

At Local Level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. The proposed project falls within the City of Tshwane Metropolitan Municipality.

- » In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.
- » By-laws and policies have been formulated by local authorities to protect environmental resources relating to issues such as air quality, community safety, etc.

3.4.2. Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this Draft EIA Report:

- » National Environmental Management Act (Act No 107 of 1998)
- » EIA Regulations, published under Chapter 5 of the NEMA (GN R385, GN R386 and GN R387 in Government Gazette 28753 of 21 April 2006)
- » Guidelines published in terms of the NEMA EIA Regulations, in particular:
 - * Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)
 - * Guideline 4: Public Participation in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, May 2006)
 - * Guideline 5: Assessment of alternatives and impacts in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)

Acts, standards or guidelines which have informed the project process and the scope of issues assessed within this EIA are summarised in Table 3.4.

Table 3.4: List of applicable legislation and compliance requirements required for the Tshwane Strengthening Project Phase 1.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	<p>EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations.</p> <p>In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation.</p> <p>In terms of GNR 387 of 21 April 2006, a scoping and EIA process is required to be undertaken for the proposed project</p>	<p>National Department of Environmental Affairs and Tourism – lead authority.</p> <p>Gauteng Department of Agriculture, Conservation and Environment – commenting authority.</p>	<p>The final EIA report will be submitted to DEA and GDARD in support of the application for authorisation submitted in May 2009.</p>
National Environmental Management Act (Act No 107 of 1998)	<p>In terms of the Duty of Care provision in S28(1) Eskom as the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised.</p> <p>In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.</p>	<p>Department of Environmental Affairs (as regulator of NEMA).</p>	<p>While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992).	National Department of Environmental Affairs Local authorities	» Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that— 5 (a) the containers in which any waste is stored, are intact and not corroded or in any other way rendered unfit for the safe storage of waste; (b) adequate measures are taken to prevent accidental spillage or leaking; (c) the waste cannot be blown away; (d) nuisances such as odour, visual impacts and breeding of vectors do not arise; 10 and (e) pollution of the environment and harm to health are prevented There is no requirement for a noise permit in terms of the legislation. Noise impacts are expected to be associated with the construction phase of the project and are likely to present an intrusion impact to the local community. On-site activities should be limited to 6:00am to 6:00pm Monday – Saturday (excluding public holidays). Should activities need to be

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Water Act (Act No 36 of 1998)	Section 21 sets out the water uses for which a water use license is required.	Department of Water Affairs	undertaken outside of these times, the surrounding communities will need to be notified and appropriate approval will be obtained from DEA and the Local Municipality. As no water use (as defined in terms of S21 of the NWA) will be associated with the proposed project, no water use permits or licenses are required to be applied for or obtained.
National Water Act (Act No 36 of 1998)	In terms of Section 19, Eskom as the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	Department of Water Affairs (as regulator of NWA)	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including <ul style="list-style-type: none"> » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » any development or other activity which will change the character of a site exceeding 5 000 m² in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines),	South African Heritage Resources Agency (SAHRA)	Certain sites/graves of archaeological significance were identified within the proposed power line corridors were identified and therefore impacts on archaeological sites associated with the proposed project are expected to be of moderate significance for alternative 1 and 2. A permit may, however, be required should any cultural/heritage sites of significance be unearthed during the construction phase of the transmission power lines or at the substation site.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m²; or the re-zoning of a site exceeding 10 000 m² in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided.</p> <p>Stand alone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.</p>		
<p>National Environmental Management: Biodiversity Act (Act No 10 of 2004)</p>	<p>In terms of Section 57, the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007.</p> <p>In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA phase of the project to incorporate the legal provisions as well as the regulations associated with listed</p>	<p>National Department of Environmental Affairs</p>	<p>Some Red Data species were identified along the proposed alternative 1 and 3 and this means that Eskom might be carrying out restricted activity, as is defined in Section 1 of the Act, a permit may be required to be obtained in this regard.</p> <p>Specialist flora and fauna studies are required to be undertaken as part of the EIA process. A specialist ecological assessment has been undertaken for the proposed project (refer to Appendix F).</p> <p>A permit may be required should any</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Conservation of Agricultural Resources Act (Act No 43 of 1983)	<p>threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA phase.</p> <p>Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Weeds are described as Category 1 plants, while invader plants are described as Category 2 and Category 3 plants. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.</p>	Department of Agriculture	<p>protected plant species within the power line corridors or at the substation site be disturbed or destroyed as a result of the proposed development.</p> <p>While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.</p>
Hazardous Substances Act (Act No 15 of 1973)	<p>This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.</p> <p>Group I and II: Any substance or mixture of a</p>	Department of Health	<p>It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the substation site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
<p>National Road Traffic Act (Act No 93 of 1996)</p>	<p>substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; Group IV: any electronic product; Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.</p>		
	<p>The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts. The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is</p>	<p>Gauteng Department of Public Transport, Roads and Works (provincial roads) South African National Roads Agency Limited (national roads)</p>	<p>An abnormal load/vehicle permit may be required to transport the various power line and substation components to site for construction. These include: » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Environmental Waste Act (Act No 59) of 2008	<p>made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.</p> <p>» The Minister may by notice in the <i>Gazette</i> publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment.</p> <p>» The Minister may amend the list by—</p> <p>(a) adding other waste management activities to the list;</p> <p>(b) removing waste management activities from the list; or</p> <p>(c) making other changes to the particulars on the list.</p>	National Department of Environmental Affairs (DEA)	» Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that— <p>5 (a) the containers in which any waste is stored, are intact and not corroded or in</p> <p>any other way rendered unfit for the safe storage of waste;</p> <p>(b) adequate measures are taken to prevent accidental spillage or leaking;</p> <p>(c) the waste cannot be blown away;</p> <p>(d) nuisances such as odour, visual impacts and breeding of vectors do not arise; 10</p> <p>and</p> <p>(e) pollution of the environment and harm to health are prevented</p>
Gauteng Transport Infrastructure Act (Act 8 of 2001) of 2001	» The provincial MEC may grant permit to undertake works within 200m of the published route upon receipt of the report assessing the potential impacts thereof.	Gauteng Department of Public Transport, Roads and Works	» Any application for authorisation contemplated in the ECA and NEMA in respect of a 200m area on either side of a published route determination for a provincial road

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
			must be accompanied by a report that addresses the issues listed in that section of the Act. Eskom will address these issues outside of this EIA process.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

CHAPTER 4

This section of the EIA Report provides a description of the environment that may be affected by the proposed Tshwane Strengthening Project Phase 1. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment. Aspects of the biophysical, heritage, social and economic environment that could be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area and proposed development site as well as collected field data, and aims to provide the context within which the environmental assessment has been conducted. A more detailed description of each aspect of the affected environment is included within the specialist assessment reports contained within Appendices I – N.

Alternative power line corridors comparatively assessed within this EIA report include alternative 1, 2 and 3 as well as the recommended deviation (refer to Figure 4.1).

The sites for the Kwagga substation extension and establishment of Phoebus substation were also assessed in this report.

4.1. Location and Baseline Environment of the Study Area

The study area for the Kwagga-Phoebus line stretches from Kwaggasrand in the south to some parts of Shoshanguve in the north and Ga-Rankuwa in the south-west. Due to the size of the study area and proximity to the City of Pretoria, the land uses include many varied types including protected natural environments, heavy industrial zones, agricultural holdings, and high-density residential zones. Prominent hydrological features include the Skinnerspruit in the south and the Sand River with many tributaries in the west and northwest. Prominent geological features include the Daspoortrand ridge and the Magaliesberg to the south. The topography of the area is described as gentle plains in the north with distinct ridges in the south.

The natural land cover has been extensively altered by urbanisation and agriculture over most of the study area. However, significant nature reserves and other protected areas are found either within or in very close proximity to the proposed Tshwane Strengthening Project Phase 1.

The two substation sites (existing Kwagga and the new Phoebus substation) are mostly surrounded by either residential townships or main roads. Neighbouring residential areas include Soshanguve Extension YY, Soshanguve Extension SS, Hebron, Danville, Atteridgeville and Garankuwa (refer to Figure 4.2 and 4.3)

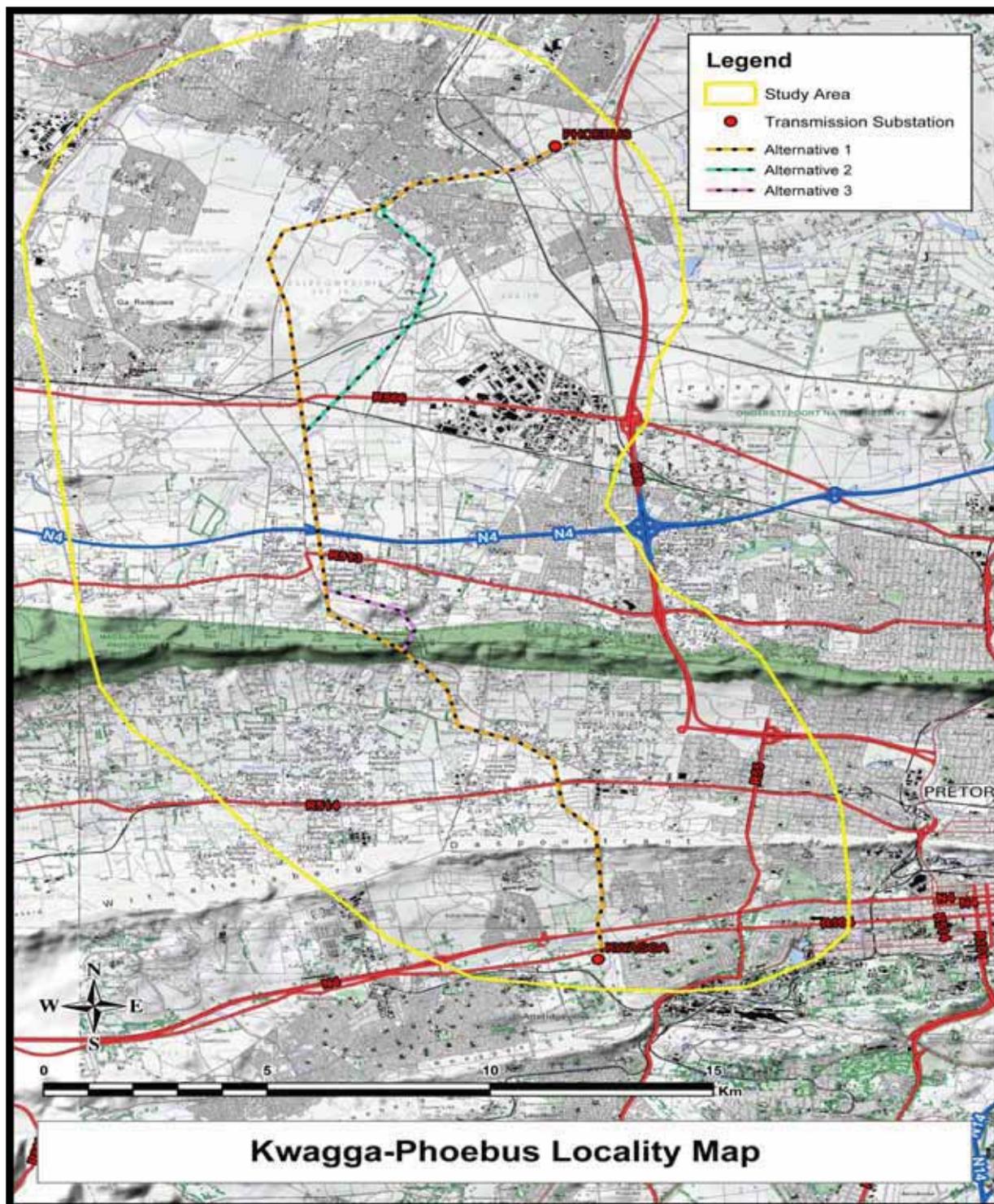


Figure 4.1: Power line Alternatives comparatively assessed during the EIA phase of the process

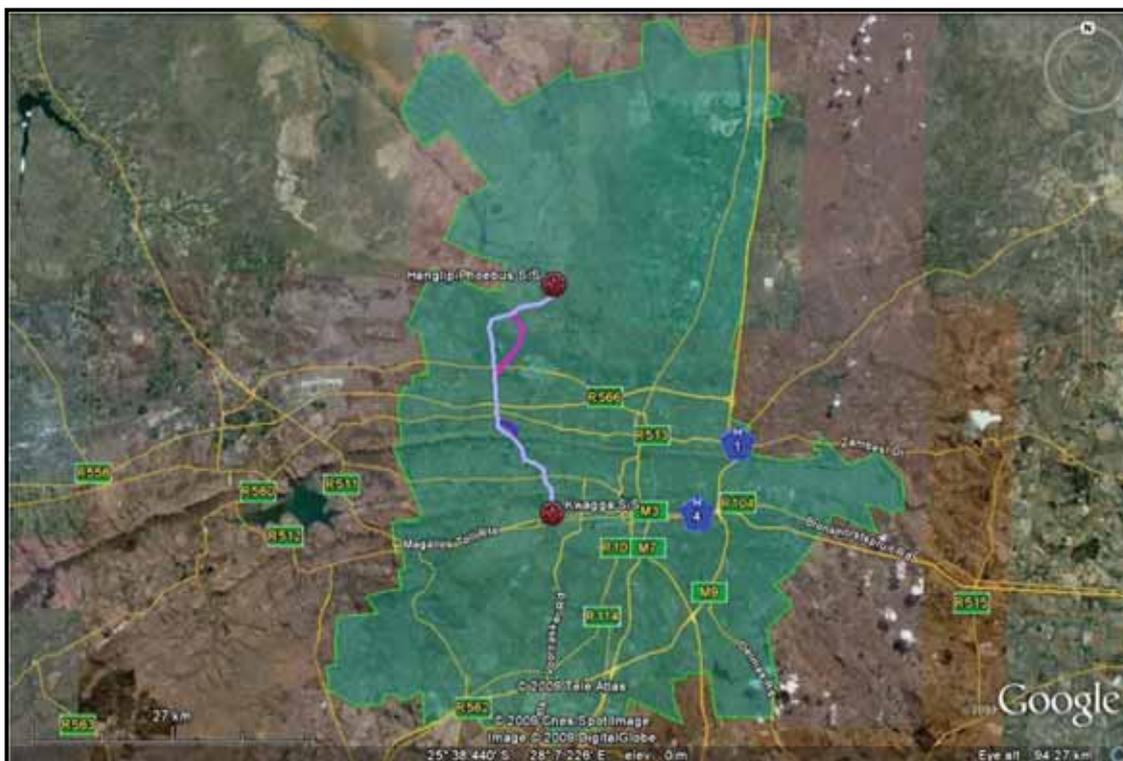


Figure 4.2: Image showing delineation of the City of Tshwane Metropolitan Municipality in Gauteng and the location of the identified corridors for the Kwagga-Phoebus power line and substations

4.2. Social Characteristics of the Study Area

The Gauteng Province is the smallest province in South Africa with a geographical area of approximately 16 927km². The province consists of three District Municipalities (Metsweding, West Rand, and Sedibeng) and three Metropolitan Municipalities (City of Tshwane, City of Johannesburg, and the Ekurhuleni Metropolitan Municipality).

Gauteng is generally perceived as the 'economic hub' of South Africa. According to the Gauteng Provincial Growth and Development Strategy (GPGDS) (2005), the Gauteng Province account for 33% of South Africa's Gross Domestic Product (GDP) and is the largest sub-national African economy. The province generates approximately 49.6% of all employee remuneration in the country and an estimated 52% of all institutional turn-over. Despite this fact, the GPGDS also states that there is an ever-increasing divide between the province's rich and poor - the opportunities created to engage meaningfully in the economic activities and growth of the Province have largely benefited those sectors of the society that are already financially secure and stable and who have the necessary skills, means and resources to participate in the economy.

The GPGDS identified the following disparities still evident in the province, which still needs to be addressed:

- » Continued high levels of unemployment and the resultant high levels of poverty;
- » Inadequate housing facilities;
- » A lack of education, with approximately 8% of the population who has had no education;
- » An insufficient electricity network, resulting in approximately 20% of households that are still in need of electricity for lighting, 30% for heating, and 27% for cooking; and
- » Providing treated piped water to the remaining 2.5% of households who still have a water supply below RDP standard (defined as piped either inside the dwelling or within a 200m radius of the dwelling).

Gauteng has a growth rate higher than the national average and for this reason the province is attracting unemployed job seekers faster than it is able to absorb these migrants into the labour market. According to the GPGDS, Gauteng receives – on average – more migrants than any other province in the country, not only from other provinces, but also from other SADC countries. The GPGDS estimated that around 5% of the province's total population was made up of migrants, but it is unclear whether this 5% relates to migrants in general, or to migrants from other SADC countries only.

Worldwide, emphasis is being placed on sustainable development by creating awareness of the linkages between the natural environment, economic stability, and general social well-being. This is no different for Gauteng, as the province is characterised by limited available land, a rising industrial congestion, and increased demographic densification. The GPGDS therefore emphasised the importance of sustainable development as a prerequisite in ensuring a flourishing society, a growing but stable economy, and a beneficial natural environment.

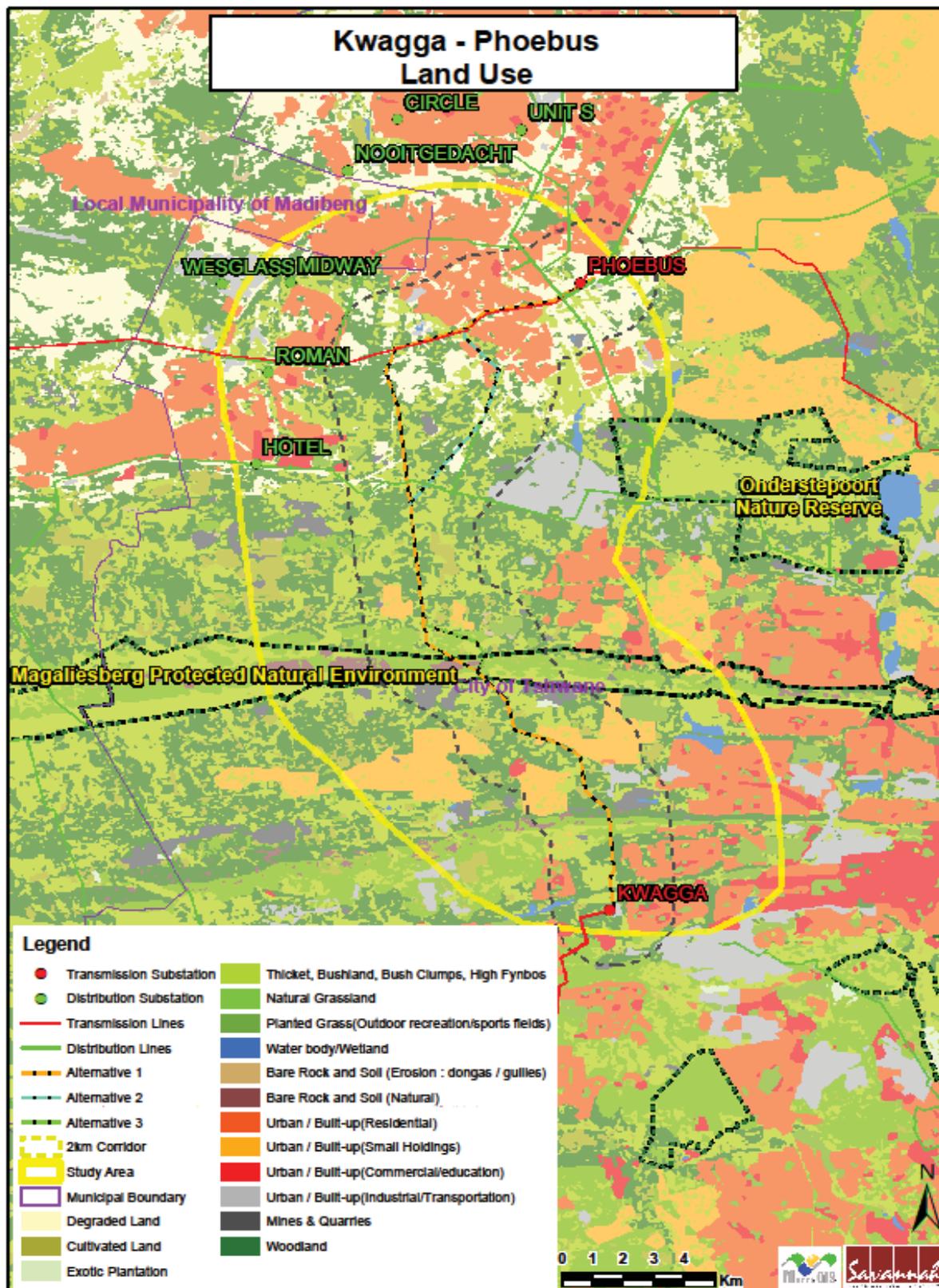


Figure 4.3: Land use map of the study area

4.1.1. Demographic Profile

The City of Tshwane Metropolitan Municipality (CoT) covers an area of 2 175km². In 2001, the CoT had a total population of 1 982 228 people (with a population density of approximately 911.8 people per km²), which increased at an average rate of 60 612 persons per annum to a total population of 2 345 907 people in 2007. This increase in the population size also affected the population density in the area, which grew at an average of 27.9 persons per km² to a population density of approximately 1 079.1 persons per km² in 2007.

According to the CoT IDP (2006-2011), the population growth rate in the Central region (including areas such as Kwaggasrand, Danville, and Lotus Gardens) between the years 1996 and 2001 was estimated at around 18.9%. This represents an increase of approximately 54 184 individuals from a population size of 286 836 in 1996 to 341 020 in 2001. The Northwest region (including areas such as Chantelle, Rosslyn, Soshanguve and Ga-Rankuwa) have a similar profile in terms of population growth, estimated at 18.74% between 1996 and 2001 (from 568 112 individuals to 674 579). The IDP further stated that of the housing in the Central region, only 2.4% was informal in 2008 compared to the 18% informal housing in the Northwest region.

The predominant population group within the City of Tshwane remained the same between 2001 and 2007 and are therefore still Black African (74.6%), followed by White (22.1%). The female population group was only slightly bigger than that of their male counterparts at 50.1%. In 2007, it was estimated that more than two thirds (68.3%) of the total population in the City of Tshwane fall within the working age category, which is defined by Statistics South Africa as the ages between 15 and 64.

4.1.2. Socio-economic Profile

The CoT is characterised by a fairly high employment rate where, on average, close just over two thirds of the working age population (excluding the not economically active population) is formally employed. Although the employment rate exceeds the unemployment rate by far, it is still a point of concern that an estimated one in every third person from the working age population is still unemployed as this gives rise to a whole series of social problems such as poverty, crime and a high dependency ratio.

In a country facing a severe unemployment challenge, understanding where jobs have been created and lost in the local economy takes on special significance. Paradoxically, the more successful an area is in creating jobs the more likely it is to attract an inflow of unemployed people looking for work. The result can be an increase in the unemployment rate, even though that local economy is a net creator of jobs, i.e. the skills supply and demand is not aligned. Unemployment and the lack of a supportive social network bring with it poverty and a general decrease in the individual and/or households' socio-economic conditions, and an increase in informal settlements (van Der Walt, 2009).

The CoT, in its IDP, illustrated the overloaded areas in terms of the local electricity network (see Figure 4.4). In terms of this illustration, Soshanguve is already experiencing problems in terms of electricity supply (residents also complained of this at the public meeting) – this means that the current electrical supply to the area is unable to keep up with the area's development and subsequent demand for electricity. If a 'no go' option is implemented, the situation will deteriorate significantly over the next 10 or so years so that more areas are affected by 2022.

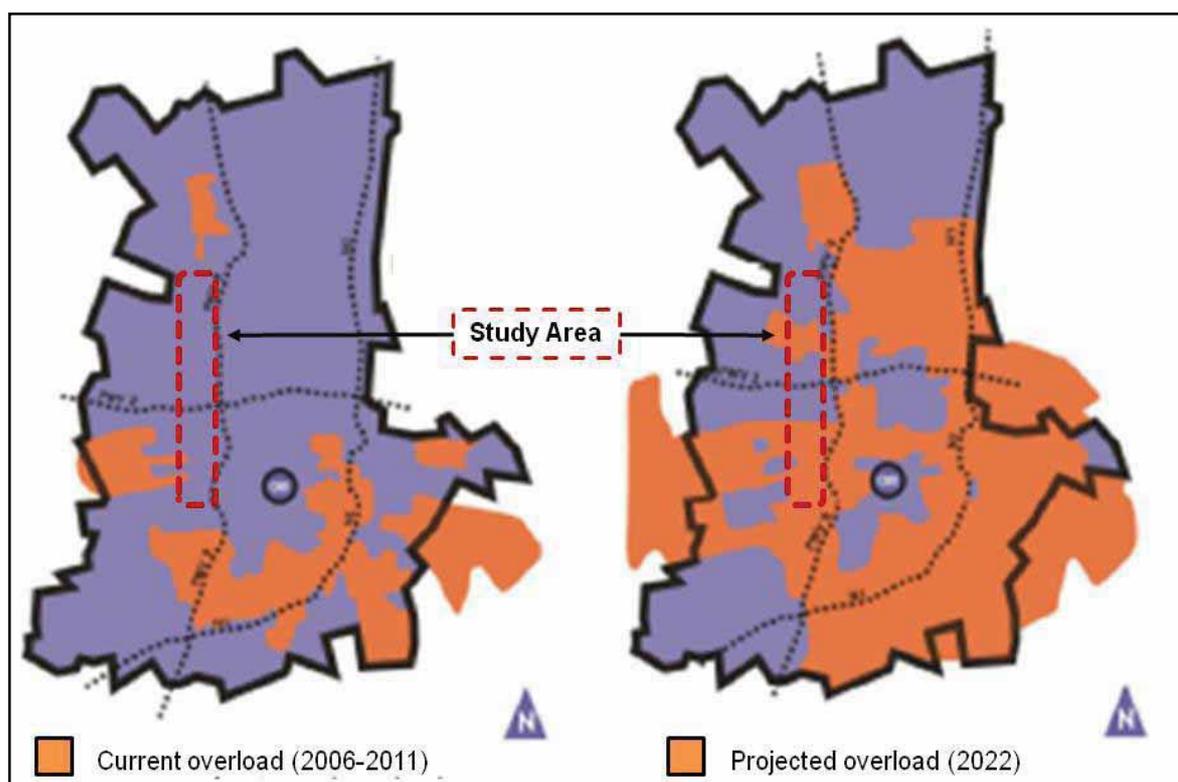
4.1.3. Services and Infrastructure

The years between 2001 and 2007 saw a steady increase in the delivery of municipal services to the households within the CoT. Municipal infrastructure backlogs are mostly confined to the previously disadvantaged township areas, and, as could be expected, in informal settlement areas.

Municipal wide, the majority of households (97.1%) have access to water that is on par or above RDP standard (i.e. piped water either in or within 200m from a dwelling). Even more households in both the Central and Northwest regions of the CoT have access to piped water – in both regions it is estimated at 99% of all households. Overall, it also appears that 97% of all households within the CoT have access to sanitation services that are on par or above RDP standard (i.e. connected to a sewerage system or a VIP system with ventilation). In the Central

region it is estimated that 99% of all households have proper sanitation services, but this figure drops significantly in the Northwest region, where it is estimated that 87.4% of all households have access to a proper sanitation service (this percentage corresponds more or less with the 18% informal settlement in the region, so that it can be expected that it would be mostly informal houses that do not have access to RDP sanitation services).

The CoT, in its IDP, illustrated the overloaded areas in terms of the local electricity network (refer to figure 4.4). In terms of this illustration, Soshanguve is already experiencing problems in terms of electricity supply (residents also complained of this at the public meeting) – this means that the current electrical supply to the area is unable to keep up with the area’s development and subsequent demand for electricity. If a ‘no go’ option is implemented, the situation will deteriorate significantly over the next 10 or so years so that more areas are affected by 2022.



Source: Adapted from the TIPD 2006-2011 Third Revision

Figure 4.4: Current and projected overload areas in the CoT

4.1.4 Socio-Cultural Profile

The proposed Phoebus substation will be located within Soshanguve, which is a township situated approximately 45km north-west of Pretoria. Soshanguve was established in 1974 on land that was supposed to be incorporated into a Bantustan bordering on Mabopane in the then Bophuthatswana. The name

Soshanguve was derived from the **Sotho**, **Shangaan**, **Nguni** and **Venda** people who were resettled from Atteridgeville and Mamelodi. Soshanguve was incorporated into the CoT and in January 2006 was the scene of riots due to poor service delivery.

Socio-cultural change processes that are associated with the construction and operation of the proposed project include changes such as health and safety aspects and sense of place. The concept of 'health' is not only limited to physical health (i.e. the absence of ailments or illness), but also includes mental and social health. The following socio-cultural change processes are expected:

- » Disruption in daily living and movement patterns;
- » Dissimilarity in social practices;
- » Alteration in family structure;
- » Conflict;
- » Safety and crime impacts; and
- » Change in sense of place.

4.2. Biophysical Characteristics of the Study Area

4.2.1. Geographical Profile (Topography and Surface Water Hydrology)

Varied topography is recognised as one of the most powerful influences contributing to the high biodiversity of southern Africa. The interplay between topography and climate over a long period has led to the evolution of a rich biodiversity. Landscapes composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do homogeneous landscapes. The richness and diversity of flora has been found to be significantly higher in sites with high geomorphological heterogeneity and it can reasonably be assumed that associated faunal communities will also be significantly more diverse in spatially heterogeneous environments. The power line will traverse two prominent ridges in the study area.

At least three threatened mammal species that occur within Gauteng utilise habitat provided by the ridge environment, including Juliana's Golden mole (*Amblysomus julianae*), which is perhaps the most threatened small mammal in Africa. Several bird species occurring in Gauteng that are on the South African or international Red Data lists or are considered to be of conservation concern are dependent on ridges, koppies and hills. Similarly, three rare reptile species that occur in Gauteng utilise rocky habitats such as those provided by ridges. The Northern Pygmy Toad (*Bufo fenoulheti*) and the Common River Frog (*Rana angolensis*) are found in kloofs. Many Red Data butterflies (especially those belonging to the lycaenid group) occur on the southern slopes of ridges, e.g. the Heidelberg copper butterfly (*Chrysoritis aureus*) is restricted to the rocky

southern slopes of the Alice Glockner Nature Reserve. *Metisella meninx* is a vulnerable butterfly species that occurs at altitudes above 1,600m and as such, these butterflies are often present on ridge systems. Invertebrates are reliant on hilltops as thermal refugia from winter cold air drainage. The proposed corridors are located in areas that comprise extensive areas of natural habitat as well as some transformed areas. Land transformation is mostly the result of urban developments and settlements.

The Central Sandy Bushveld is located in undulating terrain, occurring mainly in a broad arc south of the Springbokvlakte from the Pilanesberg in the west through Hammanskraal and Groblersdal to GaMasemola in the east. The habitat conforms to low undulating areas, sometimes between mountains, and sandy plains and catenas supporting tall, deciduous *Terminalia sericea* and *Burkea africana* woodland on sandy soils (with the former often dominant on the lower slopes of sandy catenas) and low, broadleaved *Combretum* woodland on shallow, rocky or gravelly soils.

Gold Reef Mountain Bushveld is situated on rocky hills and ridges often west-east facing slopes associated with distinct florist differences (e.g. preponderance of *Acacia caffra* on the southern slopes). Tree cover elsewhere is variable. Marikana Thornveld comprises of the northern and southern sections of the study area. This ecological type is structurally similar to open *Acacia* savanna woodland, occurring in valleys and slightly undulating plains and some lowland hills. Shrubs are denser along drainage lines, on termitaria and rocky outcrop or in other habitat protected from fire. The Marikana Thornveld is a threatened ("endangered") vegetation type of which less than 1% is formally conserved within reserves and is mainly threatened by cultivation and urbanisation. The following species are regarded representative of the Marikana Thornveld vegetation type.

Moot Plains Bushveld occurs immediately to the south of both the Dwarsberg-Swatruggens Mountain Bushveld and Gold Reef Mountain Bushveld, consisting of an open to closed *Acacia* savanna with a well-developed herbaceous layer dominated by grasses. This vegetation type is Vulnerable of which only 13% is conserved, mainly in the Magaliesberg Nature Area.

Norite Koppies Bushveld is encapsulated in the central part of the study area, corresponding to low, semi-open to closed woodland up to 5m tall, consisting of dense deciduous shrubs and trees with very sparse undergrowth on shallow soil, with large areas not covered by vegetation. Tree and shrub layers are continuous.

4.2.2. Climate

The climate of the area can be regarded as typical of the Highveld, with cool to cold, dry winters and warm, moist summers (Koch, 1984). The main climatic indicators are given in Table 4.1.

Table 4.1: Climate data of the study area

Month	Average Rainfall (mm)	Average Min. Temp (°C)	Average Max. Temp (°C)	Average frost dates
Jan	109.9	16.6	29.8	Start date: 24/5 End date: 23/8 Days with frost: ± 32
Feb	89.7	16.3	29.2	
Mar	76.6	14.5	28.2	
Apr	40.2	10.7	25.7	
May	18.0	5.6	23.0	
Jun	6.5	2.0	20.4	
Jul	6.2	1.8	20.8	
				Heat units (hrs > 10°C)
Aug	6.5	4.0	23.6	Summer (Oct-Mar): 2 213 Winter (Apr-Sept): 796
Sep	14.2	8.6	27.0	
Oct	51.9	12.7	28.8	
Nov	97.1	14.6	28.7	
Dec	102.2	15.8	29.4	
Year	619.0 mm	18.2 °C (Average)		

The long-term average annual rainfall is 619.0 mm, of which 527.4 mm, or 85.2%, falls from October to March. Temperatures vary from an average monthly maximum and minimum of 29.8°C and 16.6°C for January to 20.8°C and 1.8°C for July respectively. The extreme high temperature that has been recorded is 40.6°C and the extreme low -9.0°C. Frost occurs every year on approximately 32 of the 100 days on average between May and August.

4.2.3. Ecological Profile

Areas of Surface Water

Areas of surface water that will potentially be affected by the proposed power line corridors include perennial and non-perennial rivers. The distribution of these areas is illustrated in Figure 4.5, as part of the C-Plan sensitivities.

Areas of surface water contribute significantly towards the local and regional biodiversity of an area due to the atypical habitat that is present within the interface of terrestrial and aquatic habitat types. These ecotones (areas or zones of transition between different habitat types) are frequently occupied by species that occur in both the bordering habitat types, and is therefore generally rich in species. In addition, many flora and fauna species is specifically adapted to exploit the temporal or seasonal fluctuation in moisture levels in these areas and exhibits extremely narrow habitat variation tolerance levels. In addition, these areas are also visited on a frequent basis by all terrestrial animals that utilise water sources on a frequent basis. Ecotonal interface areas form extremely narrow bands around areas of surface water and they constitute extremely small portions when calculated on a purely mathematical basis. However, considering the high species richness, these areas are extremely important on a local and regional scale.

Rivers also represent important linear migration routes for a number of fauna species as well as a distribution method for plant seeds. This method of seed distribution is extremely evident in the case of several invasive alien tree species that occur extensively in many of the rivers and streams. The morphology of a region can also be loosely associated with the presence and diversity of aquatic habitat types. Topographically heterogeneous regions are usually associated with the presence of numerous smaller rivers and streams caused by increased run-off and slopes. Plains and areas where low slopes prevail are usually characterised by the presence of few, but large, rivers and pans, comprising extensive surface areas.

Rivers and streams in the study area were found to be severely compromised by nearby urban developments and settlements in particular. Litter, dumping, infestation by exotic species, poor water quality and erosion are some attributes that are currently affecting the status of wetland habitat types within the study area adversely. A high biophysical sensitivity was nonetheless ascribed to all wetland habitat types as part of the biophysical sensitivity analysis.

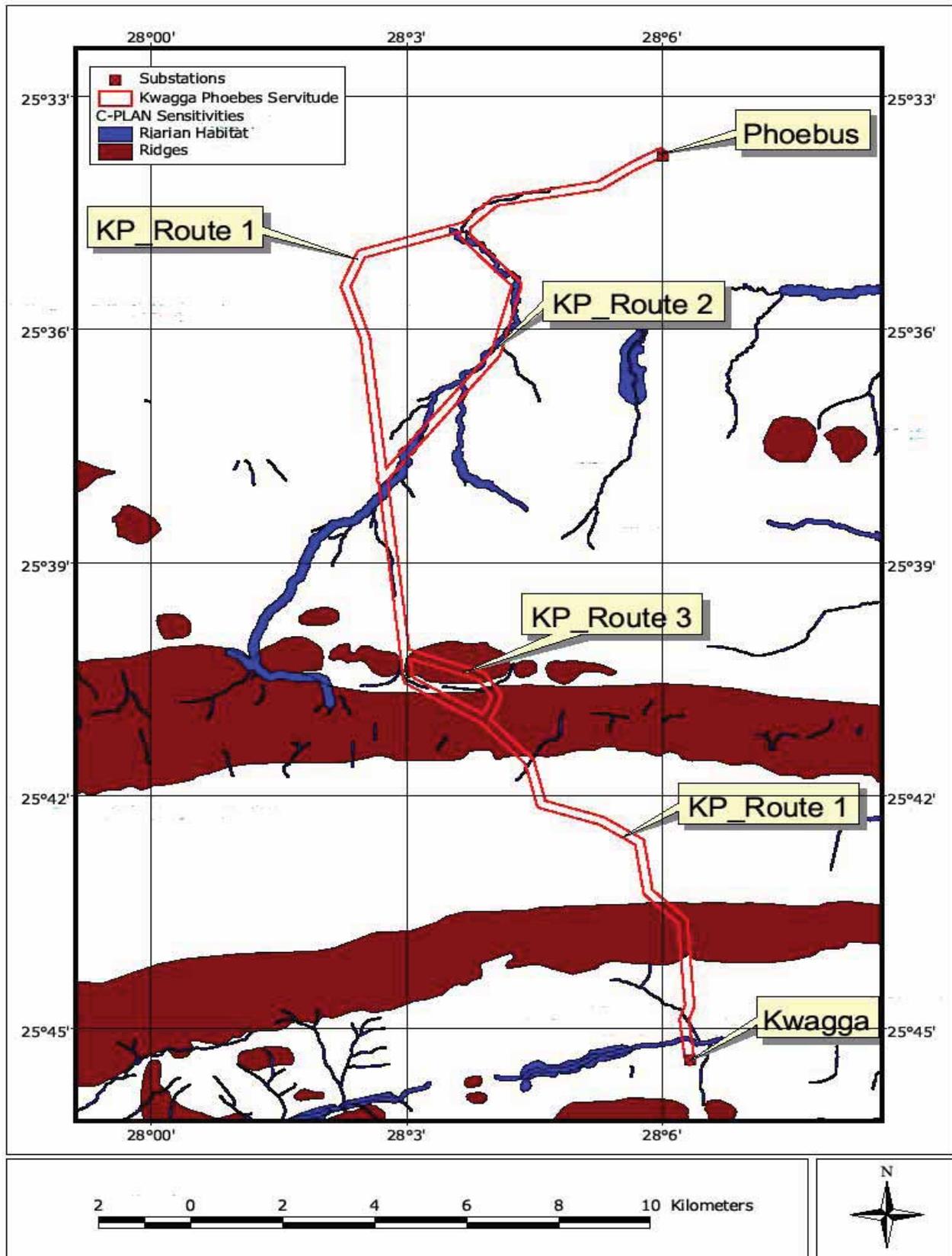


Figure 4.5: Areas of surface water along the proposed route corridors

Ridges & Slopes

Varied topography is recognised as one of the most powerful influences contributing to the high biodiversity of southern Africa. The interplay between topography and climate over a long period has led to the evolution of a rich biodiversity. Landscapes composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do homogeneous landscapes. The richness and diversity of flora has been found to be significantly higher in sites with high geomorphological heterogeneity and it can reasonably be assumed that associated faunal communities will also be significantly more diverse in spatially heterogeneous environments.

Ridges are characterised by high spatial heterogeneity due to the range of differing aspects (north, south, east, west and variations thereof), slopes and altitudes, all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions. The temperature and humidity regimes of microsites vary on both a seasonal and daily basis. Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes. Variation in aspect, soil drainage and elevation/altitude has been found to be especially important predictors of biodiversity. It follows that ridges will be characterised by a particularly high biodiversity; as such their protection will contribute significantly to the conservation of biodiversity in Gauteng.

Many Red Data/ threatened species of plants and animals inhabit ridges. Due to their threatened status, Red Data species require priority conservation efforts in order to ensure their future survival. As such, the conservation of ridges in Gauteng will contribute significantly to the future persistence of these species.

At least three threatened mammal species that occur within Gauteng utilise habitat provided by ridges environment including Juliana's Golden mole (*Amblysomus julianae*), which is perhaps the most threatened small mammal in Africa. Several bird species occurring in Gauteng that are on the South African or international Red Data lists or are considered to be of conservation concern are dependent on ridges, koppies and hills. Similarly, three rare reptile species that occur in Gauteng utilise rocky habitats such as those provided by ridges. The Northern Pygmy Toad (*Bufo fenoulheti*) and the Common River Frog (*Rana angolensis*) are found in kloofs. Many Red Data butterflies (especially those belonging to the lycaenid group) occur on the southern slopes of ridges, e.g. the Heidelberg copper butterfly (*Chrysothis aureus*) is restricted to the rocky southern slopes of the Alice Glockner Nature Reserve. *Metisella meninx* is a Vulnerable butterfly species that occurs at altitudes above 1,600m and as such, these butterflies are often present on ridge systems. Invertebrates are reliant on hilltops as thermal refugia from winter cold air drainage.

Natural corridors, which are present in unfragmented landscapes, such as rivers, riparian zones and topographic features should be retained following fragmentation. Such corridors may remain relatively self-sustaining after fragmentation as they continue to be essentially isolated in a larger matrix, unlike remnant corridors that require substantial management to counteract the external effects of the surrounding matrix. Remnant corridors only become corridors when the surrounding landscape is fragmented and until that time had been part of the overall matrix.

Ridges may have a direct effect on temperature/radiation, surface airflow/wind, humidity and soil types. Ridges also influence fire in the landscape, offering protection for those species that can be described as "fire-avoiders". Because of the influence of topography on rainfall, many streams in Gauteng originate on ridges and control water inputs into wetlands. The protection of the ridges in Gauteng in a natural state will thus ensure the normal functioning of ecosystem processes. In contrast, development of a ridge will alter these major landscape processes. For example, water runoff into streams and wetlands will increase. The proposed line variants will potentially affect Class 1, Class 2 and Class 3 ridges. Significant ridge areas are present in the southern part of the proposed lines.

Habitat Types

An analysis of aerial photographs and results of the field surveys revealed the following communities and variations within the proposed corridors:

- » Degraded Woodland;
- » Natural Woodland Community, including:
 - * Central Sandy Bushveld Variation;
 - * Gold Reef Mountain Bushveld Variation;
 - * Marikana Thornveld Variation;
 - * Norite Koppies Bushveld Variation;
- » Ridge Habitat Type;
- » Transformed Areas; and
- » Wetland Habitat Types.

The extent of habitat types within the proposed corridors is presented in Table 4.2. The extent of habitat types within the respective sections of the corridors is presented in Table 4.3.

Table 4.2: Extent of habitat types in proposed corridors

Habitat Type	Extent	Percentage
Degraded Woodland	269.7 ha	37.2%
Natural Woodland - Central Sandy Bushveld	21.7 ha	3.0%

Natural Woodland - Gold Reef Mountain Bushveld	24.1 ha	3.3%
Natural Woodland - Marikana Thornveld	92.8 ha	12.8%
Natural Woodland - Norite Koppies Bushveld	13.0 ha	1.8%
Ridge Habitat Types	121.0 ha	16.7%
Transformed Areas	99.3 ha	13.7%
Wetland Habitat Types	83.1 ha	11.5%
Total	724.6 ha	

Table 4.3: Extent of habitat types within corridor sections

Habitat Type	Sec 1	Sec 2	Sec 3	Sec 4	Sec 5	Sec 6	Sec 7
Degraded Woodland	47.9 ha	40.3 ha	63.1 ha	43.9 ha	2.8 ha	4.7 ha	67.0 ha
Central Sandy Bushveld	21.7 ha	0.0 ha	0.0 ha	0.0 ha	0.0 ha	0.0 ha	0.0 ha
Gold Reef Mountain Bushveld	0.0 ha	0.0 ha	0.0 ha	0.0 ha	9.6 ha	0.0 ha	14.4 ha
Marikana Thornveld	0.0 ha	62.5 ha	8.3 ha	16.7 ha	0.0 ha	0.0 ha	5.3 ha
Norite Koppies Bushveld	0.0 ha	13.0 ha	0.0 ha	0.0 ha	0.0 ha	0.0 ha	0.0 ha
Ridge Habitat Types	0.0 ha	12.2 ha	0.0 ha	0.0 ha	27.3 ha	41.0 ha	40.5 ha
Transformed Areas	7.6 ha	9.4 ha	6.5 ha	11.1 ha	2.4 ha	5.6 ha	56.7 ha
Wetland Habitat Types	10.7 ha	3.4 ha	55.0 ha	5.4 ha	2.7 ha	0.8 ha	5.0 ha
Total	88.0 ha	140.9 ha	132.9 ha	77.1 ha	44.8 ha	52.0 ha	188.9 ha

Floristic and Faunal Sensitivity Analysis

Floristic sensitivity is based on an analysis of floristic attributes, taking existing impacts and conservation potential into consideration, but also considering the potential significance of impacts resulting from the proposed development. The following floristic sensitivities are estimated for respective habitat types (Table 4.4). A calculation of the area extent of floristic habitat sensitivities within the respective corridor sections is presented in Table 4.4 and Figure 4.7 with a calculation of the extent of habitat sensitivities per corridor sections presented in Table 4.3.

Habitat types that are pristine are regarded as high quality faunal habitat and the likelihood of Red Data species occurring within these areas is generally high. These habitat types are often associated with environmental features that are also regarded as sensitive, such as riparian zones aquatic regions and rocky

outcrops. The extent of faunal habitat sensitivities per corridor section is presented in Table 4.4 and Figure 4.7.

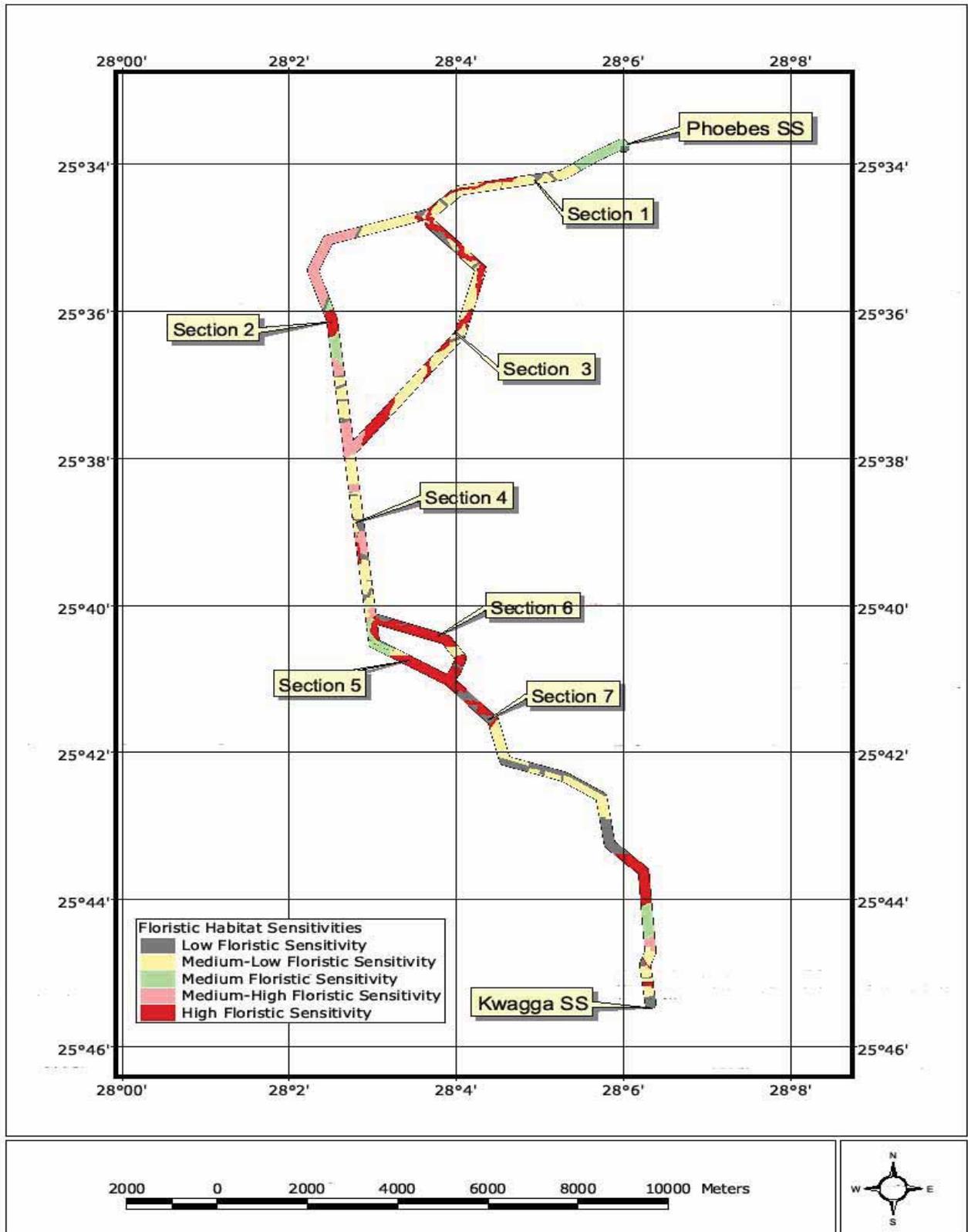


Figure 4.6: Areas of floristic habitat sensitivities

Table 4.4: Floristic sensitivity of habitat types in the proposed corridors

Criteria	RD species	Landscape species sensitivity	Status/Ecological quality	Species composition	Functionality/ fragmentation	TOTAL	SENSITIVITY INDEX	SENSITIVITY CLASS
Community								
Criteria Ranking								
Degraded Woodland	2	4	4	6	6	108	35%	Medium-Low
Central Sandy Bushveld	4	6	6	7	4	157	51%	Medium
Gold Reef Mountain Bushveld	4	5	6	7	6	152	49%	Medium
Marikana Thornveld	5	8	7	8	6	194	63%	Medium-High
Norite Koppies Bushveld	4	6	8	8	6	176	57%	Medium
Ridge Habitat Types	9	10	10	10	10	280	90%	High
Transformed Areas	0	2	2	2	3	39	13%	Low
Wetland Habitat Types	9	10	7	7	10	247	80%	High

Table 4.5: Faunal Sensitivity of habitat types in the proposed corridors

Community	Status	Linkage	RD Likelihood	Average	SENSITIVITY CLASS
Degraded Woodland	2	5	2	30%	Medium-Low
Central Sandy Bushveld	6	3	2	37%	Medium-Low
Gold Reef Mountain Bushveld	7	4	3	47%	Medium
Marikana Thornveld	5	3	2	33%	Medium-Low
Norite Koppies Bushveld	7	4	8	63%	Medium-High
Ridge Habitat Types	9	9	9	90%	High
Transformed Areas	1	3	1	17%	Low
Wetland Habitat Types	6	9	9	80%	High

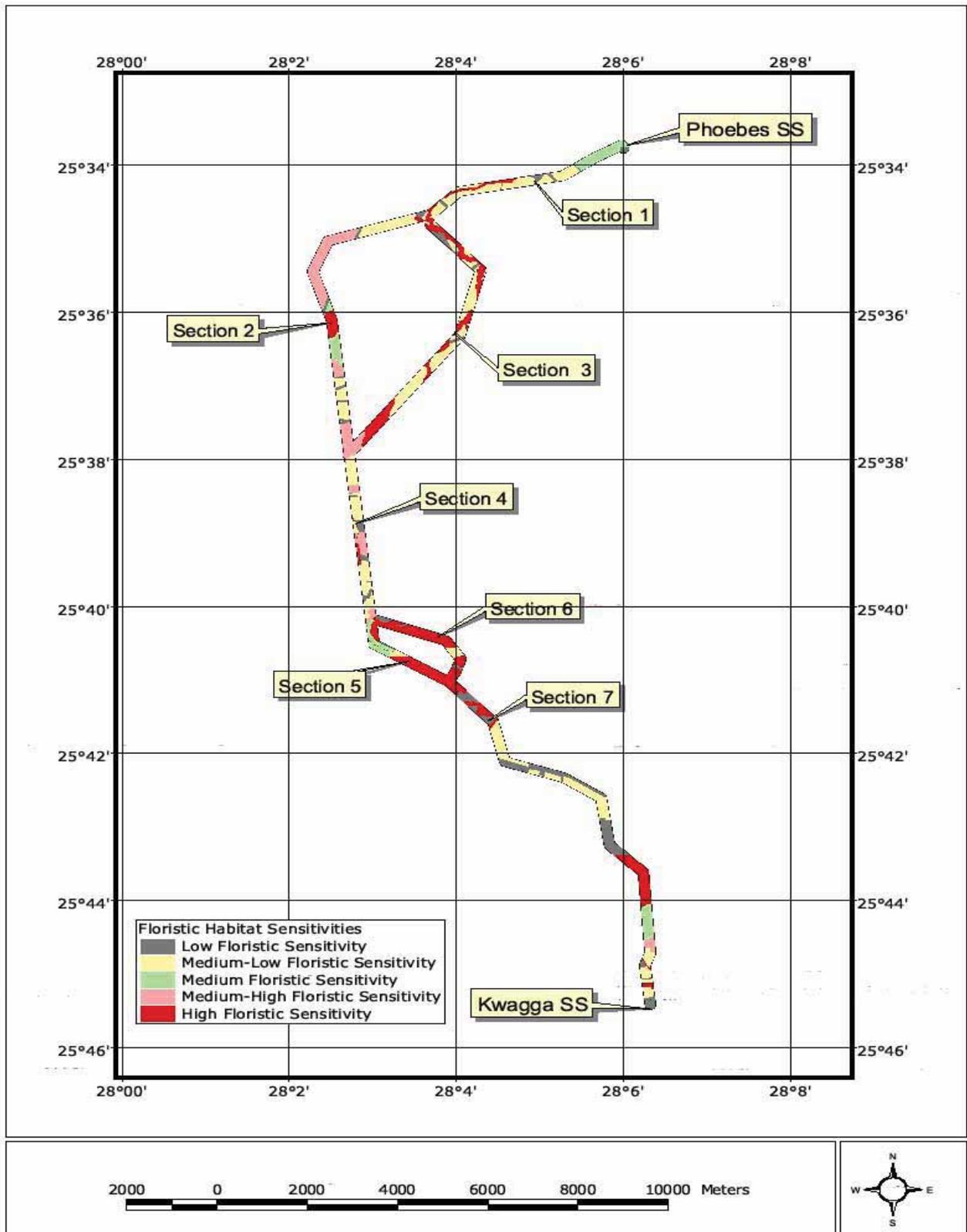


Figure 4.7: Areas of faunal sensitive

» *Degraded Woodland Habitat:*

As a result of historic disturbances, including agriculture, high grazing pressure, poor management principles, destruction of the woody layer through wood gathering, frequent fires, etc., extensive parts of the natural woodland areas of the study area constitute secondary climax vegetation. This community is confined to the floodplains of the study area where characteristically flat (slopes $>5^\circ$), or slightly undulating areas, predominate and surface rocks are generally absent. The species diversity of this community is not particularly high

» *Natural Woodland Community*

This community includes relative pristine variations of the regional vegetation types, including:

- * Central Sandy Bushveld Variation;
- * Gold Reef Mountain Bushveld Variation;
- * Marikana Thornveld Variation; and
- * Norite Koppies Bushveld Variation.

The main characteristic of these variations is the prominence of the woody layer, which is, to a larger or lesser extent, unaffected by impacts noted in the general surrounds. These areas are normally contained within private property where access is not readily available and few continued pressure effects are present. The woody layer is diverse and dominant and a well-developed substratum is noted in these parts. Some parts, particularly the Marikana Thornveld (Endangered) and Central Sandy Bushveld (Vulnerable) Variations, have a threatened status. Biophysical habitat attributes are similar to the Degraded Woodland Community.

» *Riparian Habitat:*

Perennial and non-perennial drainage lines are present in the study area. The vegetation within the drainage lines were found to be highly degraded, consisting of a variety of weeds and exotic species. *Phragmites australis* and *Typha capensis* stands is characteristic of large sections of this habitat type. Extremely little of the original, pristine wetland habitat types remain in the study area.

Impacts that compromise this habitat type include effects of nearby urban development and settlements, such as litter, dumping, infestation by exotic species, as well as poor water quality resulting from effluents from industrial areas and erosion.

» *Ridge Habitat Type:*

This habitat type includes all areas of natural/ pristine vegetation that are situated within ridge areas as captured in the Gauteng Ridges Policy. Common characteristics of this habitat type include high rockiness and slopes that exceed 5° (8.8%). Several variations are noted that vary between grassland and open savanna to closed woodland, all of these are included in this community as a result of a similar sensitivity and importance on a local and regional scale.

A high diversity of plant species is noted throughout these parts and the vegetation was found to be in a prime condition, mostly as a result of inaccessibility for cattle that could potentially impact adversely on the vegetation.

» *Transformed Habitat*

Transformed areas represent parts where historical or recent human activities led to the total transformation of the natural vegetation. No natural vegetation remains in these areas and the floristic status of these areas is therefore regarded low because of the presence of secondary vegetation or the entire absence of any vegetation. The likelihood of encountering Red Data flora species within these areas are regarded low and a low floristic status is ascribed to this habitat type.

Stands of Wattle (*Acacia mearnsii*) and *Eucalyptus* are present in the study area (south) and are included in the Transformed Habitat Type. The species composition and physiognomy is dominated by the exotic trees and a poorly developed herbaceous layer is noted in most cases. In stands where the density of trees is not particularly high, a well developed grass layer may be present, consisting almost exclusively of *Hyparrhenia hirta*, *Eragrostis chloromelas*, *E. curvula* and *E. gummiflua*.