated floodplain and / or riparian zone. Although wetlands and rivers are both watercourses, the legal implications differ in terms of development, buffer zones, etc.

7.4 Watercourses in the study area

The main perennial and/or large rivers of the region are not within the study area. The Diep River is approximately 7,5km due west of Sykerkuil Substation, while the Turfloop River is approximately 1 km northwest from the study at is closest point. The Mphogodima River is about 2,5km east of the study area and the Thlabasane about 3,8km south of the Rampheri Substation and CNC sites. The Diep and Turfloop Rivers flow north and eventually into the Limpopo River, while the Mphogodima and Thlabasane Rivers flow south and eventually into the Olifants River (Figure 17 & Figure 18).

As already mentioned above, there are no large, perennial rivers in the study area, the closest being the Turfloop River. However, a main tributary of the Turfloop River is within the northern section of the study area. In the southern section of the study area is a tributary of the Thlabasane River. Both these tributaries are unnamed on maps and are semi-perennial streams.

Besides the two main tributaries mentioned above, there are still a few small drainage lines in the study area. These are seasonal in nature and tend to flow for a few days only after good rainfalls. There are no wetlands in the study area.

Erosion and donga formation is a bit of a problem, especially in the southern half of the study area where the topography at times can be steeper. The donga and surface erosion is linked to surface rainwater run-off near streams or steep ravines. These dongas / erosion lines in affect become drainage lines and as such need to be avoided were possible.

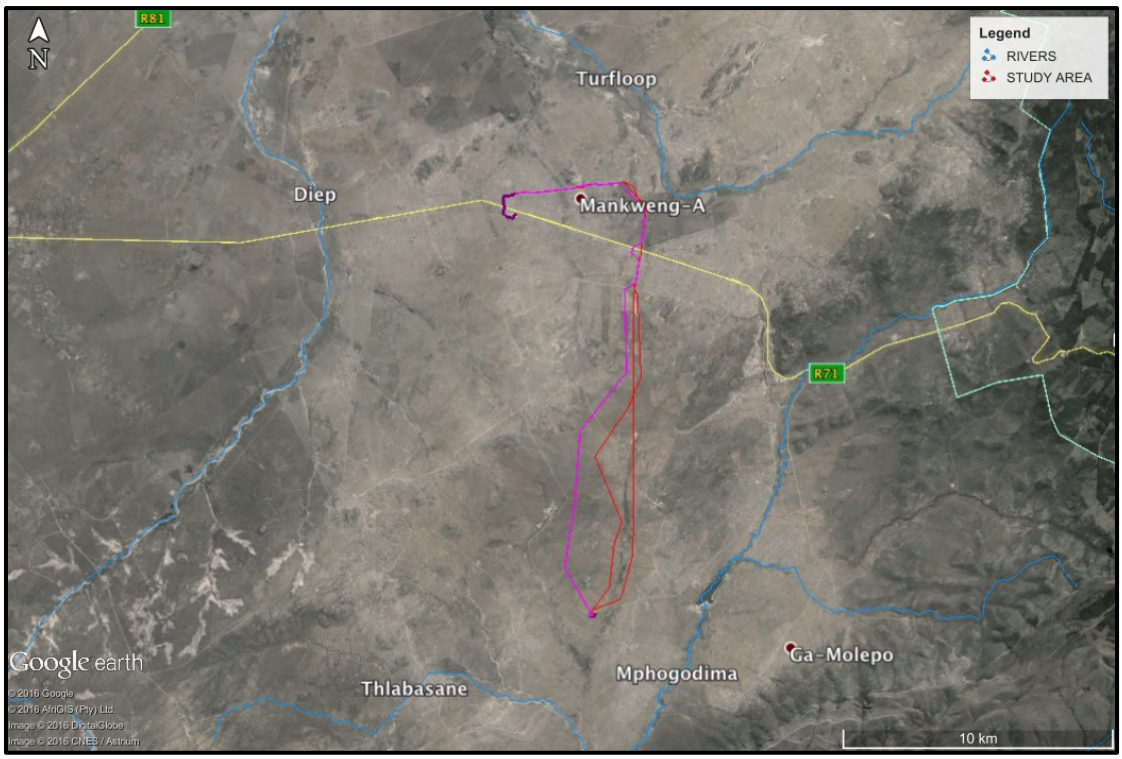

Figure 17: Rivers in the region (Google Earth image)

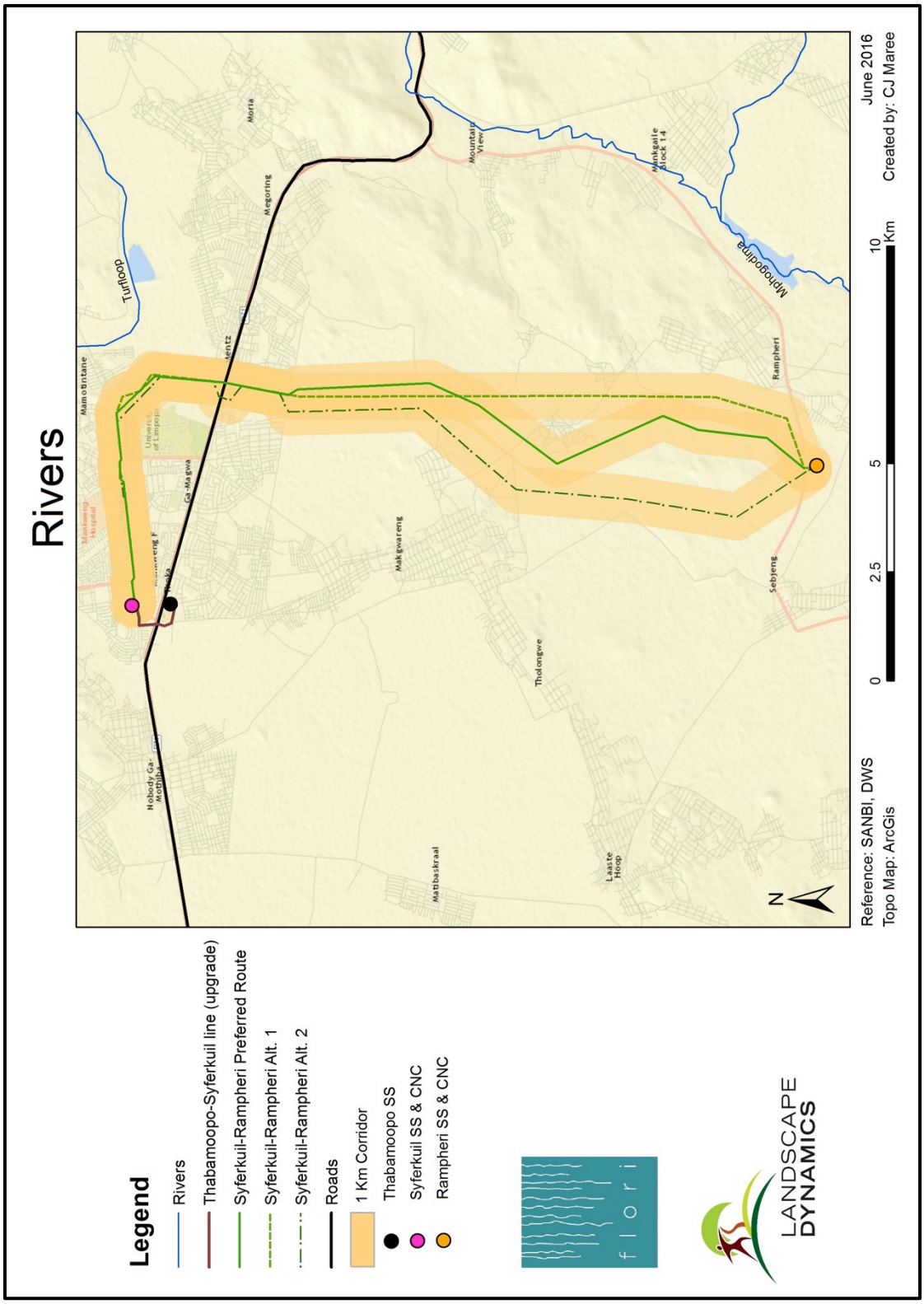

Figure 18: Main Rivers in the region

7.5 Classification of watercourses in the study area

All watercourses within the study area were delineated and classified according to the classification system shown in Figure 16. The watercourses of the study area were also classified along different hydrogeomorphic (HGM) types or units, up to Level 4, in terms of various levels as refined for South Africa by Kleynhans, *et. al*. (2005) and used in the Classification System for Wetlands user manual – SANBI Series 22 (Ollis *et. al.* 2013). See tables below (Table 9 & Table 10). This in addition to the classification system used above (Figure 16).

Table 9: Classification levels 1 - 4

LEVEL 1 System	**LEVEL 2 Regional setting (Ecoregion)**	**LEVEL 3 Landscape Unit**	**LEVEL 4 HGM Unit**	
			HGM Type	Landform
Inland	SA Ecoregions according to DWS and/or NFEPA	• Valley floor • Slope • Plain • Bench	River	• Mountain headwater stream • Mountain stream • Transitional stream • Upper foothill • Lower foothill • Lowland • Rejuvenated foothill • Upland floodplain
			Channeled valley bottom wetland	
			Unchannelled valley bottom wetland	
			Floodplain Wetland	
			Depression	• Exorheic • Endorheic • Dammed
			Seep	• With channel outflow (connected)

				• Without channel outflow (disconnected)
			Wetland flat	

Table 10: HGM Level 4: Seasonal drainage line in study area

Delineated systems	Level 1 System	Level 2 Regional Setting (Ecoregion)	Level 3 Landscape Unit	Level 4 HGM Unit
Turfloop tributary	Inland	Central Bushveld Group 6	Valley floor	River (Lower Foothill)
Thlabasane tributary	Inland	Central Bushveld Group 6	Valley floor	River (Lower Foothill)
Small drainage lines	Inland	Central Bushveld Group 6	Valley floor	River (Lower Foothill)

7.6 Delineated Watercourses

The watercourses within the study area where the proposed powerline routes may potentially impact on have been delineated and need to be avoided. The Substations and CNCs are not near any watercourses (including wetlands).

As mentioned early, there is donga formation and shallow, surface erosion areas that preferably need to be avoided. To simplify matters these areas have been delineated along with the associated watercourses. In affect, these erosion gullies (dongas) have become drainage lines that become active during heavy rain downpours and as such are better to be avoided.

There are three main areas where the Syferkuil-Rampheri powerline servitude potentially impacts on, or comes close to, watercourses and erosion areas. These areas have been marked as sensitive, but are not 'no-go' zones. However, it is strongly recommended that a final walk-through be conducted prior to the start of construction just to help fine-tune the positioning of poles (pylons) as to avoid dongas, drainage lines, etc. This will also assist in avoiding triggering the need for a WULA process. Although it looks possible that a GA process might still be required.

7.7 Drainage areas

South Africa is geographically divided up into a number of naturally occurring Primary Drainage Areas (PDA) and Quaternary Drainage Areas (QDA) (Figure 19). The different areas fall under the authority of different Water Management Areas (WMA) and Catchment Management Agencies (CMA) (Figure 20 & Figure 21).

The study area is situated within the Primary Drainage Areas (PDAs) of A and B and the Quaternary Drainage Areas (QDA) of A71B and B52H (Figure 22, Figure 23 & Figure 24).

The northern half of the study area is within the Limpopo Water Management Area (WMA 1) and under the jurisdiction of the Limpopo Catchment Management Agency (CMA 1) (Figure 21). While the southern half of the study area is within the Olifants Water Management Area (WMA 4) and under the jurisdiction of the Olifants Catchment Management Agency (CMA 2) (Figure 21). Not all CMAs are currently fully operational.

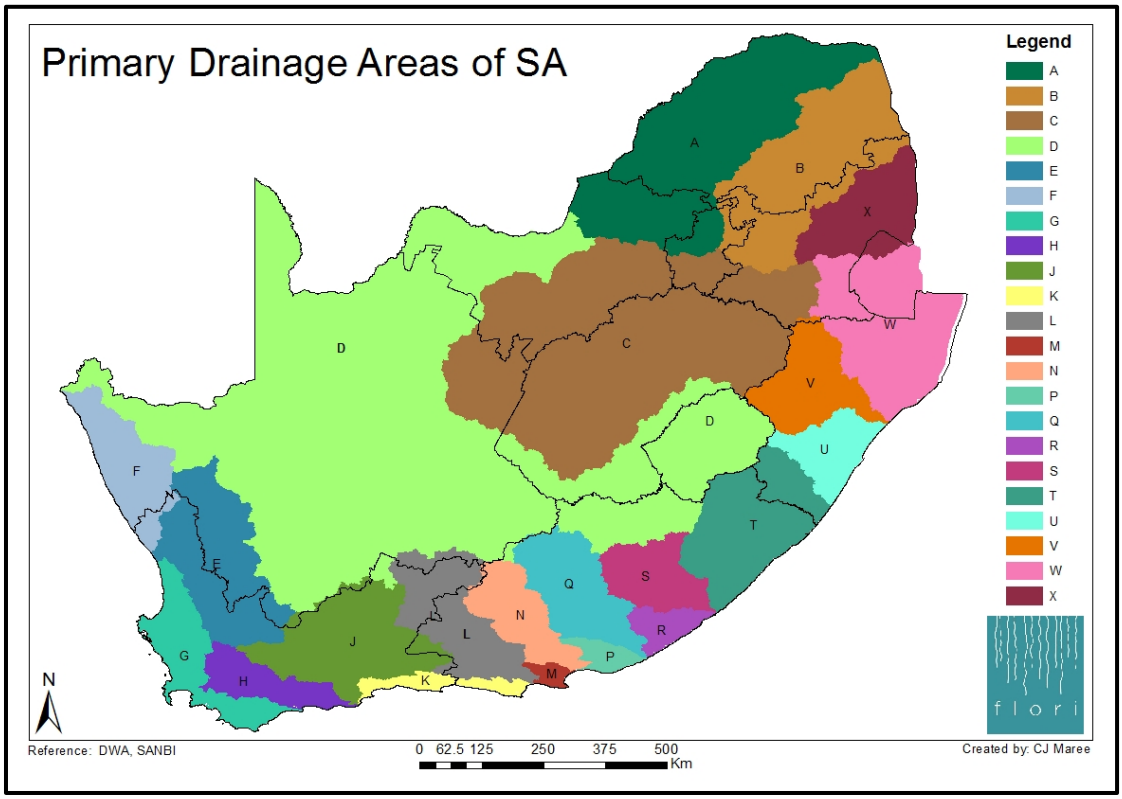

Figure 19: Primary drainage areas of South Africa

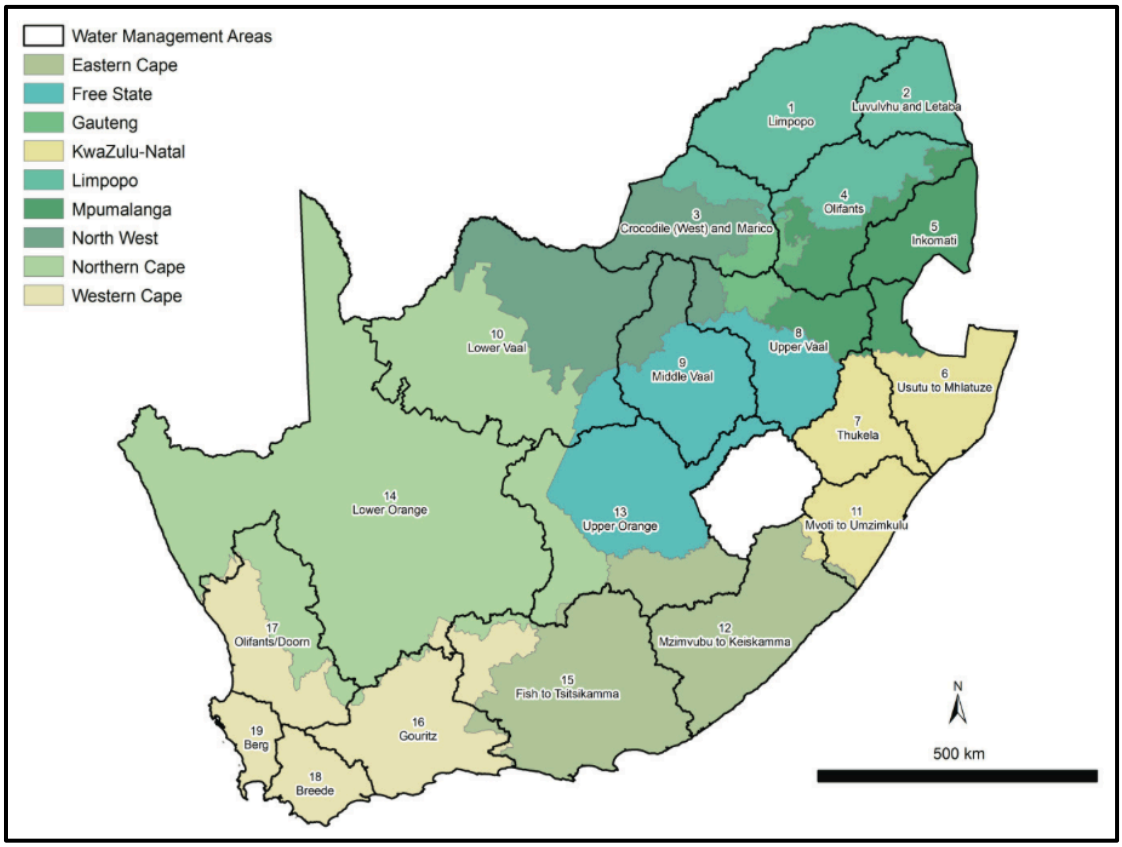

Figure 20: Water management areas of South Africa

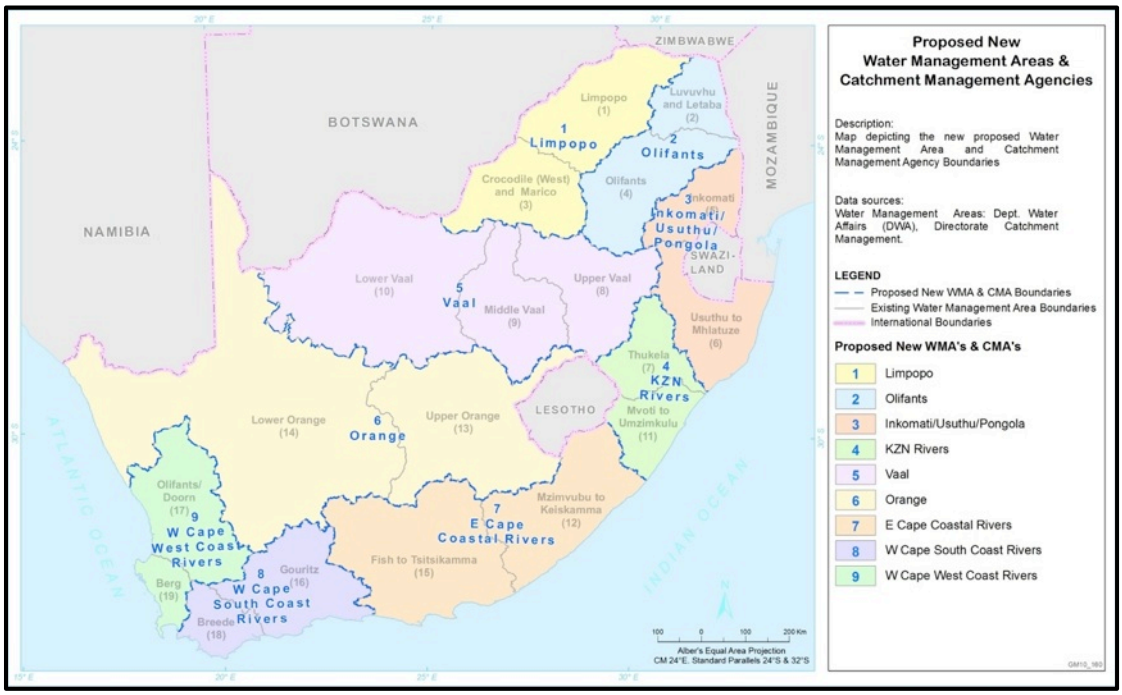

Figure 21: WMAs & CMAs of South Africa

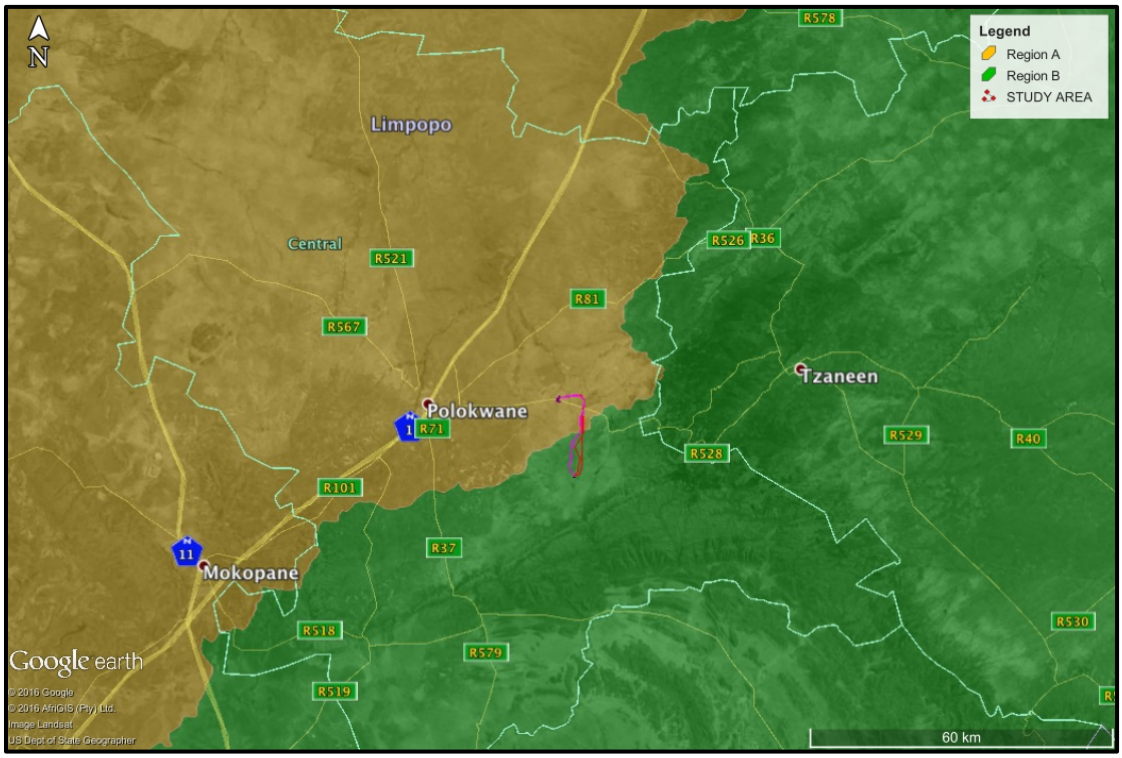

Figure 22: PDAs in which the study area is situated

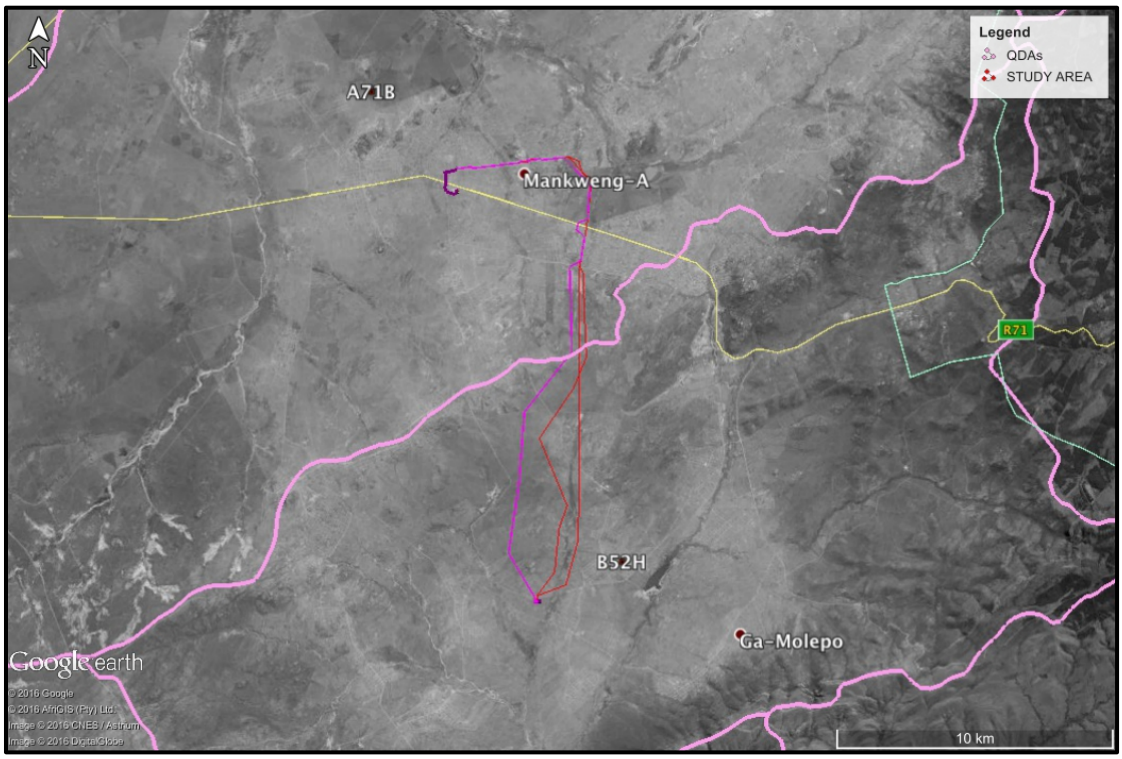

Figure 23: QDAs (Google Earth Image)

In terms of the water environment the study area is situated within a single Wetland Vegetation Ecoregion, namely the Central Bushveld Group 6 (Figure 25).

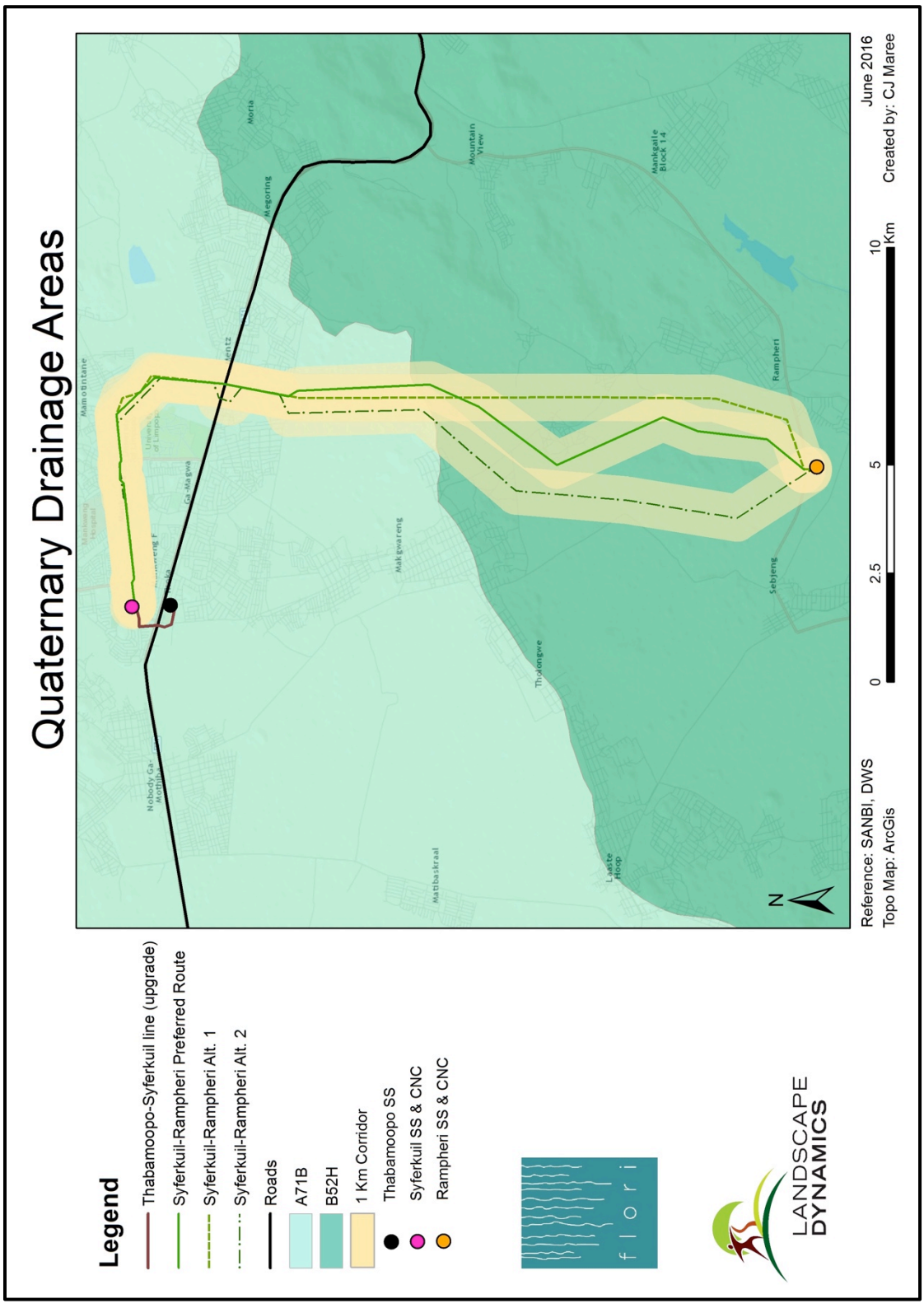

Figure 24: Quaternary drainage areas (QDAs)

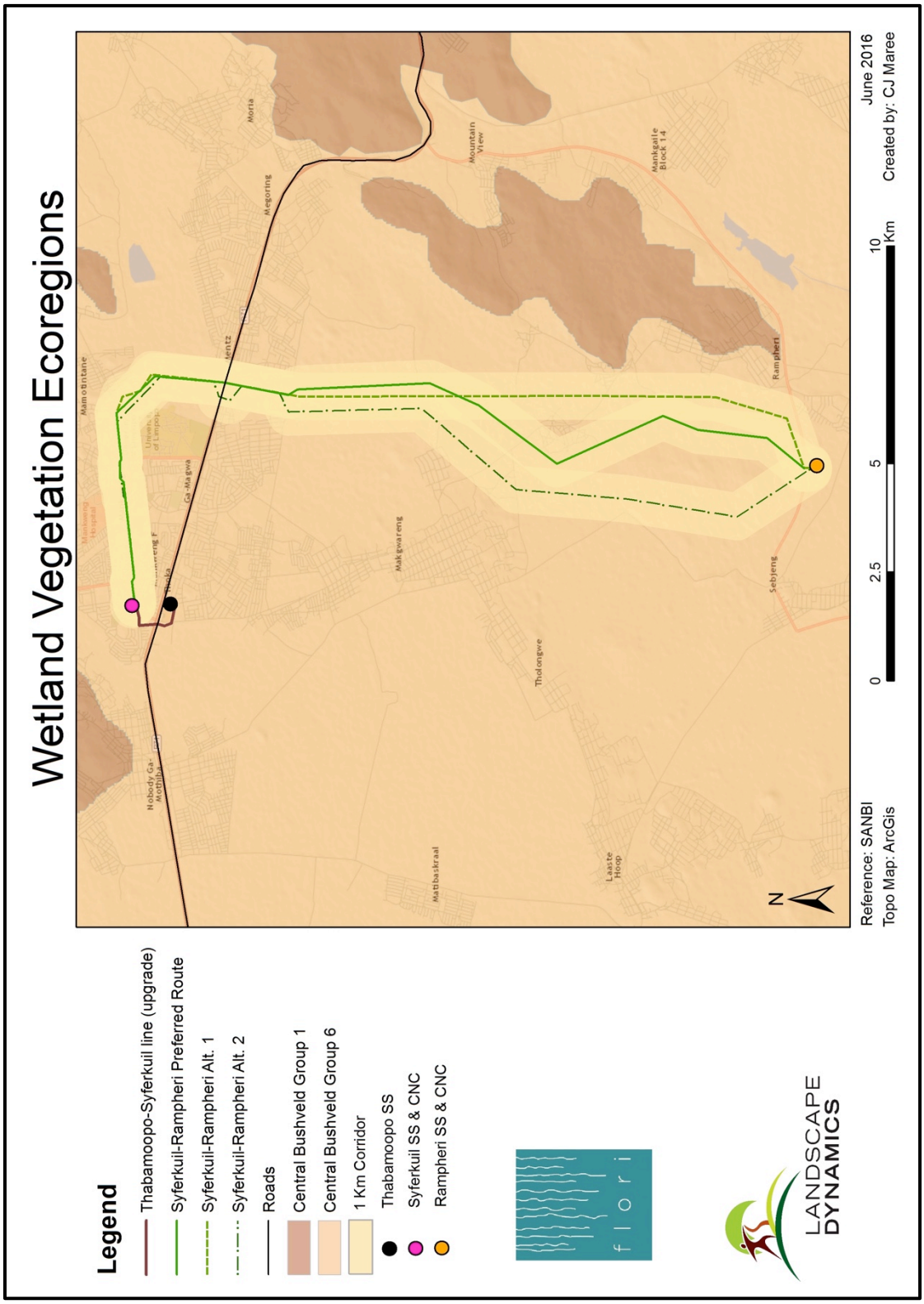

Figure 25: Wetland Vegetation Ecoregions

7.8 Strategic water source areas (SWSA) of South Africa

The Strategic Water Source Areas of South Africa (SWSA) are those areas that supply a disproportionate amount of mean annual runoff compared to the actual size of the geographical area. These areas are important because they have the potential to contribute significantly to the overall water quality and supply of the country, supporting growth and development needs that are often a far distance away. These areas make up 8% of the land area across South Africa, Lesotho and Swaziland but provide 50% of the water in these countries.

At a national level, Strategic Water Source Areas form the foundational ecological infrastructure on which a great deal of built infrastructure for water services depends. Investing in Strategic Water Source Areas is also an important mechanism for long-term adaptation to the effects on climate change on water provision growth and development (SANBI). The study area is not situated within any Strategic Water Source Areas (SWSA) of South Africa, but is just on the outer fringes of the SWSA areas of the Strydpoort and Wolkberg Mountains (Figure 26).

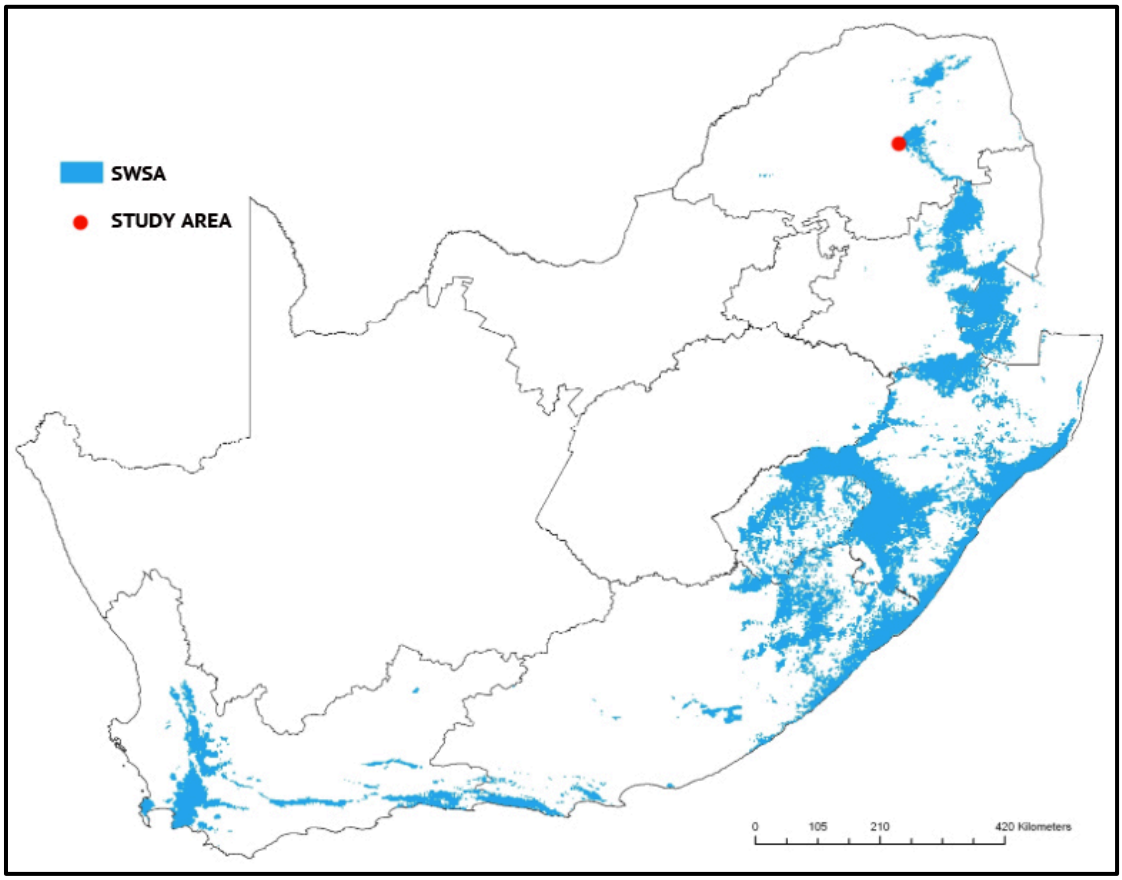

Figure 26: SWSA of South Africa

7.9 Methodology (PES)

The Present Ecological State (PES) is the current (present) ecological condition (state) in which the watercourse is found, prior to any further developments or impacts from the proposed project. The PES ratings of watercourses found in the study area are just as important to determine, as are the potential impacts of the proposed development. The PES of a watercourse is assessed relative to the deviation from the Reference State (also known as the Reference Condition).

The reference state is the original, natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES Method (DWA, 2005) was used to establish the present state (integrity) of the unnamed drainage line in the study area. The methodology is based on the modified Habitat Integrity approach of Kleynhans (1996, 1999).

Table 11 shows the criteria used for assessing the habitat integrity (PES) of wetlands and other watercourses, along with Table 12 describing the allocation of scores to the various attributes. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a wetland.

Table 11: Habitat assessment criteria

Rating Criteria	Relevance
Hydrology	
Flow modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural lands. Changes in flow regime (timing, duration, frequency), volumes, and velocity, which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water quality	
Water Quality Modification	From point or diffuse sources. Measured directly

	by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.
Geomorphology & Hydraulics	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities, which reduce or changes wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of Biota	Overgrazing, over fishing, over harvesting of plant material, etc.

Table 12: Scoring guidelines for habitat assessment

Scoring guidelines per criteria	
Natural / unmodified	5
Mostly natural	4
Moderately modified	3
Largely modified	2
Seriously modified	1
Critically modified (totally transformed)	0

Table 13 provides guidelines for the determination of the Present Ecological Status Category (PESC), based on the mean score determined for the assessments. This approach is based on the assumption that extensive degradation of any of the wetland attributes may determine the PESC (DWA, 2005).

Table 13: Wetland integrity categories

Category	Mean Score	Description
A	>4	Unmodified, natural condition.
B	>3 to 4	Largely natural with few modifications, but with some loss of natural habitats.
C	>2,5 to 3	Moderately modified, but with some loss of natural habitats.
D	2 to 2,5	Largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
E	>0	Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
F	0	Critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

The integrity of watercourses with a category rating of F,E & D were deemed to be Low. Category rating of C was deemed to be Medium, while Category ratings of B & A were deemed to be High.

7.10 PES of watercourses in the study area

All of the watercourses identified during field investigations in the study area were assessed (Table 14). The small streams and drainage lines are in reality and functionality the same. They have therefore been assessed as a group. The assessment criteria and structure is based on the modified Habitat Integrity approach of Kleynhans (1996, 1999). The PES is calculated by looking at the hydrology,

geomorphology, water quality and biota of each watercourse. Of importance is the overall PES of the system.

Table 14: PES of watercourses in the study area

Criteria	Identified Watercourses		
	Turfloop Tributary	Thlabasane Tributary	Drainage Lines
HYDROLOGY			
Flow modification	2	2	2
Permanent inundation	1	1	1
WATER QUALITY			
Water Quality Modification	2	2	2
Sediment Load Modification	2	2	2
GEOMORPHOLOGY			
Canalisation	2	2	2
Topographic Alteration	2	2	2
BIOTA			
Terrestrial Encroachment	2	2	2
Indigenous Vegetation Removal	2	2	2
Invasive Plant Encroachment	3	3	3
Alien Fauna	3	3	3
Over utilisation of Biota	1	1	1
Total:	22	22	22
Average:	2,0	2,0	2,0
Category:	**D**	**D**	**D**
Integrity (PES):	**Low**	**Low**	**Low**
PES Description	**Largely Modified**	**Largely Modified**	**Largely Modified**
Recommended EMC	**C**	**C**	**C**

All of the streams and drainage lines in the study area are basically identical in terms of their PES ratings. All have been calculated to be Category D (Largely Modified). Ideally, one would want the watercourses in the area to be managed and improved to a PES of at least Category C. However, this falls outside of the responsibilities of Eskom or the sub-contractors. Except in terms of limiting further impacts on these watercourses during the construction phase of the project.

7.11 Methodology (EIS)

Ecological importance and sensitivity (EIS) looks at the importance of the wetland, watercourse or water ecosystem in terms of biodiversity and maintenance. The determination is not just based on the identified watercourse in isolation, but also its' importance in terms of supplying and maintaining services to the larger catchment and water systems up and downstream.

The ecological sensitivity (ES) part of the EIS looks at how sensitive the system is to changes in services and environmental conditions. The Recommended Environmental Management Class (REMC) is the recommended state to which the watercourse should be returned to or maintained at. The EIS categories and descriptions are outlined in the table below (Table 15).

A high REMC relates to ensuring a high degree of sustainability and a low risk of ecosystem failure occurring. A low REMC would ensure marginal sustainability, but with a higher risk of ecosystem failure. The REMC is based on the results obtained from assessing the ecosystem or watercourse in terms of EIS, PES and function. The ideal would be that with realistic recommendations and mitigating actions, to return the system to a certain level of functionality and original state. The determination of the Environmental Importance and Sensitivity (EIS) of the identified watercourses in the study area are shown below (Table 16).

Table 15: EIS Categories and Descriptions

EIS Categories	Median Range	Category
Wetlands that are considered ecologically important and sensitive on a **national or international** level. The biodiversity of these wetlands is usually very sensitive to flow & habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	Very high 3 - 4	A
Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	High 2 - 3	B
Wetland that are considered to be ecologically important and sensitive on a **provincial or local** scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	Moderate 1 - 2	C
Wetlands that are not ecologically important and sensitive on any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	Low 0 - 1	D

7.12 EIS of watercourses in the study area

The EIS values of the watercourses were determined using the above methodology. The calculations and categories are shown below (Table 16).

Table 16: EIS and EMC values of watercourses

Determinant	Turfloop Tributary	Thlabasane Tributary	Drainage Lines	Confidence
PRIMARY DETERMINANTS				
1. Rare & Endangered Species	3	3	2	4
2. Populations of Unique Species	2	2	2	4
3. Species/taxon Richness	2	2	2	4
4. Diversity of Habitat Types or Features	2	2	1	4
5 Migration route/breeding and feeding site for wetland species	3	3	2	3
6. Sensitivity to Changes in the Natural Hydrological Regime	3	3	3	3
7. Sensitivity to Water Quality Changes	3	3	3	3
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	3	3	2	3
MODIFYING DETERMINANTS				
9. Protected Status	1	1	1	4
10. Ecological Integrity	3	3	2	4
TOTAL	25	25	20	-
AVERAGE	2,5	2,5	2,0	-
Overall EIS	**B**	**B**	**C**	**-**
Description	**High**	**High**	**Moderate**	**-**

The EIS ratings of the two main tributaries of the Turfloop and the Thlabasane Rivers, are deemed to be high because they are important catchments servicing rivers in the region that many rural villages rely on for drinking and irrigation purposes. Furthermore, these waterways help sustain larger downstream rivers that are important for faunal breeding species such as waterbirds and migratory birds.

Their importance is heightened by the fact that the natural environment and all watercourses in the region are under severe pressure due to over-utlisation and increasing urbanisation. The drainage lines, although still important, contribute less

to the general fauna and flora of the region, as well as to the catchment's discharge into larger rivers. These are some of the reasons that their EIS is calculated to be Category C (Moderate).

7.13 Drivers of ecological change on the watercourses

The main drivers of ecological change on the watercourses and water ecosystems in the study area are:

- Cultivation;
- Impoundment by means of in-channel farm dams;
- Urbanisation; and
- Over-utilisation of natural resources.

Although powerlines generally have a small impact on watercourses, especially in terms of impeding and/or diverting waterflow, their potential impact in the study area is not a major driver of ecological change on the water environment.

8 SENSITIVITY ASSESSMENT

The sensitivity assessment identifies those areas and habitats within the study site that have a high conservation value and that may be sensitive to disturbance. All watercourses, including seasonal streams and drainage lines are always deemed to be sensitive, even if they are badly degraded. Areas or habitats have a higher conservation value (or sensitivity) based on their threatened ecosystem status, ideal habitat for priority species (including Red Data species), species-richness, distinctive habitats, etc.

The natural environment within the study area is fairly uniform and consists of three distinctive natural habitats, namely open bushveld, granite koppies and watercourses. The watercourses are similar to one another in nature. Most of the natural habitat along the route of the study area has been moderately modified to totally transformed, primarily as a result of cultivation and urbanisation. Such areas are not viewed as sensitive at all. Pristine bushveld areas would be viewed in this area as sensitive, but none occur, with the exception of the granite koppies, although not totally pristine. The floral and faunal sensitivity analyses are shown in the tables below (Table 17 & Table 18).

8.1 Floristic Sensitivity Analysis

The sensitivity analysis of the floral component of the study area within the different identified habitats is shown in the table below (Table 17).

Table 17: Floristic sensitivity analysis

Criteria	Distinctive habitats in the study area			
	Bushveld	Cultivated lands & Urban areas	Granite Koppies	Watercourses
Red Data Species	3	2	7	4
Habitat Sensitivity	4	2	8	6
Floristic Status	4	2	8	6
Floristic Diversity	4	1	8	5
Ecological Fragmentation	5	3	8	8
Sensitivity Index	40%	16%	78%	58%
Sensitivity Level	Medium	Low	Medium/High	Medium
Development Go Ahead	Go-But	Go	Go-But	Go-But

8.2 Faunal Sensitivity Analysis

The sensitivity analysis of the faunal component of the study area within the different identified habitats is shown in the table below (Table 18).

Table 18: Faunal sensitivity analysis

Criteria	Distinctive habitats in the study area			
	Bushveld	Cultivated lands & Urban areas	Granite Koppies	Watercourses
Red Data Species	3	3	8	5
Habitat Sensitivity	4	3	8	7
Faunal Status	4	3	8	7
Faunal Diversity	4	3	8	7
Ecological Fragmentation	5	3	8	8
Sensitivity Index	40%	30%	80%	68%
Sensitivity Level	Medium	Medium/Low	High	Medium/High
Development Go Ahead	Go-But	Go-Slow	No-Go	Go-But

8.3 Ecological Sensitivity Analysis

The ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in nature (Table 19).

Table 19: Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity	Development Go-ahead
Bushveld	Medium	Medium	Medium	Go-But
Cultivated lands & Urban areas	Low	Medium/Low	Medium/Low	Go-Slow
Granite Koppies	Medium/High	High	High	No-Go
Watercourses	Medium	Medium/High	Medium/High	Go-But

According to the analyses the grantie koppies (rocky outcrops) are High sensitivity areas / habitats and need to be viewed as 'No-Go' areas in terms of the proejct development. Watercourses were calculated to be of Medium/High sensitivity in

terms of the actual ecological component. However, all watercourses must be viewed and approached as sensitive and preferablly as 'No-Go' zones in terms of project development. Fortunately no approved or proposed substations or CNCs impact on any watercourses. However, actual powerlines will need to cross over some drainage lines. Pre-construction planning needs to be such that these powerlines, especially the pylons (poles) themselves are not within watercourses. Such action will trigger the need for a Water Use Licence Application (WULA) process.

8.4 Priority areas

The study area is predominantly outside of any priority areas. None of the substations or CNCs are within any priority areas. However, in three cases the study area imposes on priority areas in terms of NFEPA 'wetlands' or open waterbodies. The Syferkuil-Rampheri powerliine corridor imposes on demarcated priority areas, this according to the datasets of the SANBI database. The north-east corner of the study area (i.e. the Syferkuil-Rampheri powerline servitude) goes through a formal protected area, while in the middle of the Syferkuil-Rampheri powerline Alt.1 crosses over a NFEPA 'wetland area', which is actually a farm dam. In the extreme south, east of the Rampheri Substation and CNC area is a watercourse area within the 1km corridor of the study area (Figure 27).

The watercourse area east of Rampheri is not problematic and can easily be avoided. However, the protected area in the north-east is unavoidable as the various route alternatives presently exist. The farm dam in about the middle of the corridor can be avoided by following the Preferred Route or by realigning Alternative 1 only slightly.

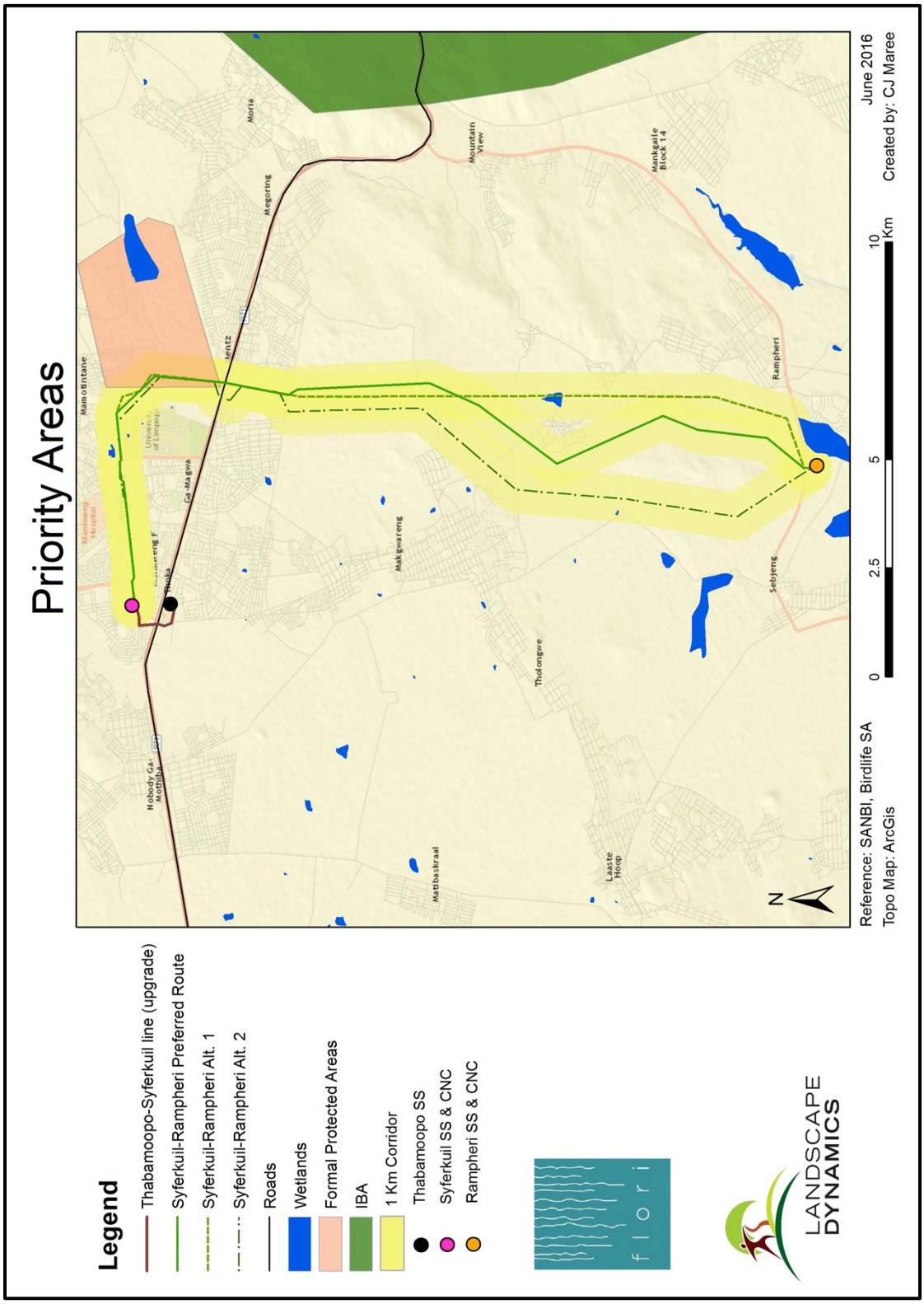

Figure 27: Priority areas

8.5 Sensitive areas identified during field investigations

Three areas were identified as sensitive, besides the granite koppies. The three areas are related to watercourses and associated erosion areas and a nature reserve area. The areas have been delineated and marked in the maps below. A final walk-through is important for these areas to make sure pole (pylon) positions are correct. It is also possible to realign powerline servitudes within these areas. The areas are, however, not 'No-Go' areas.

Sensitive Area 1 runs through a formal nature reserve area where protected trees such as marulas are more than likely to occur and where the powerline may come close to a main tributary of the Turfloop River.

Sensitive Area 2 is within an area where there is a lot of erosion close to and along a small stream. In this area caution needs to be taken to avoid impacting on the watercourse as well as increasing erosion potential. Proper spacing of powerline poles in this area is not prohibited, but is essential to be done right.

Sensitive Area 3 is also within a watercourse area and an area of high erosion. A manmade impoundment is also within this area. Once again, final alignment of the powerline and poles is crucial here, although not prohibited.

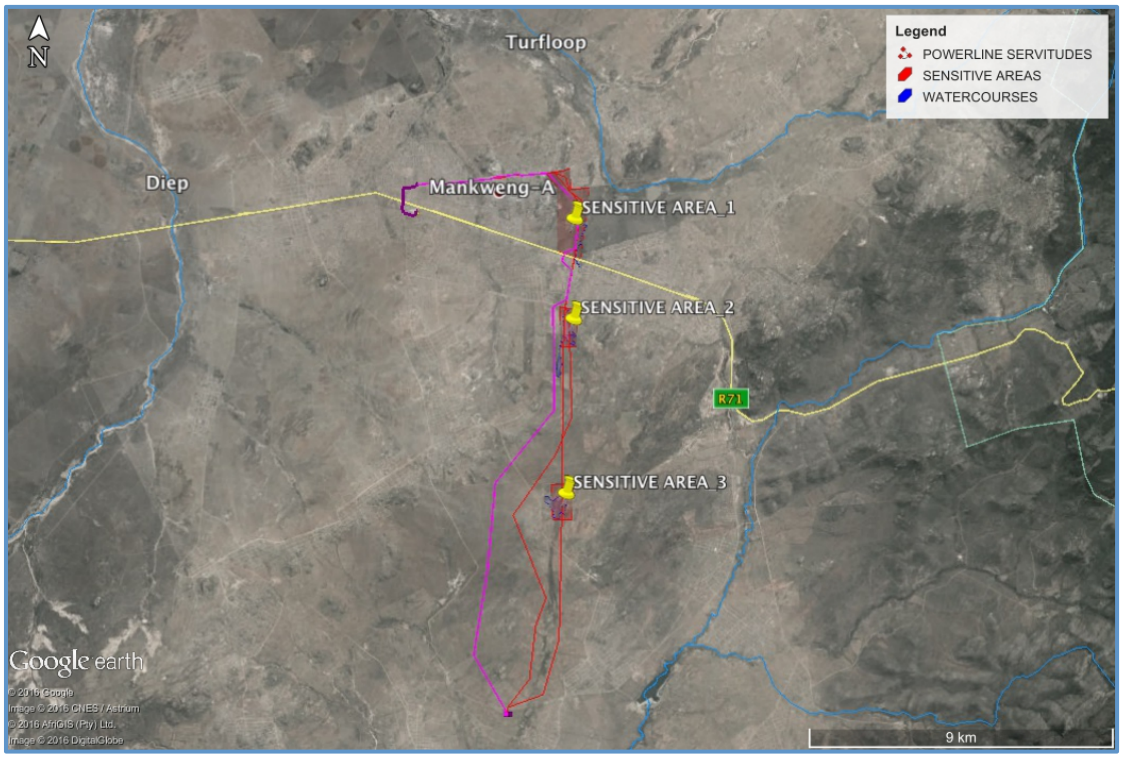

Figure 28: Study area showing sensitive areas

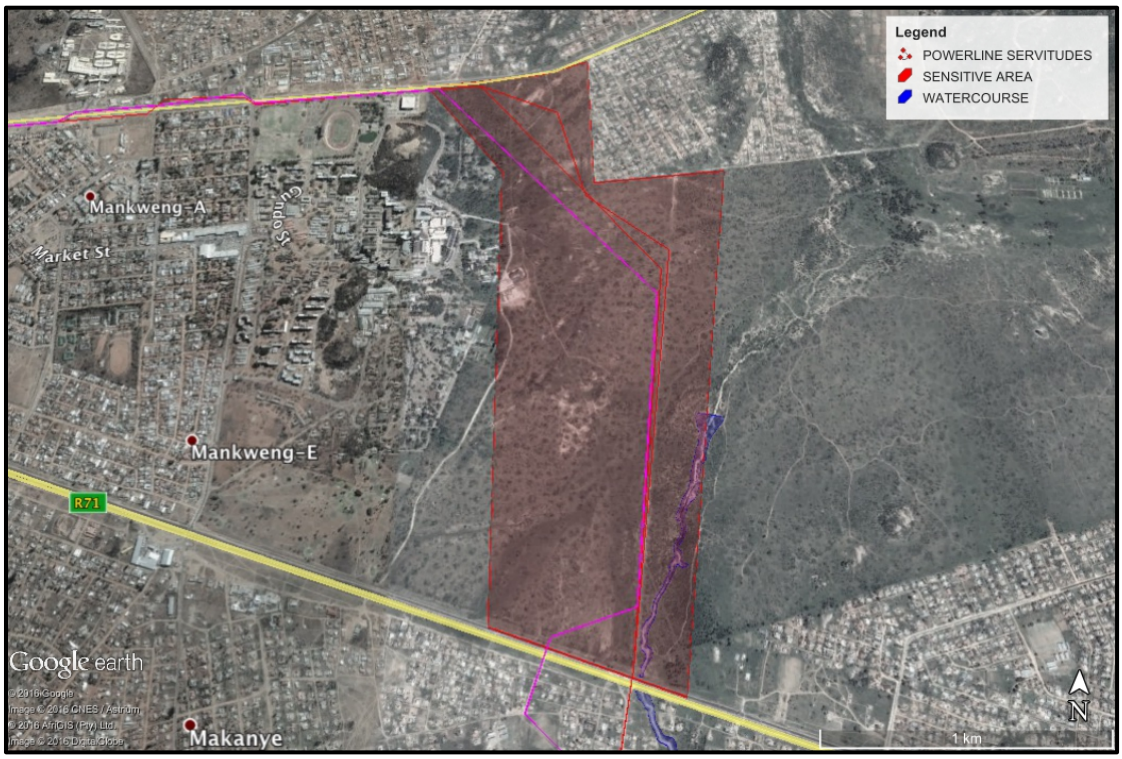

Figure 29: Sensitive Area 1

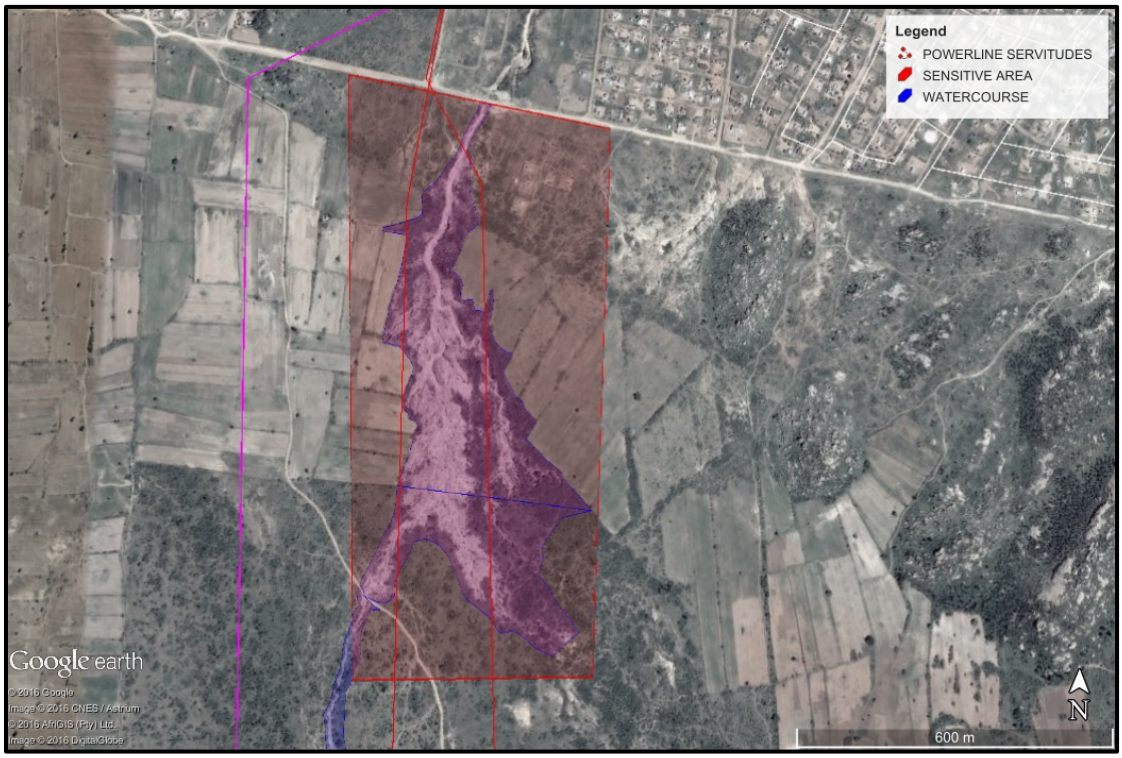

Figure 30: Sensitive Area 2

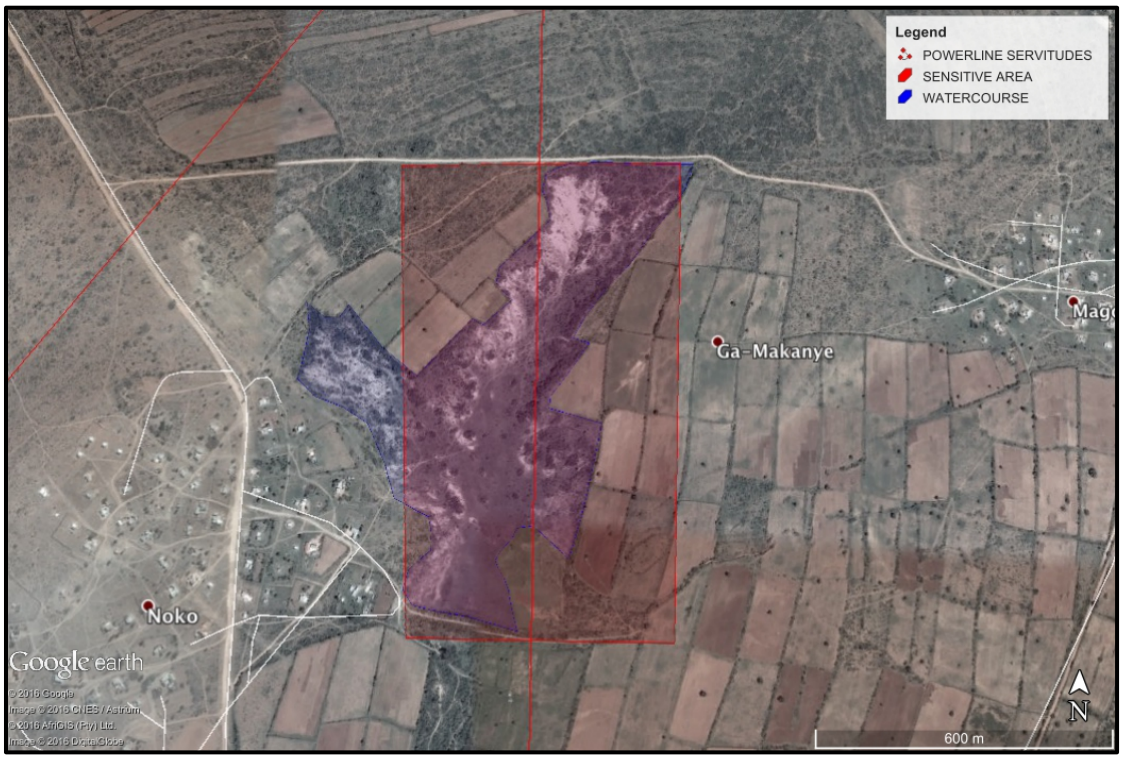

Figure 31: Sensitive Area 3

8.6 Limpopo Conservation Plan

Important conservation plans and areas that need to be considered are the national priority areas and the provincial critical biodiversity areas. According to the Limpopo Conservation Plan v.2, the study area is within some Critical Biodiversity Areas (CBAs) and some Ecological Support Areas (ESAs) (Figure 32). The CBA and PA (Protected Area) overlap in the north-east corner of the study area.

All of the priority areas and CBAs will be able to be avoided with the implementation of mitigating measures and selection of powerline routes, except for the protected area / CBA area in the north-east corner of the study area.

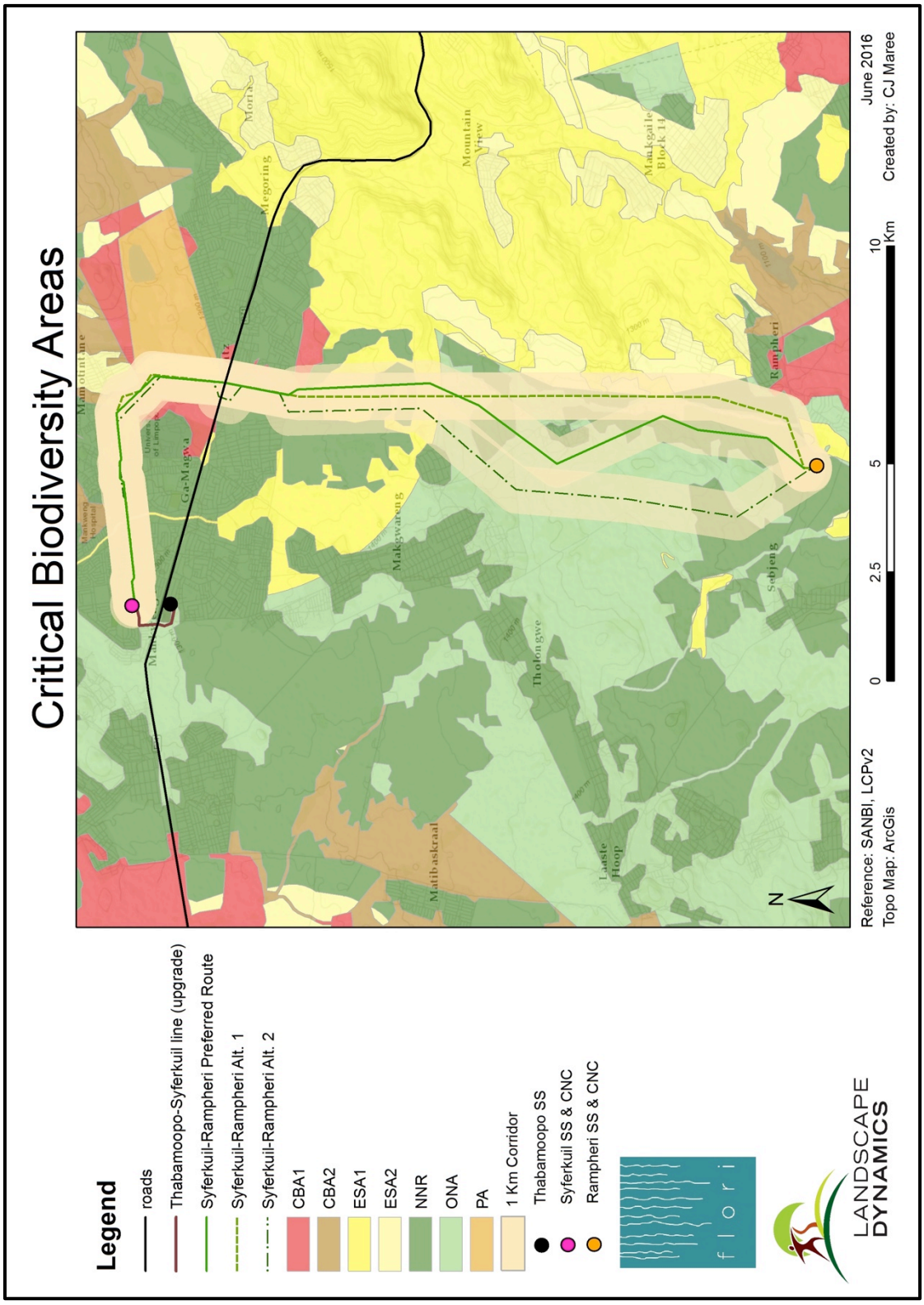

Figure 32: Critical Biodiversity Areas (CBAs)

9 THE GO, NO-GO OPTION

9.1 Classification criteria

The term 'fatal flaw' is used in the pre-application planning and screening phases of a project to evaluate whether or not an impact would have a 'no-go' implication for the project. In the scoping and impact assessment stages, this term is not used. Rather impacts are described in terms of their potential significance.

A potential fatal flaw (or flaws) from a biodiversity perspective is seen as an impact that could have a "no-go" implication for the project. A 'no-go' situation could arise if residual negative impacts (i.e. those impacts that still remain after implementation of all practical mitigatory procedures/actions) associated with the proposed project were to:

a) Conflict with international conventions, treaties or protocols (e.g. irreversible impact on a World Heritage Site or Ramsar Site);

b) Conflict with relevant laws (e.g. clearly inconsistent with NEMA principles, or regulations in terms of the Biodiversity Act, etc.);

c) Make it impossible to meet national or regional biodiversity conservation objectives or targets in terms of the National Biodiversity Strategy and Action Plan (BSAP) or other relevant plans and strategies (e.g. transformation of a 'critically endangered' ecosystem);

d) Lead to loss of areas protected for biodiversity conservation;

e) Lead to the loss of fixed, or the sole option for flexible, national or regional corridors for persistence of ecological or evolutionary processes;

f) Result in loss of ecosystem services that would have a significant negative effect on lives (e.g. loss of a wetland on which local communities rely for water);

g) Exceed legislated standards (e.g. water quality), resulting in the necessary licences/approvals not being issued by the authorities (eg. WULA);

h) Be considered by the majority of key stakeholders to be unacceptable in terms of biodiversity value or cultural ecosystem services.

9.2 Potential Fatal Flaws for the Project

There are no issues with regard to the criteria listed above (a to h), as far as the all aspects of the project are concerned, except for Point d, to a degree. This includes the construction of the proposed Syferkuil-Rampheri powerline; the upgrade of the Thbamoopo-Syferkuil powerline; the decommissioning of the existing Syferkuil Substation; the construction of the new proposed Suiferkuil Substation and CNC; the construction of the approved Rampheri Substation; and the construction of the proposed Rampheri CNC.

There are no fatal flaws and the project may go ahead, with the implementation of mitigating measures and recommendations as laid out in this specialist study report.

There are 'No-Go' areas within the study site, namely the granite koppies. There is the potential 'No-Go' area of the protected area.

Watercourses although preferred to be viewed as 'No-Go' areas are not strictly such. However, any impact on their main channel, banks and riparian zones will more than likely trigger the need for a WULA. Mitigating measures have been put forward to avoid this happening and need to be implemented to avoid impacting on watercourses and creating the need for a WULA.

10 IMPACT ASSESSMENT

The impacts of the activities related to the proposed project were rated. There are existing and potential impacts that need to be taken into consideration. Mitigating measures are recommended to help reduce the sum of these impacts.

The project consists of a few subsections and these have therefore been assessed separately. For example, powerlines are linear in nature, while those of substations are nodular. Furthermore, the natural environment varies considerably for some of the different subsections. For example, the Thabamoopo-Syferkuil powerline upgrade and Syfkerkuil Substation and CNC are within a high-density urban environment, while the Syferkuil-Rampheri powerline, Rampheri Substation and Rampheri CNC are within a mix of urban areas and bushveld areas.

The rated potential impacts of the different sections of the overall project before and after the implementation of mitigating measures are shown in the matrices below (Table 20 to Table 25).

Table 20: Impact Rating matrix: Thabamoopo-Syferkuil Powerline upgrade

Potential Impact on Habitat BEFORE Mitigating & Management Measures	
Criteria	**Rating**
Extent	2
Duration	2
Intensity	2
Probability of occurrence	2
Total	**8**
Rated as a **MEDIUM** negative impact before the implementation of mitigating and management measures	
Impact AFTER Mitigating and Management Measures	
Criteria	**Rating**
Extent	1
Duration	1
Intensity	2
Probability of occurrence	1
Total	**5**

Rated as a **LOW** negative impact after the successful implementation of all mitigating and management measures.
Main mitigating measures reducing intensity are: • Where possible, position powerline within the existing servitude. • No temporary facilities or storage of materials within any open veld areas. • Ensure no concrete, or soil stockpiles are left behind after construction phase. • Ensure litter and used material such as wires are cleaned up and removed on a daily basis. • Concrete may not be mix on open, bare ground / soil.

Table 21: Syferkuil Substation & CNC

Potential Impact on Habitat BEFORE Mitigating & Management Measures	
Criteria	**Rating**
Extent	2
Duration	3
Intensity	2
Probability of occurrence	3
Total	**10**
Rated as a **MEDIUM** negative impact before the implementation of mitigating and management measures	
Impact AFTER Mitigating and Management Measures	
Criteria	**Rating**
Extent	2
Duration	2
Intensity	2
Probability of occurrence	1
Total	**7**
Rated as a **LOW** negative impact after the successful implementation of all mitigating and management measures.	
Main mitigating measures reducing intensity are: • No temporary facilities or storage of materials within any pristine bushveld or other open veld areas. • No indigenous trees to be removed if not entirely necessary. • Stormwater Management Plan to be compiled and implemented. • Certified toilets and drinking water tanks to be used only and by a certified contractor	

only.

- Sufficient and proper rubbish bins to be available on site at all times.
- Litter and general rubbish to be removed weekly to a certified landfill site only and by a certified contractor only.
- Soil stockpiles to be placed only within transformed or totally disturbed areas. No trees to be removed to make place for soil stockpiles.
- No soil stockpiles to be left after construction.
- All areas outside of the substation and CNC sites disturbed or used during construction phase to be properly and completely rehabilitated as part of the construction phase. In other words, not left to months or even weeks later.
- Proper Eskom procedures to be in place to deal with oil spills, etc.
- Dust suppression to be implemented during construction phase.
- All left-over materials to be totally removed after construction phase.
- Open veld areas used during construction that have become denuded of grass due to construction activities to be rehabilitated and re-grassed. Either by hydro-seeding or by planting of grass sods. (Recommended grass mixes can be found in the appendices.)
- Any damage or removed trees in temporary storage and accommodation areas to be replaced.

Table 22: Rampheri Substation & CNC

Potential Impact on Habitat BEFORE Mitigating & Management Measures	
Criteria	**Rating**
Extent	2
Duration	3
Intensity	2
Probability of occurrence	3
Total	**10**
Rated as a **MEDIUM** negative impact before the implementation of mitigating and management measures	
Impact AFTER Mitigating and Management Measures	
Criteria	**Rating**
Extent	2
Duration	2
Intensity	2

Probability of occurrence	2
Total	**8**

Rated as a **MEDIUM** negative impact after the successful implementation of all mitigating and management measures.

Main mitigating measures reducing intensity are:

- No temporary facilities or storage of materials within any pristine bushveld or other open veld areas.
- No indigenous trees to be removed if not entirely necessary.
- Stormwater Management Plan to be compiled and implemented.
- Certified toilets and drinking water tanks to be used only and by a certified contractor only.
- Sufficient and proper rubbish bins to be available on site at all times.
- Litter and general rubbish to be removed weekly to a certified landfill site only and by a certified contractor only.
- Soil stockpiles to be placed only within transformed or totally disturbed areas. No trees to be removed to make place for soil stockpiles.
- No soil stockpiles to be left after construction.
- All areas outside of the substation and CNC sites disturbed or used during construction phase to be properly and completely rehabilitated as part of the construction phase. In other words, not left to months or even weeks later.
- Proper Eskom procedures to be in place to deal with oil spills, etc.
- Dust suppression to be implemented during construction phase.
- All leftover materials to be totally removed after construction phase.
- Open veld areas used during construction that have become denuded of grass due to construction activities to be rehabilitated and re-grassed. Either by hydro-seeding or by planting of grass sods. (Recommended grass mixes can be found in the appendices.)
- Any damage or removed trees in temporary storage and accommodation areas to be replaced.
- Temporary access roads to construction site to be kept to an absolute minimum. Where possible existing roads to be used. Roads to be continually maintained during construction phase and immediately on completion of sites. Water trucks to be used daily for dust suppression along gravel / sand access roads.

Table 23: Syferkuil-Rampheri Powerline on Bushveld

Potential Impact on Habitat BEFORE Mitigating & Management Measures	
Criteria	**Rating**
Extent	2
Duration	1
Intensity	2
Probability of occurrence	3
Total	**8**
Rated as a **MEDIUM** negative impact before the implementation of mitigating and management measures	
Impact AFTER Mitigating and Management Measures	
Criteria	**Rating**
Extent	1
Duration	1
Intensity	2
Probability of occurrence	2
Total	**6**
Rated as a **LOW** negative impact after the successful implementation of all mitigating and management measures.	

Main mitigating measures reducing intensity are:

- No temporary facilities or storage of materials within any pristine bushveld or other open veld areas.
- No indigenous trees to be removed if not entirely necessary.
- Certified toilets and drinking water tanks to be used only and by a certified contractor only.
- Sufficient and proper rubbish bins to be available on site at all times.
- Litter and general rubbish to be removed weekly to a certified landfill site only and by a certified contractor only.
- No soil stockpiles to be left after construction.
- Proper Eskom procedures to be in place to deal with oil spills, etc.
- All leftover materials to be totally removed after construction phase. Special attention must be given to removing all cables, wires and material wrappings.
- Temporary access roads to construction site to be kept to an absolute minimum. Where possible existing roads to be used. Roads to be continually maintained during construction phase and immediately on completion of sites. Water trucks to be used daily for dust suppression along gravel / sand access roads.

Table 24: Impact Rating Matrix: Syferkuil-Rampheri Powerline on Watercourses

Potential Impact on Habitat BEFORE Mitigating & Management Measures	
Criteria	**Rating**
Extent	2
Duration	2
Intensity	3
Probability of occurrence	3
Total	**10**
Rated as a **MEDIUM** negative impact before the implementation of mitigating and management measures	
Impact AFTER Mitigating and Management Measures	
Criteria	**Rating**
Extent	1
Duration	2
Intensity	2
Probability of occurrence	2
Total	**7**
Rated as a **LOW** negative impact after the successful implementation of all mitigating and management measures.	

Main mitigating measures reducing intensity are:

- No temporary facilities to be erected within 100m of any watercourse.
- Only existing roads and tracks to be used to cross a watercourse.
- Attention must be given to avoid erosion around riverbanks.
- Attention must be given to avoid siltation from upgrade activities in the area of watercourses.
- Proper permits and/or authorisation must be obtained if water is to be used from out of any watercourses in the area.
- No pylons (poles) to be erected within 50m buffer of the edge of a stream or riverbank.
- No pylons (poles) to be erected within the stream channel of a watercourse.
- No pylons (poles) to be erected or positioned within the riparian zone of any watercourse.

Besides the direct impacts of the project, a number of other general impacts can occur during the construction phase that needs to be taken into account. The significances of these are highlighted in the table below (Table 25).

Table 25: General impacts of the project in the study area

Issue	Significance rating before and after mitigation	
	Before	After
Farming Related & Other Issues		
Access to properties	Low	Low
Access roads (damage, blocking)	Low	Low
Loss of agricultural potential	Low	Low
Loss of cultivation potential	Low	Low
Loss of grazing potential	Low	Low
Impact on airstrips	Low	Low
Impacts on seasonal activities	Low	Low
Natural Environment		
Erosion	Low	Low
Impact on flora	Low	Low
Impact on fauna	Low	Low
Impact on wetlands	Low	Low
Impact on watercourses	Medium	Low
Importation of alien vegetation	Low	Low
Impact of herbicides	Low	Low
Impact on conservation areas	Low	Low

11 LINE VARIANT RECOMMENDATIONS

Line variant recommendations are made on the strength and combination of all the impacts and mitigating actions. As well as on the sensitivities of the various biophysical features, faunal habitats and vegetation types that each proposed route alternative impacts on. A comparison between the three alternative routes for the proposed Syferkuil-Rampheri 132kV powerline, as to the number of ecologically sensitive units each one potentially impacts on, is shown below (Table 26).

Table 26: Comparison of Potential Impacts by Alternative Routes

Ecological Sensitive Units	Preferred Route	Route Alternative 1	Route Alternative 2
Areas of High ecological sensitivity	1	1	1
No-Go areas in close proximity	0	0	0
No. of river & stream crossings	1	2	0
No. of major drainage line crossings	3	3	4
Rocky outcrops in corridor	0	0	3
Ridges in corridor	0	0	0
Major Wetlands encountered	0	0	0
Total impacts per route	**5**	**6**	**8**

Route Alternatives 1 & 2 have more sensitive areas that they impact on compared to the Preferred Route Alternative. Route Alternative 2 also tends to impact more and come closer to more granite koppies, which are seen as very sensitive. Route Alternative 2 also tends to run through more, natural bushveld thereby potenitally causing greater impact on the natural environment than the other two alternatives.

There is little difference between the Preferred Route and Alternative 1, except in the area of Sensitive Area 3 (Figure 31). Here Route Alternative goes through this area, but not the Preferred Route.

Taking all of the above issues into account, the Ecological recommended line variant for the proposed Syferkuil-Rampheri Line is: PREFERRED ROUTE ALTERNATIVE.

12 MITIGATION OF IMPACTS

The following mitigating measures are general recommendations to help reduce the potential negative impacts of the project on the natural environment. The implementation of recommended mitigating measures are necessary if the conclusions and assessments of the report are to remain pertinent. Mitigating measures are also given under the Impact Assessment Section for each project subsection.

12.1 Construction Phase

- No temporary accommodation or storage facilities may be setup within 100m of any river, stream, drainage line, wetland or farm dam.
- No temporary accommodation or storage facilities may be setup within 500m of the outer boundary of any wetland area.
- No temporary facilities (including portable toilets) to be positioned within a 50m bufferzone of the edge of any watercourses.
- Only existing roads to be used by vehicles during construction as far as possible. Especially in terms of crossing over watercourses.
- No vehicles may drive through watercourses areas and no new service road may be made through wetland areas.
- Upgrade activities close to watercourses to be carefully monitored in terms of erosion and possible resulting siltation of watercourses. Weekly inspection of work areas around watercourses to be conducted. Any signs of new erosion and siltation to be rectified immediately.
- Disturbed surface areas in the construction phase to be rehabilitated. No open trenches to be left. No mounds of soils created during construction to be left.
- All construction material, equipment and any foreign objects brought into the area by contractors to be removed immediately after completion of the construction phase.
- Proper rubbish/waste bins to be provided. These to be emptied weekly and the waste to be removed to an official waste disposal site.
- Granite koppies to be totally avoided.

12.2 Maintenance phase

- Mechanical control of alien plants around disturbed areas caused by construction need to be implemented within three months of completion of construction. Thereafter every six months. Mechanical control to be of such a nature as to allow local, indigenous grasses and other pioneers to colonise the previously disturbed areas, thereby assisting in keeping out invasive weed species.
- No chemical control (herbicides) of alien plants to be used within 100m of any watercourses.
- Areas around foundations of poles (pylons) need to be check before and after the summer rainy season for signs of soil erosion due to stormwater run-off. Such sites need to be modified and rehabilitated to prevent ongoing erosion. These sites need to be monitored more closely than other sites which show no or minimal signs of erosion.
- Proper stormwater management plans for the substations and CNCs need to be compiled and implemented.

13 APPENDICES

13.1 List of floral species identified on site

Below are the dominant plant species identified during field investigations.

Trees

Acacia caffra, *Acacia permixta*, *Acacia rehmanniana*, *Acacia hebeclada, Acacia karroo*, *Acacia tortilis, Acacia davyi*, *Acacia gerrardii*, *Acacia nilotica*, *Combretum hereroense*, *Combretum molle*, *Croton gratissimus, Cussonia natalensis*, *Cussonia transvaalensis*, *Dombeya rotundifolia*, *Diospyros lycioides* subsp. *sericea*, *Euclea crispa* subsp. *crispa*, *Erythrina lysistemon*, *Euphorbia cooperi, Euphorbia ingens, Gymnosporia senegalensis*, *Heteropyxis natalensis*, *Lannea discolor*, *Maytenus undata*, *Ormocarpum kirkii*, *Searsia leptodictya*, *Searsia pyroides*, *Ziziphus mucronata.*

Shrubs, Herbaceous plants & Succulents

Aloe cryptopoda, Aloe wickensii, Aloe greatheadii, Aloe marlothii, Anthospermum rigidum subsp. *rigidum*, *Asparagus africanus*, *Buddleja saligna*, *Canthium mundianum*, *Carissa edulis*, *Clerodendrum glabrum, Cotyledon barbeyi, Cotyledon orbiculata var. orbiculata, Dichrostachys cinerea, Felicia mossamedensis, Gymnosporia glaucophylla*, *Hirpicium bechuanense*, *Hypoxis hemerocallidea, Hypoxis rigidula, Kalanchoe sexangularis, Lantana rugosa*, *Pollichia campestris, Sanseviera aethiopica, Senecio burchellii*, *Sida rhombifolia*, *Solanum panduriforme*,

Grasses

Aristida congesta, *Aristida diffusa*, *Brachiaria nigropedata*, *Digitaria eriantha* subsp. *eriantha*, *Eragrostis curvula*, *Cymbopogon caesius*, *Cynodon dactylon*, *Digitaria diagonalis*, *Diheteropogon amplectens*, *Elionurus muticus*, *Eragrostis gummiflua*, *Eragrostis racemosa*, *Eragrostis superba*, *Eustachys paspaloides*, *Heteropogon contortus, Panicum maximum, Themeda triandra,*

Aquatic species

Ceratophyllum demersum, *Cyperus congestus, Cyperus cyperoides, Phragmites australis, Marsilea capensis, Schoenoplectus corymbosus, Typha capensis*

Red Data species

None.

Priority Species (Species of conservation concern)

Aloe marlothii, Euphorbia cooperi, Euphorbia ingens, Hypoxis hemerocallidea, Sclerocarya birrea subsp. caffra.

13.2 Protected trees

Below is the national list of protected trees of South Africa (Table 27). Each province also has trees that are protected within that province, but not necessary in other provinces. Provincially protected trees need to be treated in the same way as nationally protected trees.

Table 27: Protected trees of South Africa

BOTANICAL NAME	COMMON NAME	Likely to occur in the region	Found in the study area
Acacia erioloba	Camel thorn	Yes	Possible
Acacia haematoxylon	Grey camel thorn	No	
Adansonia digitata	Baobab	No	
Afzelia quanzensis	Pod mahogany	Yes	No
Balanites maughamii	Torchwood / Greenthorn	No	
Barringtonia racemosa	Powder-puff tree	No	
Boscia albitrunca	Shepherd's tree	Yes	Possible
Brachystegia spiciformis	Msasa	No	
Breonadia salicina (=*B. microcephala*)	Matumi / Transvaal teak	No	
Brugeiera gymnorrhiza	Black mangrove	No	
Cassipourea swaziensis	Swazi onionwood	No	
Catha edulis	Bushman's tea	No	
Ceriops tagal	Indian mangrove	No	
Cleistanthus schlechteri var. *schlechteri*	False tamboti	No	
Colubrina nicholosonii	Pondo weeping thorn	No	
Combretum imberbe	Leadwood	Yes	Possible
Curtisia dentata	Assegai tree	No	
Elaeodendron transvaalense	Bushveld saffron	No	
Erythrophysa transvaalensis	Bushveld red balloon	No	
Euclea pseudebenus	Ebony guarri	No	
Ficus trichopoda	Swamp fig	No	
Leucadendron argenteum	Silver tree	No	
Lumnitzera racemosa var.	Spring-tide mangrove	No	

racemosa			
Lydenburgia abottii	Pondo bushman's tea	No	
Lydenburgia cassinoides	Sekhukhuni bushman's tea	No	
Mimusops caffra	Coast red milkwood	No	
Newtonia hildebrandtii var. *hildebrandtii*	Lebombo wattle	No	
Ocotea bullata	Stinkwood	No	
Ozoroa namaquensis	Gariep resin tree	No	
Philenoptera violacea	Apple-leaf	No	
Pittosporum viridiflorum	Cheesewood	No	
Podocarpus elongatus	Breede River yellowwood	No	
Podocarpus falcatus	Outeniqua yellowwood	No	
Podocarpus henkelii	Henkel's yellowwood	No	
Podocarpus latifolius	Real yellowwood	No	
Protea comptonii	Saddleback sugarbush, Barberton mountain protea	No	
Protea curvata	Barberton Lowveld sugarbush	No	
Prunus africana	Red stinkwood	No	
Pterocarpus angolensis	Kiaat, Wild teak	No	
Rhizophora mucronata	Red mangrove	No	
Sclerocarya birrea subsp. *caffra*	Marula	Yes	Yes
Securidaca longipedunculata	Violet tree	No	
Sideroxylon inerme subsp. *inerme*	White Milkwood	No	
Tephrosia pondoensis	Pondo fish-poison pea	No	
Warburgia salutaris	Pepper-bark tree	No	
Widdringtonia cedarbergensis	Clanwilliam cedar	No	
Widdringtonia schwarzii	Willowmore cedar	No	

The above list of national tree species has been declared as protected by Government Gazette Notice 1012 of 27 August 2004. This protection is afforded in terms of the National Forests Act, No 84 of 1998 (as amended). The main aim of the list is to contribute towards the protection of biodiversity and ecosystems, which have become a high priority after South Africa, ratified the Convention on the Protection of Biological Diversity a few years ago.

Trees are protected for a variety of reasons, including to control over harvesting and utilisation. In terms of the Act (84 of 98), forest trees or protected tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold - except under licence granted by the Department of Agriculture, Forestry and Fisheries (or a delegated authority**).**

13.3 Grass Seed Mixes for Rehabilitation

The information below is a guideline and may need to be adjusted slightly depending on the availability of seed species and volumes. No alien plant species should be used for rehabilitation purposes, including grasses. Tef (*Eragrostis tef*) is often used for roadside and other rehabilitation, but it is not indigenous to the Limpopo Province or South Africa for that matter. All the grass species below are indigenous to the study area and establish and grow well in disturbed areas.

Table 28: Summer grass mix and application rate

Grass Species	Common Name	Application Rate
Eragrostis curvula	Weeping love grass	8 kg / ha
Setaria sphacelata var. *torta*	Creeping bristle grass	8 kg / ha
Cynodon dactylon	Couch grass	4 kg / ha
Aristida congesta	Spreading three-awn grass	7 kg / ha
Total	**-**	**27 kg / ha**

Table 29: Winter grass mix and application rate

Grass Species	Common Name	Application Rate
Eragrostis curvula	Weeping love grass	10 kg / ha
Aristida congesta	Spreading three-awn grass	10 kg / ha
Cynodon dactylon	Couch grass	10 kg / ha
Total	**-**	**30 kg / ha**

The contractor may determine the type of fertiliser or soil-improvement material to be added. The fertiliser is normally applied in liquid form and should ideally have a higher percentage of Nitrogen (N) and Phosphorus (P) than that of Potassium (K).

13.4 Photographs

Photo 1: Existing Syferkuil Substation

Photo 2: Syferkuil-Rampheri Powerline route along University Rd in Mankweng

Photo 3: Example of Polokwane Plateau Bushveld in the study area

Photo 4: Syferkuil-Rampheri line route in Mankweng. University Road looking east

Photo 5: Granite koppies with dominant *Euphorbia cooperi (Transvaal candelabra)*. These koppies are sensitive 'No-Go' zones.

Photo 6: Thabamoopo-Syferkuil existing line on right and servitude near Thabamoopo Substation looking west

Photo 7: Young, marula tree (protected tree) in the Thabamoopo-Syferkuil servitude

Photo 8: Typical open veld area between houses in the powerline servitudes in the built-up areas. Few trees, veld degraded and full of litter

Photo 9: Thabamoopo-Syferkuil line servitude near Paledi Mall, Mankweng

Photo 10: Syferkuil-Rampheri line servitude just south of the R71, looking south. The open veld in this area is degraded and resources such as wood over –utilised

Photo 11: Granite koppies scattered throughout the study area (1km corridor). These koppies are sensitive, 'no-go' zones.

Photo 12: Open veld areas in the north of the study area. Veld is over-grazed and tree over-exploited, leaving degraded open veld. Recent drought has also had a very negative impact on vegetation cover

Photo 13: Open veld approx. in the middle of the study area. More vegetation than in the north, but few trees. Trees are predominantly acacia thorntrees such as *A. karroo* or *A. tortilis*

Photo 14: Built-up areas in the south of the study area

Photo 15: *Aloe marlothii* and *Euphorbia ingens*, are mainly confined to rocky outcrops. However, there are plants scattered throughout the main servitude areas as seen in this photo. These need to be avoided

Photo 16: Looking south across the general region of the study area, with the Strydpoort Mountains in the south

Photo 17: Structureless (fine), red sandy soils, typical of the study area

Photo 18: Donga formation in the south of the study area. Erosion can be a problem in areas with a steeper gradient

Photo 19: Typical urban sprawl in the study area, with the impressive Strydpoort Mountains in the background

Photo 20: Open veld, with lack of grass, showing signs of stormwater run-off erosion in the foreground, which is common in the study area

Photo 21: Small, individual plots of land is the predominant type of agricultural landuse in the study area. No high-intensity commercial farming is present

Photo 22: Site for the approved Rampheri Substation and proposed CNC

Photo 23: Polokwane Plateau Bushveld in the vicinity of the Rampheri Substation and CNC sites. Looking south towards the Strydpoort Mountains

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