

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS  
DRAFT ENVIRONMENTAL IMPACT REPORT

PROPOSED TSHWANE STRENGTHENING  
PROJECT PHASE 1: APOLLO-  
VERWOERDBURG LOOP-IN TRANSMISSION  
POWER LINES & SUBSTATION EXTENSION  
GAUTENG PROVINCE

(DEA Ref No: 12/12/20/1470)

DRAFT FOR PUBLIC REVIEW  
March 2010



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## PROJECT DETAILS

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<b>DEA Reference Nos.</b>	:	12/12/20/1470 (Apollo – Verwoerdburg turn-in power lines and substation extension)
<b>Title</b>	:	Environmental Impact Assessment Process Draft Environmental Impact Assessment Report for the Proposed Tshwane Strengthening Project Phase 1, Gauteng Province
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## PURPOSE OF THE DRAFT EIA REPORT

In order to reinforce the existing Transmission network in the Tshwane Region, Eskom Transmission is currently proposing the construction of a 400kV transmission power line between the existing Apollo and Pluto substations, as well as between the existing Kwagga and proposed Phoebus substations. In addition, increased demand for a reliable electricity supply in the Central Grid has necessitated that Eskom Transmission improves the reliability and capacity of the transmission network in the area. Further, extension of the 400/132kV Verwoerdburg substation and establishment of a new Phoebus substation is also being proposed in the area in order to improve the reliability and quality of supply problems in the Tshwane area. Numerous Distribution options were investigated by Distribution network planning, the investment and a new Transmission network was preferred as the most suitable long-term solution. Eskom Transmission is therefore proposing the construction of the **Tshwane Strengthening Project Phase 1**.

Eskom has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The EIA Report consists of the seven chapters:

- » **Chapter 1** provides background to the proposed Tshwane Strengthening project Phase 1 and the environmental impact assessment process
- » **Chapter 2** provides an overview of the proposed Tshwane Strengthening project Phase 1
- » **Chapter 3** outlines the process which was followed during the EIA Phase of the EIA process
- » **Chapter 4** provides a description of the environment which may be potentially affected by the proposed project (Apollo-Verwoerdburg substation and turn-in power lines)
- » **Chapter 5** provides an assessment of the potential issues associated with the proposed extension of the Verwoerdburg substation and the 2X400kV turn-in power lines
- » **Chapter 6** presents the conclusions and recommendations of the EIA and an Impact Statement
- » **Chapter 7** presents the list of references and information sources used for the compilation of this DEIR.

The Scoping Phase of the EIA identified and described potential issues associated with the proposed project, and defining the extent of studies required within the EIA. The EIA Phase addresses those identified potential environmental impacts

and benefits (direct, indirect, cumulative impacts) associated with all the phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of the draft EIA Report provides stakeholders and I&APs and opportunity to verify that the issues they have raised through the EIA process have been captured and adequately considered. The final EIA Report will incorporate all issues and responses raised during the public review period of the draft EIA report prior to submission to the Department of Environmental Affairs.

### **PUBLIC REVIEW OF THE DRAFT EIA REPORT**

The Draft EIA Report will be available for public review at the following public places in the project area from **03 March to 07 April 2010** at the following locations:

Rietvlei Nature Reserve - Reception	City of Tshwane Metropolitan Municipality- Environment and Planning Department
Centurion Brach Library – Pioneer Road	Irene Library –
Kungwini Local Municipality Offices– Reception	<a href="http://www.eskom.co.za/eia">www.eskom.co.za/eia</a>
<a href="http://www.savannahsa.com">www.savannahsa.com</a>	

## EXECUTIVE SUMMARY

### Background and Project Overview

In order to reinforce the existing Transmission network in the Tshwane Region, Eskom Transmission is currently proposing the construction of a 400kV transmission power line between the existing Apollo and Pluto substations. In addition, increased demand for a reliable electricity supply in the Central Grid has necessitated that Eskom Transmission improves the reliability and capacity of the transmission network in the area. Further, upgrade of the 400/132kV Verwoerdburg substation and establishment of a new Phoebus substation is also being proposed in the area in order to improve the reliability and quality of supply problems in the Tshwane area. Eskom Transmission is therefore proposing the construction of the **Tshwane Strengthening Project Phase 1**. The Tshwane Strengthening Project Phase 1 comprises of the following:

- » **The extension and upgrade of the existing Verwoerdburg Substation.**
- » Construction of **2x 400kV loop-in lines from the existing Apollo–Pluto** transmission line which will feed into the Verwoerdburg Substation, a distance of approximately ~4 km.
- » Construction of the **new Phoebus Substation** adjacent to Hangklip Substation.

- » Construction of a **new 400kV transmission power line** between the Phoebus Substation and the Kwagga Substation, a distance of ~30 km.
- » Construction of loop in/out power line from Apollo-Dinaledi into Phoebus substation.
- » **Associated (infrastructure) works** to integrate the new transmission power lines and substation into the Transmission grid (such as access roads, communication tower, etc) and accommodate the new lines at existing substations (such as the construction of new feeder bays within the existing substation sites).

In total, **approximately 36 km of new power line** is proposed as part of the entire Tshwane Strengthening project Phase 1. The purpose of this project is to:

- » Improve the reliability of the existing Central Transmission network.
- » Improve the voltage regulation on the Central Grid Distribution and City of Tshwane Metropolitan Municipality network.
- » Create additional Transmission network capacity which will supply the increasing electricity demand in the Central Grid.

As separate applications were submitted to DEA for the different components of the project, separate

reports have been compiled by Savannah Environmental as follows:

- » The **nature and extent of the proposed 2x 400kV loop-in lines from the existing Apollo–Pluto and the expansion and upgrade of the Verwoerdburg substation**, as well as potential environmental impacts associated with the construction, operation and decommissioning of this infrastructure are **assessed in this Draft EIA Report (Reference Number 12/12/20/1470)**.
- » The **nature and extent of the proposed 400kV transmission power line between the Kwagga and Phoebus Substations, the expansion of the Kwagga Substation and construction of the Phoebus Substation**, as well as potential environmental impacts associated with the construction, operation and decommissioning of this infrastructure are **assessed in a separate Draft EIA Report (Reference Number 12/12/20/1471 and 12/12/20/1524)**.

This draft Environmental Impact Assessment (EIA) Report consists of the following chapters:

- » **Chapter 1** provides background to the proposed Tshwane Strengthening project Phase 1 and the environmental impact assessment process

- » **Chapter 2** provides an overview of the proposed Tshwane Strengthening project Phase 1
- » **Chapter 3** outlines the process which was followed during the EIA Phase of the EIA process
- » **Chapter 4** provides a description of the environment which may be potentially affected by the proposed project (Apollo-Verwoerdburg substation extension and turn-in power line)
- » **Chapter 5** provides an assessment of the potential issues associated with the proposed extension of the Verwoerdburg substation and the 2X400kV turn-in power lines
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### Background and Overview of the Proposed Project

Eskom Holdings Ltd (Eskom) is responsible for the provision of reliable and affordable power to its consumers in South Africa. Electricity by its nature cannot be readily or inexpensively stored and, therefore, must be used as it is generated. Electricity must, therefore, be efficiently transmitted from the point of generation to the end-user.

As part of its assessment of supply requirements, and as a result of the

projected load growth of the Gauteng region, Eskom have determined that additional transmission capacity will be required in the Tshwane area by the year 2013. For this reason, Eskom Transmission is proposing the **Tshwane Strengthening Project**. Figure 1 provides an indication of the study area considered within the EIA process for this proposed project (TSP Phase 1). This report focuses on the following components:

- » Extension of the Verwoerdburg substation (refer to Figure 1).
- » Construction of a **new 400kV transmission power line** between the Phoebus Substation and the Kwagga Substation, a distance of ~30 km (refer to Figure 2).

**Associated (infrastructure) works** to integrate the new transmission power lines and substation into the Transmission grid (such as access roads, communication tower, turn-in lines, feeder bay etc) and accommodate the new lines at existing substations (such as the construction of new feeder bays within the existing substation sites).

In addition, it must be noted that the **Tshwane Strengthening Project Phase 2** consists of the proposed Lomond/Anderson power line corridor and the refurbishment of the Lomond substation, while **Phase 3** includes the Hangklip/Dinaledi 132kV corridor as well as the installation of a third transformer at the Verwoerdburg substation. Lastly,

**Phase 4** includes the addition of a second transformer at the proposed Phoebus substation. The environmental impact assessment by **Nemai Consulting** is currently underway for the Tshwane Strengthening Project Phase 2 including the establishment of the Anderson substation and the 400kV power line between Dinaledi and Anderson substations, (Reference Numbers **12/12/20/1567** and **12/12/20/1568**) and the EIA for Phase 3 and 4 have not yet commenced.

#### The Purpose and Need for the Proposed Project

The current Eskom transmission network supplies the City of Tshwane Metropolitan Municipality (CoT) via three substations, namely: Kwagga, Njala and Verwoerdburg. The contracted reserve capacity at each point is reviewed annually. CoT has applied for new supply points and a step load increase to Eskom Transmission and Distribution. The three parties (Distribution, Transmission and the City of Tshwane Metropolitan Municipality) agreed on the 20-year load forecast for the CoT and also concluded that the CoT and the Eskom transmission networks supplying Tshwane need to be strengthened. A number of options were analysed based on technical and economic benefits to all parties involved (refer to Figure 1).

## Environmental Impact Assessment

The proposed Tshwane Strengthening Project Phase 1 is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) published in GN 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA, No 107 of 1998). In terms of sections 24 and 24D of NEMA, as read with GNs R385 (Regulations 27–36) and R387, a Scoping and EIA are required to be undertaken for this proposed project.

The National Department of Environmental Affairs (DEA) is the competent authority for this project as Eskom is a statutory body. An application for authorisation has been accepted by DEA (under Application Reference number **12/12/20/1270**). Through the decision-making process, the DEA will be supported by the Gauteng Department of Agriculture and Rural Development (GDARD) as the commenting authority.

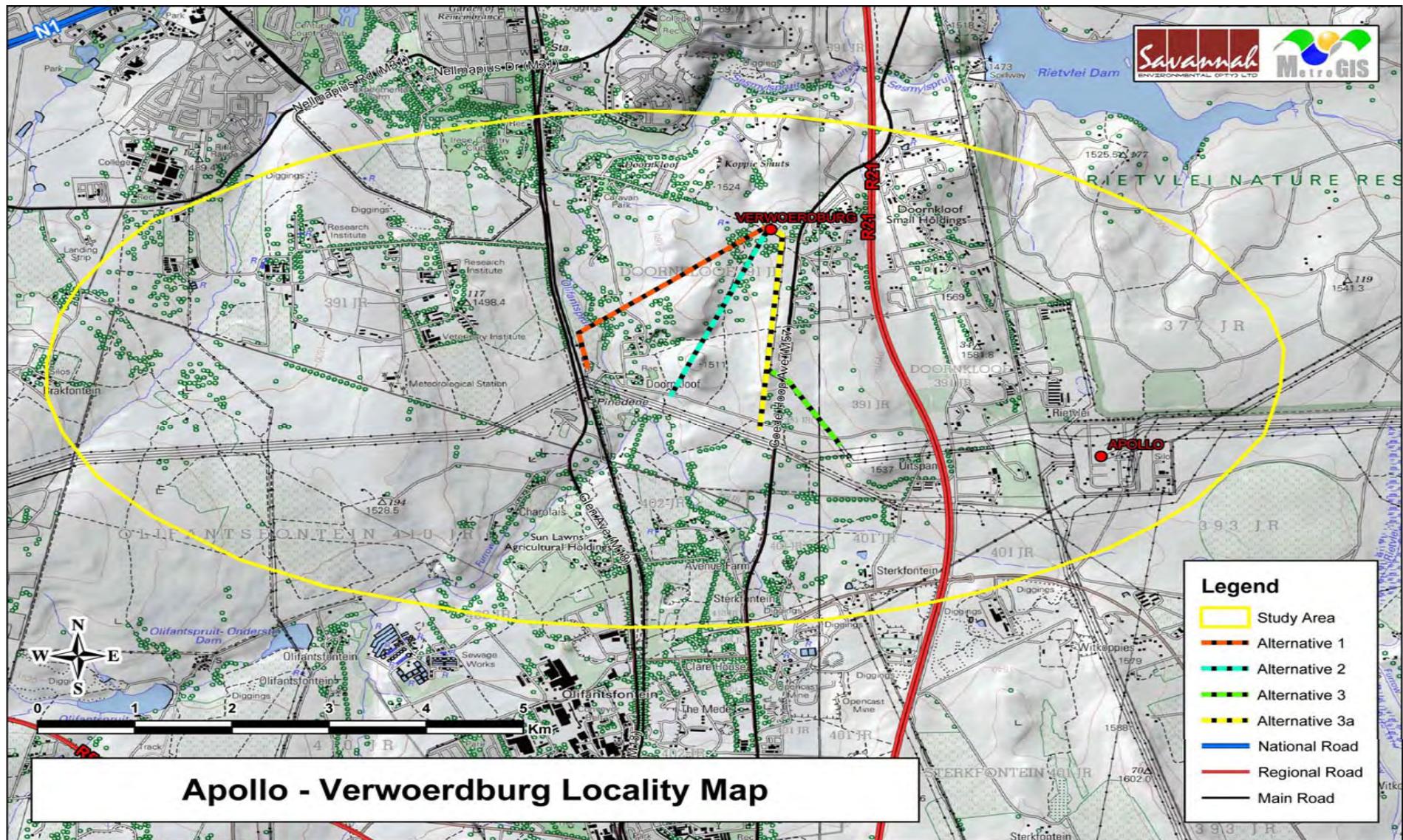
A comprehensive public participation process was undertaken in accordance with Regulation 56 of Government Notice No R385 of 2006 during the Scoping phase of this EIA process. This public participation process comprised the following:

- » **Notification of the EIA Process** in the printed media and on site, as well as through written notification to identified stakeholders affected landowners

- » **Identification and registration** of I&APs and key stakeholders.
- » Compilation and distribution of a **Background Information Document (BID)** to all identified I&APs and key stakeholders
- » **On-going consultation** with identified I&APs and stakeholders
- » Compilation and maintenance of a **database** containing the names and addresses of all registered parties
- » Preparation of a **Comments and Response Report** detailing key issues raised by I&APs as part of the EIA Process.



**Figure 1:** Locality map showing the locality of the Verwoerdburg substation adjacent to Doornkloof East in Pretoria under investigation during the EIA process



**Figure 2:** Locality map showing the locality of the proposed Apollo-Verwoerdbrug turn-in power lines under investigation during the EIA process

## **The Need for Additional Transmission Capacity in the Tshwane Area**

Studies undertaken by Eskom have shown a steady 3% per annum average load growth for the area fed from Verwoerdburg, Wildebeest and Apollo substations, the main bulk supply substations to the Tshwane Region. This is due to light industrialisation, commercialisation, urban growth and electrification within this area. It is also a sign of good economic growth in this area.

## **Alternatives for Satisfying the Additional Electricity Supply Need within the Tshwane Area**

Electrical supply constitutes a complex system of generation facilities, substations, and transmission and distribution power lines. The system operates on a demand-supply structure with the power being generated and transmitted at the moment it is needed.

### ***The "Do Nothing" Option***

The 'do nothing' alternative is the option of not extending the existing Verwoerdburg substation as well as not constructing any new transmission power lines looping in from the Apollo-Pluto power lines. By not taking any action, Eskom Transmission may end with a situation of not being able to ensure firm supply into some parts of the country and the Tshwane area in particular, in the very near future

(i.e. by 2012). This option is therefore discarded as a feasible alternative as it would neither supply the projected demand for electricity nor optimise the existing infrastructure.

### ***Demand Side Management***

Demand Side Management (DSM) can generally be defined as the activities performed by the electricity supply utility, which are designed to produce the desired changes in the load shape through influencing customer usage of electricity and to reduce overall demand by more efficient use.

### ***New Generation Systems***

The option of a new coal-fired, gas, renewable or nuclear generation plant being commissioned near to the load centre could be considered. This may have a more negative overall impact on the environment due to the land requirements, fuel resources, etc., and would take at least five years to implement and would not address the foreseen supply demand in the short-term.

### ***Upgrade Existing Transmission Power Lines by using Bigger Conductors***

The upgrade of existing transmission lines in the area by using bigger conductors would require these existing power lines to be permanently off while being upgraded to thicker conductors. This would put the existing and future load at risk

should the remaining lines in the area trip. The upgrade option would result in the physical load on the existing towers increasing substantially, resulting in sagging of the conductors. The existing towers would be inadequate to support this physical load. The power transmission from the Apollo substation would not be able to be evacuated to the load centres without causing dynamic instability in the Eskom network which could result in black-outs. This option would not improve the reliability of the Transmission system nor be sustainable and is therefore not considered to be a feasible alternative.

***Extension of the Verwoerdburg Substation and construction of 2X 400kV turn-in power lines from Apollo-Pluto Transmission power lines***

The alternative is part of the new generation and transmission capacity alternatives. The need for increased capacity and the need for optimising existing infrastructure would be met through the implementation of this option.

This option is most favoured by Eskom Transmission as well as the City of Tshwane Electricity Department as it is considered to be the most feasible from a technical and economic perspective, and will meet the required need for increased capacity and the need for optimising existing infrastructure in the short- and long-term. This option is

therefore nominated as the preferred option by Eskom Transmission to supplement the power supply to the Pretoria North area.

**Evaluation of Project Alternatives - Substation Site extension and Turn-in Power Lines**

The expansion of the Verwoerdburg substation was identified by Eskom for investigation within a broader study area based on technical criteria. Therefore, land adjacent to and north-west of the existing substation was considered to be the most suitable from a technical perspective and was provided to the EIA team for further investigation through the EIA process. There were no alternative sites identified and investigated for the substation expansion because the proposal is for the expansion of existing infrastructure.

**Alternative Turn-in Transmission Power Line Corridors**

Subsequent to the specialist workshop, an additional alternative was identified direct from the Verwoerdburg substation southwards towards the Apollo-Dinaledi power lines (Savannah Environmental, 2009). Therefore, Alternatives 1, 2, 3 and 3a has been included within this EIA Report.

**Alternative Corridor 1** starts at Verwoerdburg Substation and runs south-west for approximately 2 km to Glen Avenue road. It turns south from here and joins into the existing

Apollo-Pluto lines. The corridor crosses some open grassland and a small stream.

**Alternative Corridor 2** starts at Verwoerdburg Substation and runs south-south west for approximately 2.3 km in a straight line before joining into the existing Apollo-Pluto lines. This corridor crosses some open grassland and a small koppie.

**Alternative Corridor 3** starts at Verwoerdburg Substation and follows existing transmission lines for the entire length. It follows the road for the majority of the route. Alternative 3 does not cross any streams or koppies.

**Alternative Corridor 3a** starts at Verwoerdburg Substation and follows existing transmission lines towards the Apollo-Pluto lines south of the Verwoerdburg substation. This alternative forms a straight line from the substation towards the Apollo-Pluto lines west of the M57 Main Road.

### **Conclusions and Recommendations drawn from the Assessment of the proposed Kwagga substation expansion and new Phoebus Substation**

The majority of potential impacts identified to be associated with the construction and operation of the proposed substation are anticipated to be localised and restricted to the existing substation site footprint. No environmental fatal flaws were identified to be associated with the

site. This is largely due to the fact that the extension of the substation at this site is within the existing substation site footprint, which is already transformed as well as the fact that it would be associated with minimum disturbance to environment. For this reason, the majority of the specialists recommended that the proposed extension be implemented within this proposed development footprint.

Some areas requiring mitigation have been highlighted. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (EMP).

The majority of potential impacts identified to be associated with the construction and operation of the proposed substation are anticipated to be localised and restricted to the existing substation site footprint. No environmental fatal flaws were identified to be associated with the site. However some areas requiring mitigation have been highlighted. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (refer to Figures 3).

### **Conclusions and Recommendations drawn from the Assessment and Comparison of the Transmission Power Line Alternatives**

Nomination of a preferred alternative is based on the specialist

recommendations, public participation and the recommendations of the specialist workshop undertaken during the EIA Phase of the project.

From the conclusions of the specialist studies undertaken, the following has been recommended regarding the power line corridors investigated:

- » In terms of impacts on biodiversity, alternatives 1 and 2 are considered to be “**no go areas**” because of the ecological attributes and sensitivities along these corridors. For this reason, **alternative corridor 3 and 3a** are preferred with moderate to low ecological sensitivity.
- » In terms of avifauna, the first and most preferred alternative is **alternative 3**. This alternative follows existing power lines for the entire length and thus the impact on avifauna in terms of collisions, habitat destruction and disturbance will be significantly less. The next most preferred alternative is **alternative 3a**. While this alternative will have slightly higher impacts than alternative 3 these impacts are seen as insignificant and thus this alternative may also be used with minimal impact on avifauna. Alternatives 1 and 2 are not preferred due to the

sensitive habitats which are crossed by these corridors.

- » From a visual sensitivity analysis undertaken, the preferred alignment is **Alternative 3** based on total area of high visual impact and cumulative impact of existing power lines, although there are no fatal flaws eliminating the three (alternative 1, 2 and 3a) alternatives.
- » In terms of Agricultural Potential, in comparing the alternatives, the most suitable route would be either **Alternative 2** or **Alternative 3/3a**, where all of the soils are shallow and rocky, with a low agricultural potential. Alternative 1 is not preferred due to an area of higher potential in the vicinity of the river.
- » From a Heritage Impact assessment, no heritage resources were identified along alternative corridor 3 and 3a. Graveyards were identified to be located in the vicinity of Alternatives 1 and 2. Against this background, the preferred alternative **corridors are 3 and 3a**.

From the conclusions of the specialist workshop undertaken, it was concluded that Alternative corridor 1 and 2 are not recommended for development due to the unacceptably high impacts on the biophysical environment as well as

the impacts on the social environment. Therefore, development within these two corridors should be avoided. Alternative corridor 3 was nominated as the preferred alternative by the majority of the specialists. Impacts associated with Alternative 3a are not expected to differ significantly from those associated with Alternative 3. Therefore, this alternative is considered acceptable from an environmental perspective.

As Alternative 3a is shorter than Alternative 3 and would eliminate the need for a bend (and an associated self-supporting tower), this alternative is preferred from an economic and technical perspective. Therefore, from a holistic perspective (i.e. considering technical, ecological, social and economic criteria), **Alternative 3a** is nominated as the preferred alternative (refer to Figure 4).

It is considered vital that construction of the two turn-in power lines within this corridor take the recommended conditions identified by the specialist studies in to consideration. Should the project be authorised by DEA, the final routing of the turn-in power lines within the nominated preferred corridor should be undertaken in consultation with the affected landowners and the following specialists.

- » Biodiversity specialist
- » Avifauna specialist
- » Heritage specialist

In addition, once the final turn-in transmission power line alignment has been negotiated and the tower positions surveyed and pegged, a walk-through survey must be undertaken by the specialists in order to minimise potential environmental impacts associated with the proposed project.



**Figure 3:** Recommended site location for the proposed Verwoerdburg substation extension

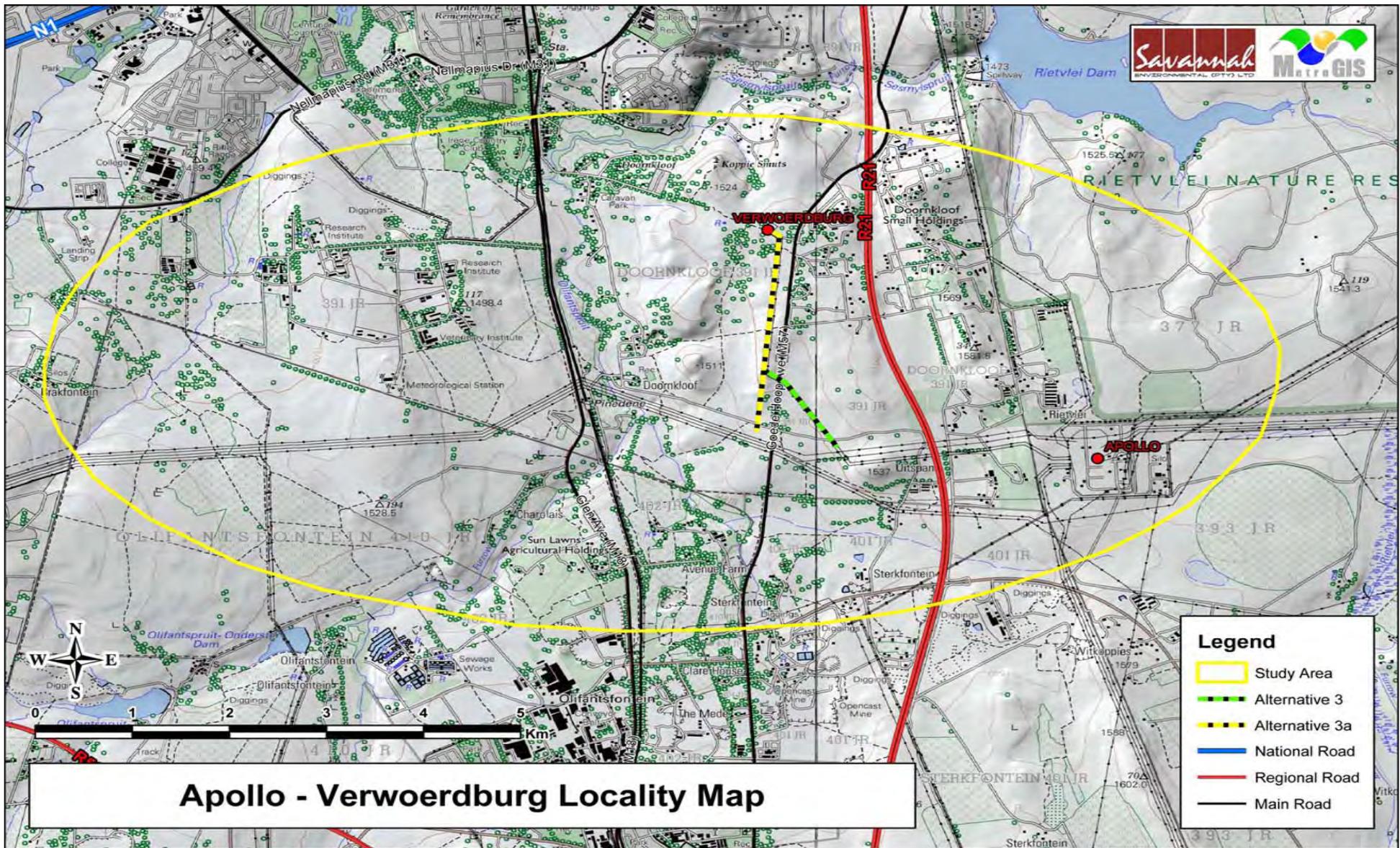


Figure 4: Nominated preferred alternative corridor for the proposed Apollo-Verwoerdburg turn-in power lines

## Overall Conclusion (Impact Statement)

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

- » Although some impacts of potential high significance are associated with the transmission lines and substation, there are no environmental fatal flaws that should prevent the proposed turn-in power lines and substation from being constructed on the proposed alignment and the proposed substation extension site respectively, provided that the recommended mitigation measures are implemented.
- » No issues of significance were identified to be associated with the proposed extension of the Verwoerdburg substation.
- » Alternative corridor 1 and 2 are not preferred from the conclusions of the majority of the specialists. This alternative corridor was only preferred from an agricultural potential perspective.
- » The majority of the specialists recommended that alternative 3 be nominated as the preferred alternative followed by alternative corridor 3a.
- » From a holistic perspective, **Alternative Corridor 3a** is nominated as the preferred corridor for the construction of

the proposed turn-in transmission power lines.

- » The significance levels of the majority of identified negative impacts can be mitigated and minimised by implementing the recommended mitigation measures

## Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the proposed substation extension, construction and operation of the turn-in transmission power lines, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Tshwane Strengthening Project Phase 1, Apollo-Verwoerdburg component (EIA Ref 12/12/20/1470) be authorised by DEA to include the following:

- » Extension/upgrade of the Verwoerdburg substation at proposed site north of the existing substation. Construction of 2X 400 kV turn-in transmission power lines looping in and out of the Apollo-Pluto transmission lines within **Alternative Corridor 3a**. Eskom must negotiate the most appropriate route within this corridor with the affected landowners.

The following conditions of this recommendation must be included within the authorisation issued:

- » All mitigation measures detailed within this report and the specialist report contained within Appendices F to K must be implemented.
- » The draft Environmental Management Plan (EMP) should form part of the contract with the Contractors appointed to construct and maintain the proposed Tshwane Strengthening Project Phase 1 (Apollo-Verwoerdburg component), and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
- » Applications for all other relevant and required permits required to be obtained by Eskom must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site and disturbance of protected vegetation.
- » A biodiversity specialist must conduct a final walkthrough before construction in order to identify and relocate any possible plant species of conservation importance.
- » During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
- » The EMP for construction must be updated to include site specific information and specifications resulting from the final walk-through surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction on site.
- » Utilisation of cross-rope suspension tower structures is recommended where possible rather than the conventional self-supporting strain towers that are more obstructive
- » Mitigation of the visual impact through conventional visual impact mitigation measures (i.e. vegetation screening, landscaping or design) is highly unlikely to succeed due to the inherent functional design of the substation structures and transmission line infrastructure. The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an on-going basis.
- » The process of communication and consultation with the community representatives must be maintained after the closure of this EIA process, and, in particular, during the construction phase associated with the proposed project.

Finally to ensure that social impacts are mitigated during construction and operation, it is recommended that the following:

- \* A Social Management Plan during construction and operation;
- \* A Local Labour and Workforce Plan;
- \* An Influx Management Plan;
- \* A Decommissioning and Closure Plan;
- \* A Grievances Mechanism for the construction and operational phases; and
- \* A Stakeholder Engagement and Education plan for construction and operation

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## **ABBREVIATIONS AND ACRONYMS**

APASA	Association of Professional Archaeologists of Southern Africa
ASGISA	Accelerated and Shared Growth Initiative of South Africa
BID	Background Information Document
CoT	City of Tshwane
DE	Department of Energy
DEA	National Department of Environmental Affairs
DEAT	National Department of Environmental Affairs and Tourism
DPW	Department of Public Works
DEIR	Draft Environmental Impact Report
DSM	Demand Side Management
DWA	Department of Water Affairs
DWEA	Department of Water and Environmental Affairs
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EWT	Endangered Wildlife Trust
GDARD	Gauteng Department of Agriculture and Rural Development
GDP	Gross Domestic Product
GG	Government Gazette
GGP	Gross Geographical Product
GN	Government Notice
GPS	Geographic Positioning System
I&AP	Interested and Affected Party
ICNIRP	International Commission for Non-Ionising Radiation Protection
IDP	Integrated Development Plan
ISEP	Integrated Strategic Electricity Planning
KLM	Kungwini Local Municipality
kV	Kilovolt
MW	Mega Watt
NEMA	National Environmental Management Act (No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (No 25 of 1999)
NWA	National Water Act (Act 36 of 1998)
OHS	Occupational Health and Safety
PSDF	Provincial Spatial Development Framework
SAHRA	South African Heritage Resources Agency
SACNASP	South African Council of Natural Scientific Professions
SDF	Spatial Development Framework
SEIA	Socio-economic Impact Assessment
SIA	Social Impact Assessment
SoE	State owned Enterprise

## DEFINITIONS AND TERMINOLOGY

**Alternatives:** Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

**Cumulative impacts:** Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

**Direct impacts:** Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

**Do nothing alternative:** The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

**Endangered species:** Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

**Environment:** the surroundings within which humans exist and that are made up of:

- i. the land, water and atmosphere of the earth;
- ii. micro-organisms, plant and animal life;
- iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and
- iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

**Environmental Impact:** An action or series of actions that have an effect on the environment.

**Environmental impact assessment:** Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

**Environmental management:** Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

**Environmental management plan:** An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

**Heritage:** That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

**Indirect impacts:** Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

**Interested and Affected Party:** Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

**Rare species:** Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

**Red data species:** Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered,

vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

**Significant impact:** An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

## INTRODUCTION

## CHAPTER 1

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In order to strengthen the existing Transmission network in the Tshwane Region, Eskom Transmission is currently proposing the construction of a 400kV looping/out of existing Apollo-Pluto transmission power line. In addition, increased demand for a reliable electricity supply in the Central Grid has necessitated that Eskom Transmission improves the reliability and capacity of the transmission network in the area. Further, upgrade of the 400/132kV Verwoerdburg substation and establishment of a new Phoebus substation is also being proposed in the area in order to improve the reliability and quality of supply problems in the Tshwane area. Eskom Transmission is therefore proposing the construction of the **Tshwane Strengthening Project Phase 1**. The Tshwane Strengthening Project Phase 1 comprises of the following:

- » **The extension and upgrade of the existing Verwoerdburg Substation.**
- » Construction of **2x 400kV loop-in lines from the existing Apollo–Pluto** transmission line which will feed into the Verwoerdburg Substation, a distance of approximately ~4 km.
- » Construction of the **new Phoebus Substation** adjacent to Hangklip Substation.
- » Construction of a **new 400kV transmission power line** between the Phoebus Substation and the Kwagga Substation, a distance of ~30 km.
- » Construction of 2 x 400 kV loop in/out of the Apollo-Dinaledi line into Phoebus substation.
- » **Associated (infrastructure) works** to integrate the new transmission power lines and substation into the Transmission grid (such as access roads, communication tower, etc) and accommodate the new lines at existing substations (such as the construction of new feeder bays within the existing substation sites).

In total, **approximately 36 km of new power line** is proposed as part of the entire Tshwane Strengthening project Phase 1. The purpose of this project is to:

- » Improve the reliability of the existing Central Transmission network.
- » Improve the voltage regulation on the Central Grid Distribution and City of Tshwane Metropolitan Municipality network.
- » Create additional Transmission network capacity which will supply the increasing electricity demand in the Central Grid.

As separate applications were submitted to DEA, separate reports have been compiled by Savannah Environmental as follows:

- » The **nature and extent of the proposed 2x 400kV loop-in lines from the existing Apollo–Pluto and the expansion and upgrade of the Verwoerdburg substation**, as well as potential environmental impacts associated with the construction, operation and decommissioning of this infrastructure are **assessed in this Draft EIA Report (Reference Number 12/12/20/1470)**.
- » The **nature and extent of the proposed 400kV transmission power line between the Kwagga and Phoebus Substations, the upgrade of the Kwagga Substation and construction of the Phoebus Substation**, as well as potential environmental impacts associated with the construction, operation and decommissioning of this infrastructure are **assessed in a separate Draft EIA Report (Reference Number 12/12/20/1471 and 12/12/20/1524)**.

This draft Environmental Impact Assessment Report consists of the following chapters:

- » **Chapter 1** provides background to the proposed Tshwane Strengthening project and the environmental impact assessment process
- » **Chapter 2** provides an overview of the proposed project
- » **Chapter 3** outlines the process which was followed during the EIA Phase of the EIA process
- » **Chapter 4** provides a description of the environment which may be potentially affected by the proposed Verwoerdburg substation expansion and the 2X400kV Apollo-Verwoerdburg turn-in power lines
- » **Chapter 5** provides an assessment of the potential issues associated with the proposed Verwoerdburg substation extension and the 2X400kV turn-in power lines and comparatively assesses the identified alternative corridors
- » **Chapter 6** presents the conclusions and recommendations of the EIA and an Impact Statement
- » **Chapter 7** presents the list of references and information sources used for the compilation of this DEIR

### 1.1. Background and Overview of the Proposed Project

Eskom Holdings Ltd (Eskom) is responsible for the provision of reliable and affordable power to its consumers in South Africa. Electricity by its nature cannot be readily or inexpensively stored and, therefore, must be used as it is generated. Electricity must, therefore, be efficiently transmitted from the point of generation to the end-user.

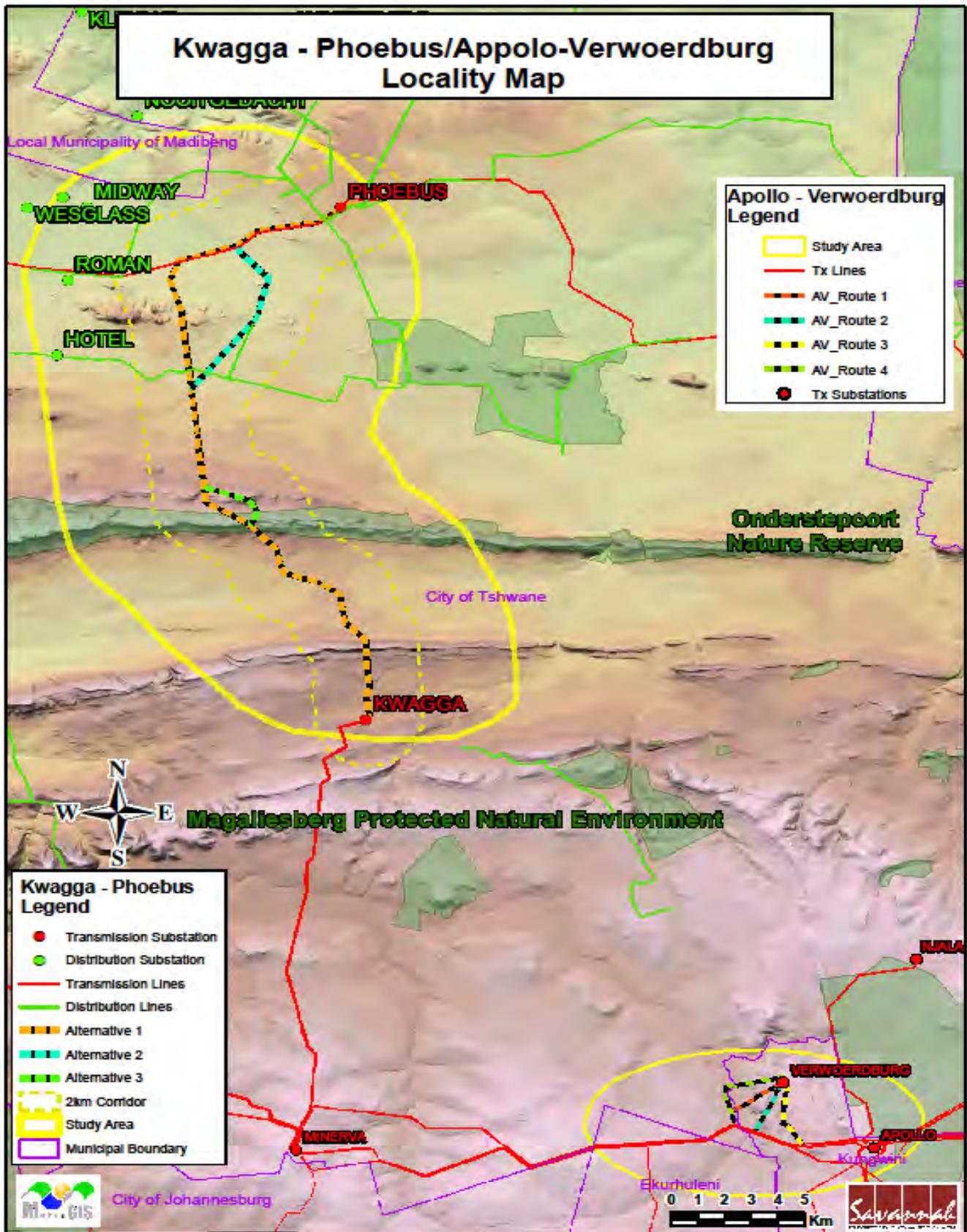
In South Africa, thousands of kilometres of high voltage transmission lines (i.e. 765kV or 400kV transmission lines) transmit this power, which is mainly generated at power stations in the Mpumalanga and Limpopo provinces, to

Eskom's transmission substations. At these transmission substations, the voltage is reduced and distributed to smaller distribution substation throughout the country through distribution lines (i.e. 132kV, 88kV or 66kV Distribution lines). Here the voltage is reduced and distributed to local substations, which distribute the power via various small lines (i.e. 22kV and 11kV lines) to local users. The power generated by Eskom can only be utilised from points of supply which transform power into usable voltage. However, transmission power lines and substations play a vital role in ensuring the provision of Distribution substations with sufficient power to be reticulated to the consumer.

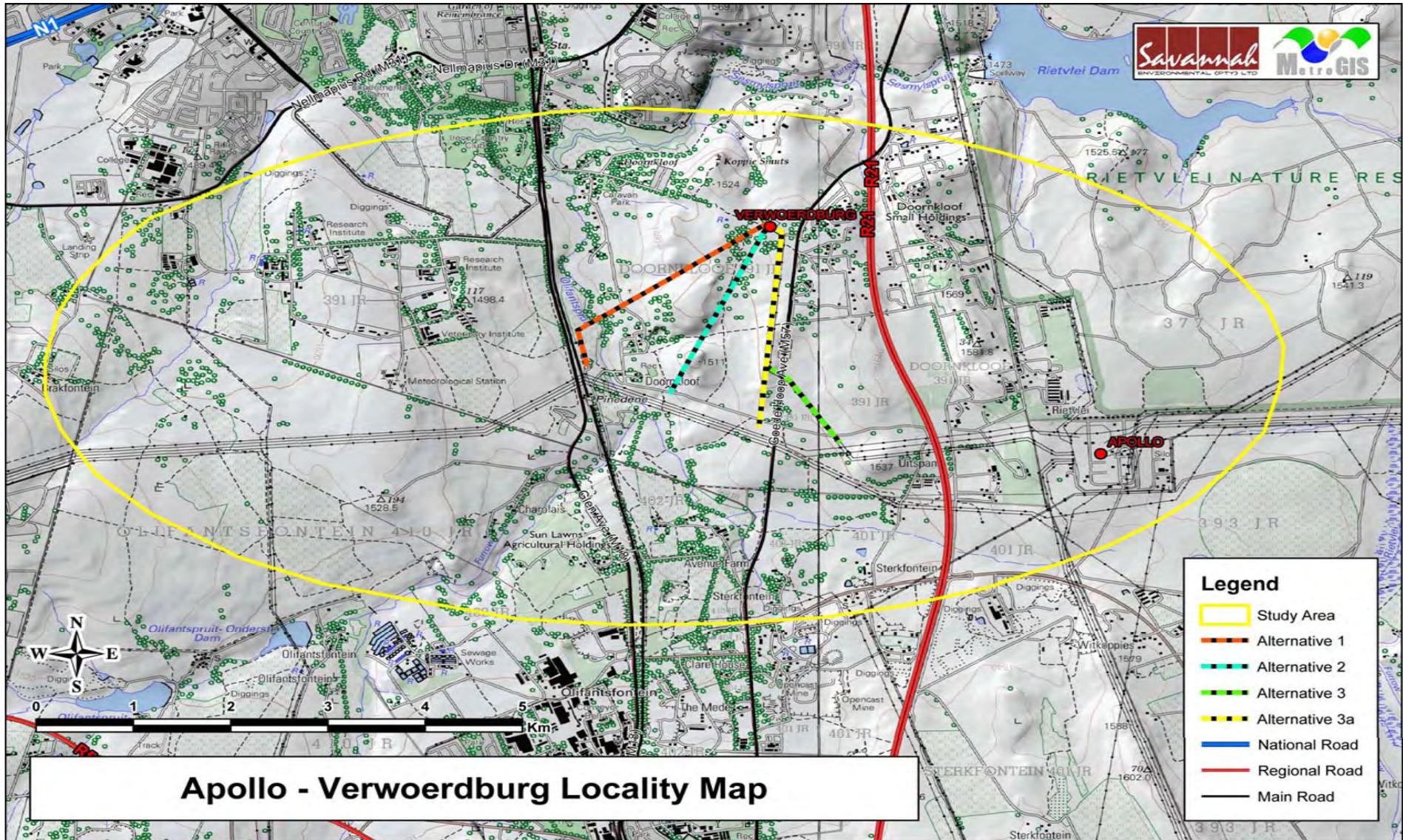
If Eskom is to meet its mandate and commitment to supply the increasing needs of end-users, the organisation is required to plan, establish and expand its infrastructure of generation capacity and transmission power lines on an on-going basis, in parallel to the expanding electricity generation process. It is vital that transmission capacity keeps up with both electricity generation capacity and electricity demand.

As part of its assessment of supply requirements, and as a result of the projected load growth of the Gauteng region, Eskom have determined that additional transmission capacity will be required in the Tshwane area by the year 2013. For this reason, Eskom Transmission is proposing the **Tshwane Strengthening Project**. Figure 1.1 and 1.2 provides an indication of the study area considered within the EIA process for this proposed project. This report focuses on the following components:

- » **The extension and upgrade of the existing Verwoerdburg Substation.**
- » Construction of **2x 400kV loop-in lines from the existing Apollo–Pluto** transmission line which will feed into the Verwoerdburg Substation, a distance of approximately ~4 km.



**Figure 1.1:** Locality Map showing the various components of the proposed Tshwane Strengthening Project Phase 1



**Figure 1.2:** Locality map showing the study area for the extension of Verwoerdbrug substation and two 400kV loop-in transmission power lines, as well as alternatives identified for consideration in the EIA process

## 1.2. The Purpose and Need for the Proposed Project

South Africa is an energy intensive country, largely as a result of an historic economic focus on energy intensive industries such as mining and primary metal processing. With current energy and electricity demands within the country projected to continue increasing, new investments in electricity generation and transmission capacity are required over the next few years.

The current Eskom transmission network supplies the City of Tshwane Metropolitan Municipality (CoT) via three substations, namely: Kwagga, Njala and Verwoerdburg. The contracted reserve capacity at each point is reviewed annually. CoT has applied for new supply points and a step load increase to Eskom Transmission and Distribution. The three parties (Distribution, Transmission and the City of Tshwane Metropolitan Municipality) agreed on the 20-year load forecast for the CoT and also concluded that the CoT and the Eskom transmission networks supplying Tshwane need to be strengthened. A number of options were analysed based on technical and economic benefits to all parties involved.

## 1.3. Requirement for an Environmental Impact Assessment Process

The proposed Tshwane Strengthening Project is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) published in terms of Section 24(5) of the National Environmental Management Act (NEMA, No 107 of 1998). This section provides a brief overview of EIA Regulations and their application to this project.

NEMA is national legislation that provides for the authorisation of certain controlled activities known as "listed activities". 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. The National Department of Environmental Affairs (DEA) is the competent authority for this project. Applications for authorisation have been accepted by DEA (under Application Reference numbers **12/12/20/1470** (Apollo-Verwoerdburg), **12/12/20/1471** (Kwagga – Phoebus 400kV power lines) and **12/12/20/1524** (Kwagga-Phoebus substations). Through the decision-making process, DEA will be supported by the Gauteng Department of Agriculture and Rural Development (GDARD)<sup>1</sup>.

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<sup>1</sup> Only one component of the project (Apollo-Verwoerdburg, 12/12/20/1470) is the subject of this report. The other components of the Tshwane Strengthening Project (12/12/20/1471 (Kwagga – Phoebus 400kV power lines) and 12/12/20/1524 (Kwagga-Phoebus substations)) are the subject of a separate report.

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the competent authority with sufficient information in order for an informed decision to be taken regarding the project.

In terms of sections 24 and 24D of NEMA, as read with Government Notices R385 (Regulations 27–36) and R387, a Scoping and EIA are required to be undertaken for this proposed project as it includes the following activities listed in terms of GN R386 and R387 (GG No 28753 of 21 April 2006):

<b>Number &amp; date of relevant notice</b>	<b>Activity No/s (in terms of relevant Regulation or notice)</b>	<b>Description of listed activity</b>
Government Notice R387 (21 April 2006)	1(l)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the transmission and distribution of above ground electricity with a capacity of 120 kV or more.
Government Notice R386 (21 April 2006)	1(c)	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of 1000 cubic metres or more at any other location or site including the storage of one or more dangerous goods, in a tank farm
Government Notice R386 (21 April 2006)	14	The construction of masts of any material of type and of any height, including those used for telecommunications broadcasting and radio transmission, but excluding: <ul style="list-style-type: none"> <li>(a) masts of 15 m and lower exclusively used by                             <ul style="list-style-type: none"> <li>(i) radio amateurs; or</li> <li>(ii) for lightening purposes</li> </ul> </li> <li>(b) flagpoles; and</li> <li>(c) lightening conductor poles</li> </ul>
Government Notice R386 (21 April 2006)	15	The construction of a road that is wider than 4 m or that has a reserve wider than 6 m, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 m long.

This report documents the assessment of the potential environmental impacts of the proposed construction, operation and decommissioning of the proposed Verrwoerdburg substation extension and associated turn-in transmission power lines. This EIA Phase followed the Scoping Phase, and was conducted in accordance with the requirements of the EIA Regulations in terms of Section

24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

#### **1.4. Eskom's Planning Process and the Role of the Environmental Impact Assessment Process**

Eskom Transmission's planning process is required to be based on anticipated load requirements, rather than immediate load requirements in order to timeously supply the anticipated increased demand in the country. This is due to the time-consuming process of acquiring the necessary permissions to construct such infrastructure from DEA and the National Energy Regulator of South Africa (NERSA), servitude negotiations with landowners, as well as transmission power line design and construction. Although, the regulatory processes are time consuming, this is necessary for the project.

Technically feasible transmission power line alignment corridors were identified and investigation within the EIA process. Through the EIA process, preferred alternative transmission power line alignments will be nominated. Should the project be authorised by the National Department of Environmental Affairs (DEA), Eskom will then enter into a servitude negotiation process with each affected landowner. The process of negotiating a servitude is independent of the EIA process, and will be undertaken directly by Eskom Transmission.

While there should be reasonable confidence in the environmental acceptability of the preferred corridor nominated (generally a corridor of 2 km in width), certain criteria identified during the land negotiation process and the final placement of towers may require minor alterations to the power line alignment within the corridor which receives environmental authorisation. These may include:

- » Identification of a technical problem during the detailed design phase which will require excessive cost to resolve (e.g. unstable subsurface conditions identified by detailed geotechnical investigations).
- » Request by a landowner during the course of the negotiation process that the alignment be shifted to avoid disruption of a particular activity on his property, but provide a feasible and reasonable new alignment.

Provided such potential deviations to the power line alignment are within the corridor authorised and are not unreasonable, it is fair for Eskom Transmission to investigate and negotiate local adjustments. This may be required at a number of points along the alignment.

## **1.5. Objectives of the Environmental Impact Assessment Process**

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the potentially feasible alternatives and extent of the studies required within the EIA Phase. This was achieved through a desk-top evaluation of the proposed project using existing information, involving the project proponent, specialists with experience in undertaking EIAs for similar projects, and a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

The EIA assesses those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction, operation and decommissioning, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The Draft EIA Report includes a draft Environmental Management Plan (EMP), which details environmental specifications required to be implemented to reduce environmental impacts associated with the proposed project. Should the project be authorised, this EMP will be finalised and will form part of the Contract documentation for construction and operation of the substation and power lines.

The release of a draft EIA Report (including the draft EMP) provides stakeholders with an opportunity to verify that the issues that they have raised through the EIA process have been captured and adequately considered. The final EIA Report will incorporate all issues and responses raised during the public review of the draft EIA report prior to submission to DEA.

## **1.6. Details of Environmental Assessment Practitioner and Expertise to conduct the Scoping and EIA**

Savannah Environmental was contracted by Eskom Transmission as an independent environmental assessment practitioner to undertake an Environmental Impact Assessment (EIA) for the proposed project, as required by the NEMA EIA Regulations. Neither Savannah Environmental, nor any of its specialist sub-consultants on this project are subsidiaries of or affiliated to Eskom Holdings Limited. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing a holistic environmental management service, including environmental assessment and planning to ensure compliance and evaluate the risk of

development; and the development and implementation of environmental management tools.

The Savannah Environmental team has considerable experience in environmental assessment and environmental management, and has been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa. Strong competencies have been developed in project management of environmental EIA processes, as well as strategic environmental assessment and compliance advice, and the identification of environmental management solutions and mitigation/risk minimising measures.

Savannah Environmental has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation and transmission projects through their involvement in related EIA processes. They have successfully managed and undertaken EIA processes for other power transmission projects for Eskom Holdings Limited throughout South Africa. Curricula vitae for the Savannah Environmental project team consultants are included in Appendix A.

In order to adequately identify and assess potential environmental impacts, Savannah Environmental has appointed several specialist consultants to conduct specialist studies, as required. Details of these specialist studies are included in Chapter 3. The curricula vitae for the EIA specialist consultants are also included in Appendix A.

## DESCRIPTION OF THE PROPOSED PROJECT

## CHAPTER 2

Electricity cannot be stored and must therefore be generated and delivered over long distances at the very instant it is needed. In South Africa, thousands of kilometres of high voltage transmission power lines transmit power, mainly from the power stations located in the Mpumalanga coal fields to major substations, where the voltage is reduced for distribution to industry, businesses, homes and farms all over the country.

If Eskom Transmission is to honour its mandate and commitment to meet the increasing needs of end-users, it has to establish and expand its infrastructure of transmission power lines and substations on an ongoing basis. Due to substantial annual load growth, load shifts and step loads in the recent past, it has become necessary to reinforce the existing electrical infrastructure through the establishment of new electricity generation and transmission capacity.

Eskom is the primary supplier of electricity in South Africa and supplies power in bulk to most towns and cities, the municipalities of which sell it to households, industrialists and other end-users within their areas of jurisdiction. Eskom also sells bulk electricity directly to end-users in some parts of South Africa. Eskom has a mandate to satisfy potential customer needs, which implies certain responsibilities. One of the most significant of these is to find and maintain the balance between satisfying the needs of society and remaining within the capabilities of the environment. In order to achieve this Eskom must continually re-assess the projected demand for electricity<sup>2</sup> in relation to its present infrastructure, and take into account new developments to ensure that there is a continued supply of electricity, without significantly impacting on the environment.

As part of its capacity expansion and grid strengthening programme, Eskom Transmission is proposing the **Tshwane Strengthening Project Phase 1**. The Tshwane Strengthening Project Phase 1 is proposed to include the following:

- » Extension of the existing Verwoerdburg (Rietvlei) Substation.
- » Construction of 2x 400kV loop-in lines from Apollo – Pluto transmission lines to feed into the Verwoerdburg (Rietvlei) Substation, a distance of approximately 4 km.
- » Construction of 400kV loop-in lines to feed into the Phoebus Substation from the existing Apollo-Dinaledi transmission power line, a distance of approximately 1 km.

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<sup>2</sup> This is undertaken through the Integrated Strategic Electricity Planning (ISEP) process

- » Construction of a new 400kV transmission power line between the proposed Phoebus Substation and the Kwagga Substation, a distance of ~30 km.
- » Expansion of the existing Kwagga Substation.
- » Establishment of the new Phoebus substation adjacent to existing Hangklip substation

In total, approximately 36 km of new power line is proposed as part of the Tshwane Strengthening project Phase 1.

## 2.1. The Need and Justification for the Proposed Project

The following provides a brief description of the need and desirability of the project from the proponent's perspective.

### **2.1.1. The Need for Additional Transmission Capacity in the Tshwane Area**

Hundreds of kilometres of transmission power lines feed electricity from power stations in the Mpumalanga and Limpopo Provinces to transmission substations across the country. The existing transmission power lines and substations within Gauteng are becoming heavily loaded and are predicted to reach their full capacity in the near future (approximately 20 years). Through technical investigations undertaken by Eskom, it has been concluded that the current transmission power line and substation infrastructure cannot supply the increased demand in the Gauteng North area. It is becoming increasingly difficult for Eskom Transmission to meet its mandate of supplying electricity to the area during a contingency situation which involves the loss of one power line, as the remaining power lines have to carry the entire load. This makes it difficult to carry out routine maintenance, resulting in the potential deterioration of operating lines and poor line performance (including faults, etc). This can be largely attributed to development growth in the area, hence an increased demand for power.

A twenty-year electricity demand forecast is produced by Eskom Transmission annually. In this forecast, inputs from customers and various governmental and commercial associations regarding load growth are taken into account. Due to economic growth and the government's policy, "*Accelerated and Shared Growth Initiative for South Africa*" (ASGISA), it was calculated that the load for the country will grow at an aggregated value of 4% per annum from the current load of 34 807 MW in 2007 to approximately 93 776 GW in 2030.

Studies undertaken by Eskom have shown a steady 3% per annum average load growth for the area fed from Verwoerdburg, Wildebeest and Apollo substations, the main bulk supply substations to the Tshwane Region. This is due to light

industrialisation, commercialisation, urban growth and electrification within this area. It is also a sign of good economic growth in this area. The load forecasters within Eskom predict that this load growth will continue into the future, which will result in the need for additional power by the year 2013. The load demand mentioned here is subject to change as the prevailing economic climate changes and as other Eskom initiatives to conserve energy are widely adopted. The various developments are being monitored, and their effect will be incorporated in future plans. The expected load in the Pretoria area is shown in Table 2.1 below.

**Table 2.1:** Projected/Expected electricity loads in the Pretoria area up to 2018 (source: Eskom Transmission Ten Year Plan, 2009-2018)

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Projected Load (MW)</b>	2171	2264	2354	2443	2570	2655	2736	2815	2931	3004	3074

### ***2.1.2. The Need to Optimise the Electrical Transmission System in the Tshwane Area***

From Section 2.1.1 above it is clear that a fault on any of the power lines supplying the Tshwane Region could have a detrimental effect on supply to customers within this area once new customer/s are supplied from the existing network. Eskom Transmission has already implemented measures to optimise the existing Transmission system within the Tshwane Region such that the construction of new power lines to supply this area will occur only when needed. These measures include:

- » Comprehensive checks on the existing lines to ensure that they are within the legal clearance for overhead lines. Lines sag when placed under heavy load conditions, due to heating of the conductors.
- » Installation of line monitoring devices that measures the atmospheric conditions prevailing. This allows Eskom Transmission to determine whether the lines can cope with more loading (e.g. on a cold day the line can be loaded to more than usual levels since the lines cool down and they do not sag as much as on hot days).
- » Installation of new infrastructure
- » Demand side management
- » Selection of the most appropriate reinforcement options in order to ensure that an optimised mix of cost, technical benefit and environmental impact was achieved.
- » Energy Efficiency initiatives

As all options for optimisation of the existing infrastructure in the Tshwane area have already been studied and implemented, new transmission power lines will be required to be constructed in order to meet the predicted load requirements. The new transmission lines will be required to be brought into operation at the time when the load growth and demand exceeds the supply, i.e. by 2012. It is therefore necessary to secure the required servitudes timeously, to ensure this will be possible.

A definite two-fold need for new transmission power lines has therefore been identified:

- » To optimise the existing system; and
- » To increase line capacity in the Transmission system.

By increasing the supply into the Transmission system, the forecasted load growth can be addressed in a suitable and economical way. Optimisation of the current system is currently underway, and would alleviate some problems in the system. The short- to medium-term load requirements can be addressed by the increased supply through the construction of new transmission power lines. In addition the extension and upgrade of the existing substations will improve the supply to the area.

## **2.2. Alternatives for Satisfying the Additional Electricity Supply Need within the Tshwane Area**

Electrical supply constitutes a complex system of generation facilities, substations, and transmission and distribution power lines. The system operates on a demand-supply structure with the power being generated and transmitted at the moment it is needed.

The forecast growth in demand in the Tshwane region over the next few years (25-30 years), however, urgently requires Eskom Transmission to take timeous action to ensure supply reaches the end-users. It is therefore necessary to ensure extra supply capacity into the Tshwane area. There is a definite need to overcome the future overloading problems on the existing transmission lines and substations.

The ideal solution should be to:

- » meet the projected demand
- » optimise existing infrastructure
- » minimise cost
- » minimise any adverse environmental impacts.

The following alternatives for satisfying the two-fold need for additional electrical supply to the region and optimising the existing infrastructure were investigated by Eskom Transmission.

### ***2.2.1. The “Do Nothing” Option***

The ‘do nothing’ alternative is the option of not extending the existing Verwoerdburg substation as well as not constructing any new transmission power lines looping in from the Apollo-Pluto power lines. By not taking any action, Eskom Transmission may end with a situation of not being able to ensure firm supply into some parts of the country and the Tshwane area in particular, in the very near future (i.e. by 2012). This would eventually lead to load shedding which can cause major disruptions of power supply to different areas at different times. This will have a significant impact on the economy of the Tshwane region, as no real economic growth would be able to take place without additional electricity supply. Therefore, without the implementation of this proposed project, there will be significant impacts on the reliability and stability of electricity supply to the Tshwane region. This option is therefore discarded as a feasible alternative as it would neither supply the projected demand for electricity nor optimise the existing infrastructure.

### ***2.2.2. Demand Side Management***

Demand Side Management (DSM) can generally be defined as the activities performed by the electricity supply utility, which are designed to produce the desired changes in the load shape through influencing customer usage of electricity and to reduce overall demand by more efficient use. These efforts are intended to produce a flat load duration curve to ensure the most efficient use of installed generation capacity.

By reducing peak demand and shifting load from high load to low load periods, reductions in capital expenditure (for network capacity expansion) and operating costs can be achieved. Some of the basic tools are the price signals (such as time of use tariffs) given by the utility and direct load management. This option is practised to a certain extent, but is currently not considered feasible for expansion in this particular region. This is so because there will be large step loads in the Tshwane area in the 20-25 years horizon. As part of a long-term plan, Eskom is planning to deload Apollo and Minerva substation as part of additional supply to Pelly. As part of the strengthening of the Tshwane region, Eskom is also planning refurbishment of Lomond substation.

Eskom Transmission is currently investigating various means to achieve a flatter load profile in this area such as building new electricity infrastructure, expansion and upgrade of existing substation infrastructure. However, the large

concentration of industrial and commercial users in this area makes this a very difficult option to pursue. This option is therefore not considered to be feasible to meet the long-term power demands associated with the expansions in the Pretoria area.

### **2.2.3. New Generation Systems**

The option of a new coal-fired, gas, renewable or nuclear generation plant being commissioned near to the load centre could be considered. This may have a more negative overall impact on the environment due to the land requirements, fuel resources, etc., and would take at least five years to implement and would not address the foreseen supply demand in the short-term. In addition, the cost of such an option will be extremely high compared to the cost of transmission power lines and could prove to be non-feasible from an economic perspective. Transmitting power via overhead transmission power lines is currently considered to be the most economical and environmentally acceptable way to supply bulk electricity.

The use of other types of generation such as wind and solar energy were suggested by some I&APs within the public participation process. However, the high cost and low output of such systems does not make these economically feasible for the supply of base load electricity supply<sup>3</sup> to the Tshwane area.

Therefore, this option is not considered feasible to address the need in the Tshwane area and was not investigated further within this EIA process.

### **2.2.4. Upgrade Existing Transmission Power Lines by using Bigger Conductors**

The upgrade of existing transmission lines in the area by using bigger conductors would require these existing power lines to be permanently off while being upgraded to thicker conductors. This would put the existing and future load at risk should the remaining lines in the area trip. The upgrade option would result in the physical load on the existing towers increasing substantially, resulting in sagging of the conductors. The existing towers would be inadequate to support this physical load. Therefore, to mitigate against sagging, additional towers would be required to be constructed within the existing servitudes being upgraded. Furthermore, it would not be possible to remove one transmission power line from service to perform the upgrading work, as the remaining supply lines would not be able to supply the electrical loads in the Transmission system. The power transmission from the Apollo substation would not be able to be evacuated to the

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<sup>3</sup> "Base load electricity generating capacity" refers to power station technology designed specifically to generate electricity continuously for all hours of the day and night. Wind and solar power does not provide base load electricity

load centres without causing dynamic instability in the Eskom network which could result in black-outs. This option would not improve the reliability of the Transmission system nor be sustainable and is therefore not considered to be a feasible alternative.

***2.2.5. Extension of the Verwoerdburg (Rietvlei) Substation and construction of 2X 400kV Loop-In Transmission power line between into Apollo-Pluto from Verwoerdburg Substation***

The alternative is part of the new generation and transmission capacity alternatives. The need for increased capacity and the need for optimising existing infrastructure would be met through the implementation of this option.

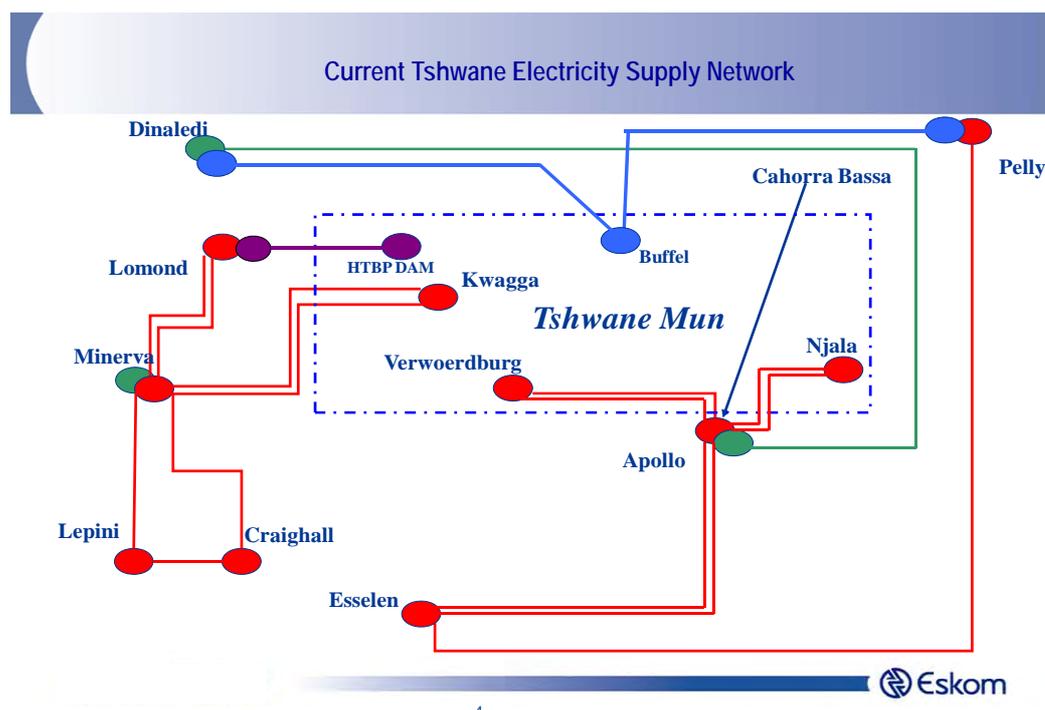
Due to current land use and development in the country, very limited open corridors remain that could be utilised to install major transmission power lines. New routes must, however be secured to ensure servitudes for the expansion of the network and to be able to meet the forecast increase in demand. Therefore, Eskom Transmission is proposing the extension of the existing Verwoerdburg 400/132kV substation and Verwoerdburg-Apollo, 2X 400kV loop-in and out of the existing Apollo-Pluto 400kV transmission power lines at Verwoerdburg Substation in order to strengthen the transmission network.

The advantages associated with this option include:

- » It overcomes the line overloading problems.
- » It will create a more flexible network, since it forms an interconnection between the loads fed from Apollo substation and the proposed new Phoebus substation<sup>4</sup>. This will improve the overall reliability of the Transmission system, which will be of benefit to both Eskom and to all electricity users within the area.
- » It will improve the angular stability of the Tshwane generation pool.
- » Compared to the other options considered, this option proves to be more economical.
- » It improves the reliability of supply to the Tshwane Customer Load network. This network presently feeds the City of Tshwane customers, affecting the livelihoods of the people and the economy of the area (refer to Figure 2.1).

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<sup>4</sup> This proposed development is a subject of separate report assessing Kwagga-Phoebus substations and Kwagga-Phoebus power lines (EIA Reference Nos 12/12/20/1524 and 12/12/20/1471).



**Figure 2.1:** Current Tshwane Electricity Supply network (Eskom Planning, 2009)

Due to current land use and development in the Irene, Doornkloof East area, very little open space remains that could be utilised to install major transmission power lines with a servitude of 110 m (i.e. two 400 kV lines in parallel). New routes must however be secured to ensure servitudes for the expansion of the network and to be able to meet the forecast increase in demand.

This is the option most favoured by Eskom Transmission as well as the City of Tshwane Electricity Department as it is considered to be the most feasible from a technical and economic perspective, and will meet the required need for increased capacity and the need for optimising existing infrastructure in the short- and long-term. This option is therefore nominated as the preferred option by Eskom Transmission to supplement the power supply to the Tshwane area.

### 2.3. Proposed Strategy for Satisfying the Additional Electricity Supply Need within the City of Tshwane Metropolitan Municipal Area

From the analysis of the various alternatives to satisfy the need for additional power transmission capacity, Eskom Transmission determined that the extension and upgrade of the existing Verwoerdburg (Rietvlei) substation and construction of 400kV loop-in transmission power lines as part of the Tshwane Strengthening Project Phase 1 was the most feasible and cost-effective solution in order to meet

the CoT electricity requirement (refer to 2.1.2 above)<sup>5</sup>. This solution will also de-load the heavily loaded Minerva- and Apollo substations. The proposed project involves the following:

- » Extension of the **Verwoerdburg substation**
- » Construction of **2x 400kV turn in & out** power lines from Apollo-Pluto into Apollo-Verwoerdburg (i.e. two 400kV lines in parallel).
- » **Associated Infrastructure works** to integrate the new transmission lines into the Transmission grid (such as access roads, bus bar, etc).

The installation of the two 400kV loop-in transmission power lines and expansion of the Verwoerdburg substation would offer the following benefits to Eskom Transmission and its customers in the Tshwane Region in the medium- to long-term:

- » Increased electricity supply to the region.
- » The proposed power lines and substation expansion will improve the electrical system performance in the region.
- » The proposed substation expansion and power lines will ensure the capacity of Eskom Transmission to supply the forecasted increase in electricity demand in the region.
- » It will alleviate the current supply constraints in the Eskom and City of Tshwane Power network.

Eskom Transmission is aware that it is thus of paramount importance that the required servitudes be obtained, to ensure an acceptable quality of electrical supply to the region. Overhead lines have been proposed over underground cables as the disadvantages of underground cables outweigh that of overhead lines.

- » Underground cabling is more expensive, since the cost of burying cables at transmission voltages is several times greater than overhead power lines.
- » Whereas finding and repairing overhead wire breaks can be accomplished in hours, underground repairs can take days or weeks, and for this reason redundant lines are run.
- » Operations are more difficult since the high reactive power of underground cables produces large charging currents and so makes voltage control more difficult.
- » Cables could take up a larger land footprint as compared to overhead lines. This is due to cables being required to be in trenches from the source of supply to the load. As a result, the land above the cable cannot be utilised for

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<sup>5</sup> Subject of a separate report investigating the other two components of the Tshwane Strengthening project Phase 1 (Savannah Environmental, 2010)

private purposes. The land footprint of overhead power lines is much less due to the land only being required to construct the towers approximately every 200 m.

- » The environmental impacts associated with underground cabling are considered to be significantly higher than that associated with overhead lines as trenches are required to be excavated for long distances resulting in severe damage to habitats and surrounding areas.

## 2.4. Verwoerdburg Substation Site

### 2.4.1. Identification of Substation Site

The expansion of the Verwoerdburg substation was identified by Eskom for investigation within a broader study area (refer to Figure 2.2) based on technical criteria. Therefore, land adjacent to and north-west of the existing substation was considered to be the most suitable from a technical perspective and was provided to the EIA team for further investigation through the EIA process. There were no alternative sites identified and investigated for the substation expansion because the proposal is for the expansion of existing infrastructure. The criteria used in selecting the land north-west of the existing substation include, amongst others:

- » access during construction and operation,
- » avoidance of environmentally sensitive features/areas, and
- » Land earmarked for substation expansion is owned by Eskom.

The area under investigation is already characterised by infrastructure of a similar nature, i.e. the existing Verwoerdburg substation and Apollo-Pluto power lines. It is therefore, at this stage, not foreseen that additions to the Verwoerdburg substation would yield significant negative impacts to the surrounding environment. Since the substation is an existing facility, there was no need to identify alternative sites other than the one earmarked for the proposed extension. Potential impacts are assessed in detail within Chapters 5 and 6 of this report.

### 2.4.2. Construction Process for the Substation

The proposed substation extension is proposed to be constructed in the following simplified sequence, and will take approximately 10 months to complete:

- Step 1:** Survey of the substation site (including a final survey by environmental specialists and the compilation of a site-specific Environmental Management Plan (EMP))

- Step 2:** Site clearing and levelling and construction of access road to substation site (if required)
- Step 3:** Construction of terrace and substation foundation, including the installation of stormwater drainage on the surface to dispose of such stormwater on the terrace
- Step 4:** Assembly, erection and installation of equipment (including transformers and control building)
- Step 5:** Connection of conductors to substation infrastructure
- Step 6:** Rehabilitation of any disturbed areas and protection of erosion sensitive areas.

Extension of the existing fences will be installed to secure the substation and the substation site. These fences include a 2.4 m high security fence to enclose all assets, a 1.8 m high fence around the yards, and a 1.2 m high boundary fence on the property-line (refer to Photograph 2.1 and 2.2).

Construction crews for construction of the substation will constitute mainly skilled and semi-skilled workers. No construction workers will reside on site. It is most likely that construction workers will be accommodated within formal housing within towns surrounding the study area.



**Photograph 2.2:** showing infrastructure development for a typical substation site

## Substation Construction



**Photograph 2.1:** showing earthworks for a substation site



**Figure 2.2:** Google Image showing the proposed Verwoerdburg substation extension identified for investigation in the EIA process



**Photograph 2.3:** View of the existing Verwoerdburg substation and Apollo-Pluto power lines (looking north from the M57)

#### ***2.4.4. Technical Details of the Proposed Substation***

» *Substation Design:*

Depending on the final design of the proposed extension to the Verwoerdburg substation, a total area of 300 m<sup>2</sup> will be required for the extension of the substation. The equipment will be designed according to Eskom specifications. The maximum height of the substation development will be 25 m.



**Photograph 2.4:** View of the gravel access road to Verwoerdburg substation from the south

## 2.5. Alternative Transmission Power Line Corridors

### ***2.5.1. Identification of Alternative Transmission Power Line Corridors***

The extent of the study area and the selection of corridors within the study area gave consideration to such aspects as ecological impacts, social impacts, visual impacts, heritage impacts, technical feasibility and cost. Technically viable, environmentally sound and cost effective corridors were identified by Eskom Transmission and Savannah Environmental EIA team for the proposed Apollo-Verwoerdburg turn-in power lines. These corridors are 2km wide.

The following technical requirements have been considered in the identification of feasible corridors for the establishment of the required transmission power lines:

- » As far as possible, the servitude lengths between supply points should be minimised.
- » As far as possible, the number and magnitude of angles along the power line should be minimised in order to allow the use of less expensive and visually intrusive tower types.
- » As far as possible, the proposed new 400kV transmission power line should be constructed in parallel with existing linear infrastructure. This will assist to minimise the physical impact on individual properties and/or activities on these properties along the proposed route.
- » Crossing over of existing major power lines should be avoided as far as possible, as this increases the potential for technical incidents during operation.
- » The alignment should cater for known topographical/terrain constraints of the tower types to be used, as well as soil conditions for the foundations in terms of geotechnical suitability and costs.
- » The proposed alignment should provide for the need of appropriate access roads to the servitude and tower positions for the both construction and maintenance/operation phases.
- » The following obvious and observable environmental issues should be taken into account:
  - o human settlements and communities
  - o land use (where possible)
  - o passing between water bodies (bird flight paths usually extend between water bodies)
  - o ecologically sensitive areas
  - o scenic areas with high visual/aesthetic quality
  - o untransformed indigenous vegetation.

**Two transmission line corridors** in order to loop the Apollo-Pluto power line into and out of the Verwoerdburg substation (refer to Figure 2.3). Subsequent to the scoping evaluation and the specialist workshop, the specialist team, the I&APs and stakeholders suggested that additional alternative corridors following the existing Apollo-Pluto power lines along the M57 main road should also be investigated in the EIA phase (Savannah Environmental, 2009). Therefore, Alternatives 1, 2, 3 have been investigated in detail in this EIA Report (refer to Figure 2.4). An additional alternative was added subsequent to the specialist workshop. A comparative assessment of the potential environmental impacts associated with these alternative power line corridors is presented within Chapter 6 of this report.

### ***2.5.2. Description of Alternative Power Line Development Corridors Considered in the EIA Phase of the EIA Process***

**Alternative Corridor 1** starts at Verwoerdburg Substation and runs south-west for approximately 2 km to Glen Avenue road. It turns south from here and joins into the existing Apollo-Pluto lines. The corridor crosses some open grassland and a small stream.

**Alternative Corridor 2** starts at Verwoerdburg Substation and runs south-south west for approximately 2.3 km in a straight line before joining into the existing Apollo-Pluto lines. This corridor crosses some open grassland and a small koppie.

**Alternative Corridor 3** starts at Verwoerdburg Substation and follows existing transmission lines for the entire length. It follows the road for the majority of the route. Alternative 3 does not cross any streams or koppies.

**Alternative Corridor 3a** starts at Verwoerdburg Substation and follows existing transmission lines towards the Apollo-Pluto lines south of the Verwoerdburg substation. This alternative forms a straight line from the substation towards the Apollo-Pluto lines west of the M57 Main Road.

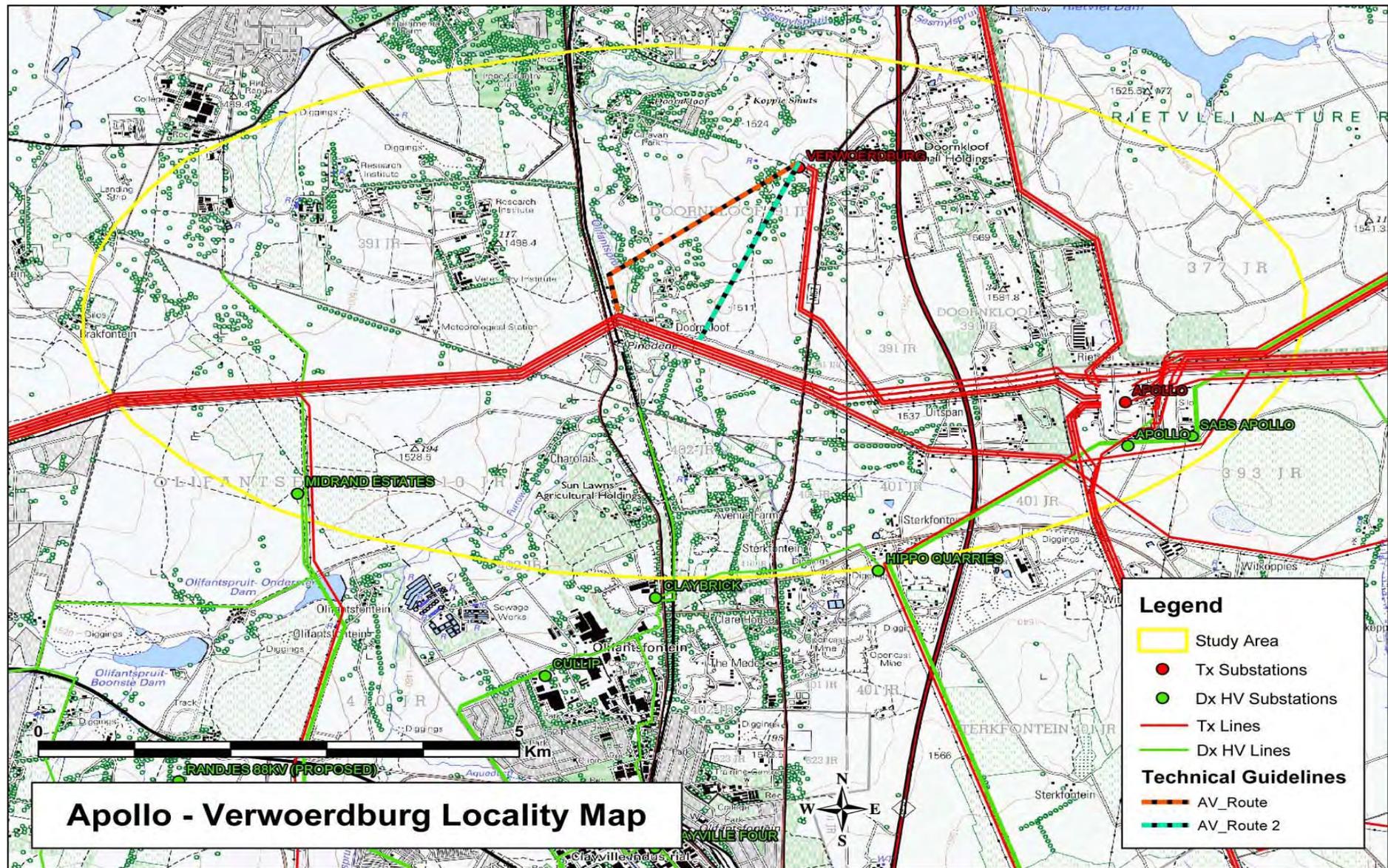


Figure 2.3: Map showing the alternative power line corridors identified by Eskom for investigation during scoping phase of the EIA process

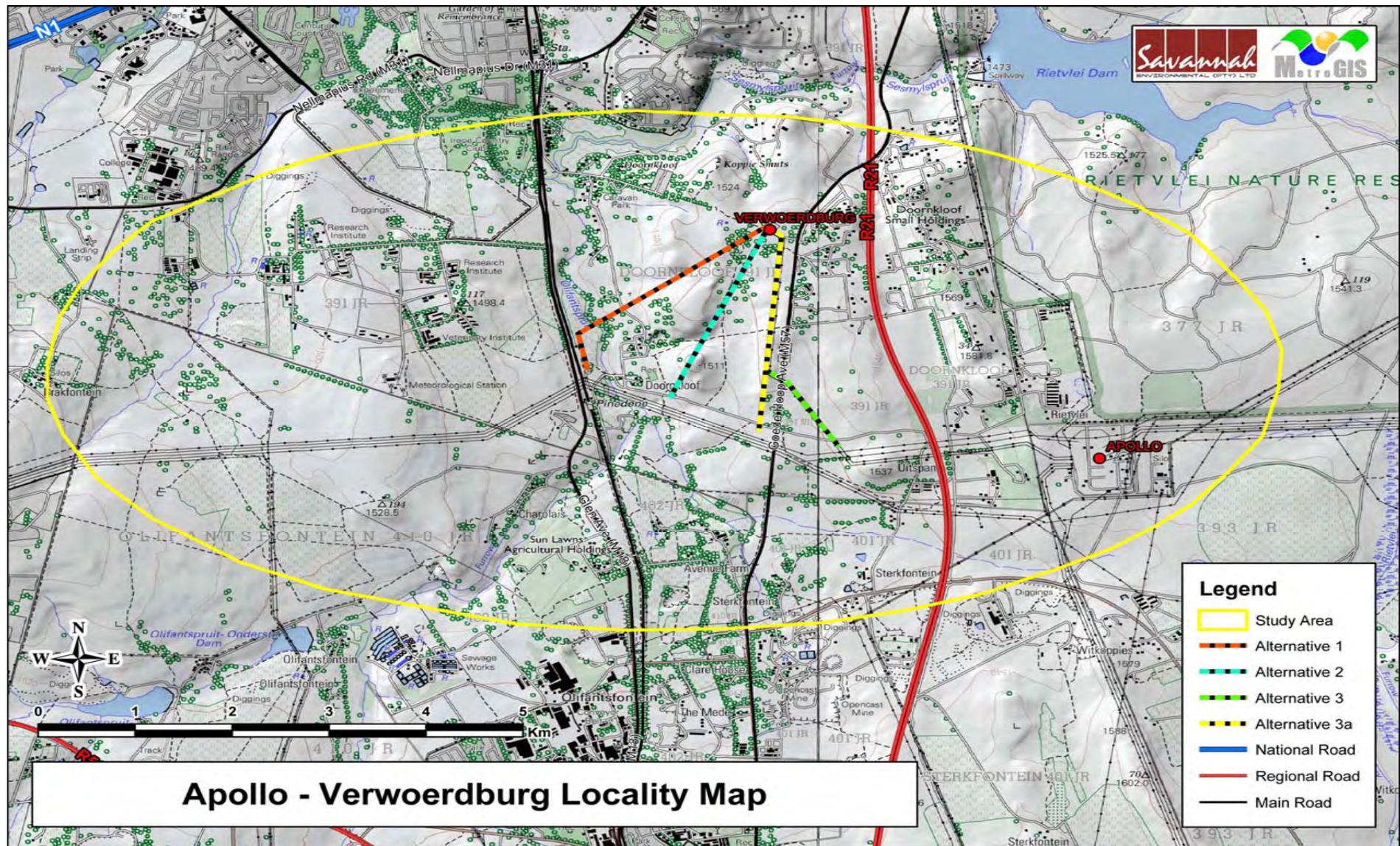
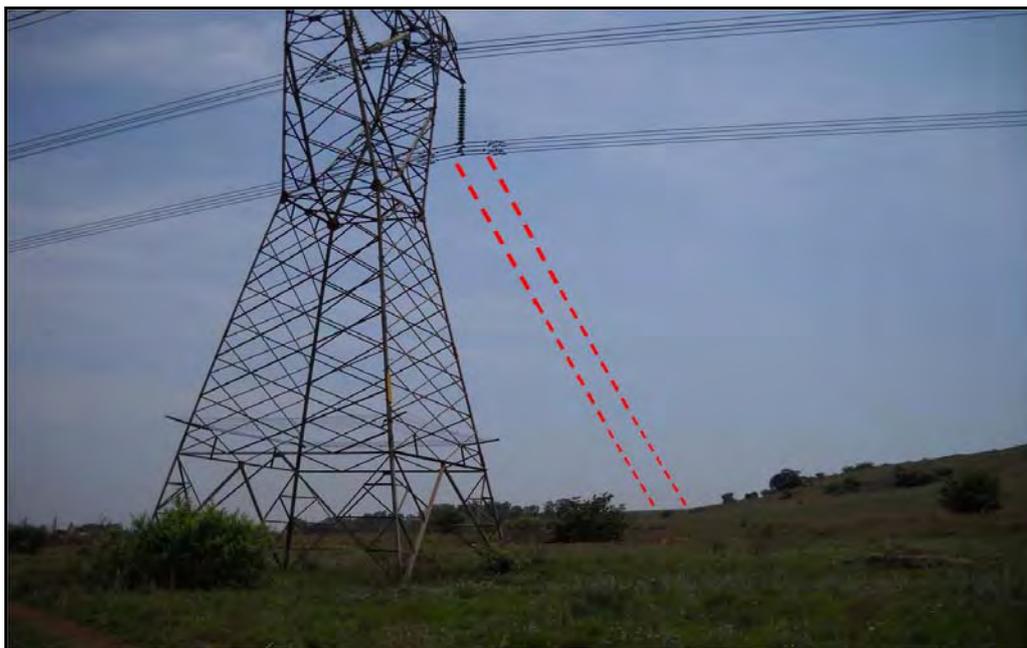


Figure 2.4: Map showing the alternative power line corridors investigated in the EIA Phase of the process



**Photograph 2.5:** Existing Apollo-Pluto power lines north-west of the Verwoerdburg substation



**Photograph 2.6:** Typical self supporting tower used for Apollo-Pluto lines in the vicinity of Alternative 2 (red dotted lines for turn-in power line)

### ***2.5.3. Construction Phase***

Transmission lines are constructed in the following simplified sequence:

- Step 1:** Determination of technically feasible alternatives
- Step 2:** EIA input into route selection
- Step 3:** Negotiation of final route with affected landowners

- Step 4:** Survey of the route (by air), should the need arise considering the length of the proposed line
- Step 5:** Determination of the conductor type
- Step 6:** Selection of best-suited conductor, towers, insulators, foundations
- Step 7:** Final design of line and placement of towers (including final walk-through survey by environmental specialists and compilation of site-specific Environmental Management Plan (EMP))
- Step 8:** Issuing of tenders, and award of contract to construction companies
- Step 9:** Vegetation clearance and construction of access roads (where required)
- Step 10:** Tower pegging
- Step 11:** Construction of foundations
- Step 12:** Assembly and erection of towers
- Step 13:** Stringing of conductors
- Step 14:** Rehabilitation of disturbed area and protection of erosion sensitive areas
- Step 15:** Testing and commissioning

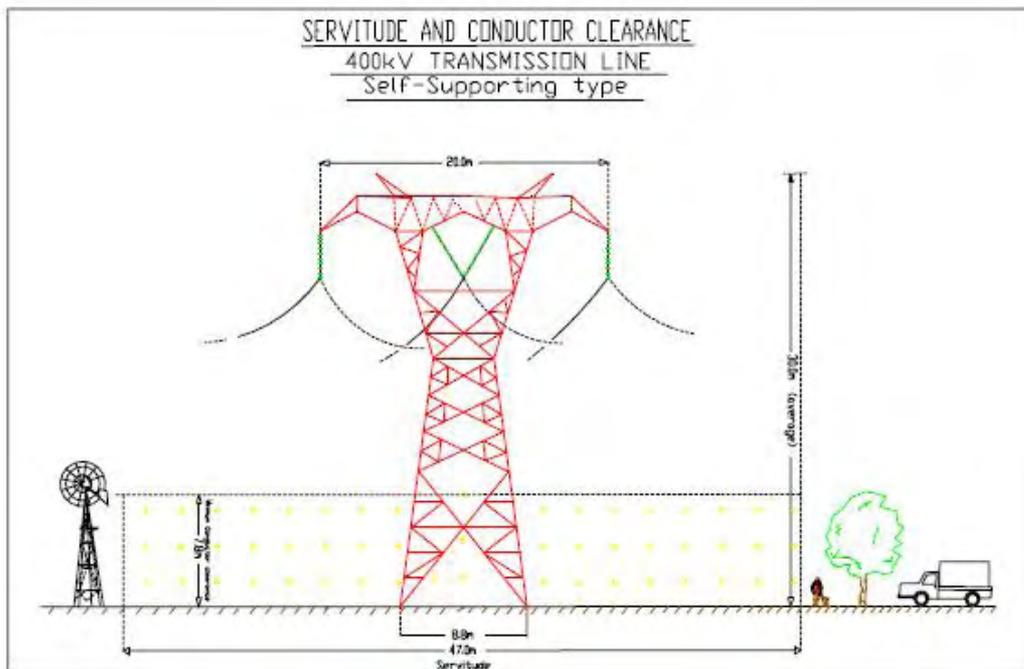
Construction of the lines proposed as part of the entire Tshwane Strengthening Project Phase 1 will take approximately 24 months to complete. Construction of these lines is anticipated to begin in 2011.

#### ***2.5.6. Technical Details of Tower and Transmission Line Designs***

All components of a transmission line are interdependent, but are distinct in the roles which they fulfil. The primary components include towers, foundations, insulators and hardware, and conductors.

##### *» Towers*

Transmission line conductors are strung on in-line (suspension) towers and bend (strain) towers. Various designs are available for use by Eskom on the proposed Apollo-Verwoerdburg turn-in power lines (refer to Figure 2.5 to 2.7). The type of towers which can be used will be dependent on the final alignment of the power lines and individual agreements with affected land owners and stakeholders.



**Figure 2.5:** Diagrammatic representation of the self-supporting strain/bend tower.



**Figure 2.6:** Self-supporting double-circuit tower

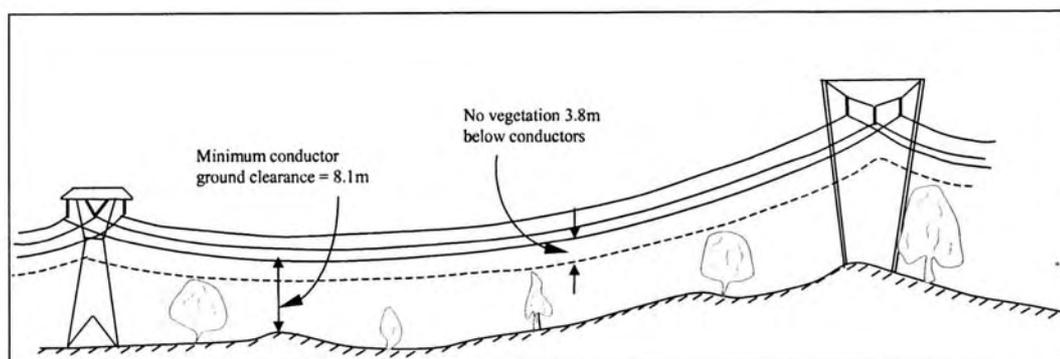


**Figure 2.7:** Guyed and Compact Cross-roped suspension tower typically used along the existing Dinaledi-Anderson 400kV transmission power line route

The compact cross-roped suspension tower is typically used along the straight section of the servitude, while the self-supporting angle towers are used where there is a bend in the power line alignment.

» *Servitude Requirements*

The servitude width for a 400kV transmission power line is 55 m. Transmission power lines running in parallel must have a minimum separation of 55 m. The minimum horizontal clearance to any building, structures, etc not forming part of the Transmission power line must be 3,8 m (Figure 2.8), while the minimum vertical clearance between the conductors and the ground is 8,1 m.



**Figure 2.8:** Servitude requirements in terms of vegetation clearing under conductors and minimum ground clearance

The minimum distance of a 400kV transmission power line running parallel to proclaimed public roads must be 95 m from the centre of the transmission power

line servitude to the centre of the road servitude. Any main road located close to a transmission line tower must have Armco barriers as protection.

The minimum distance between any part of a tree or shrub and any bare phase conductor of a 400kV transmission line must be 3,8 m, allowing for the possible sideways movement and swing of power towers and conductors.

A maximum 8 m wide strip is to be cleared of all trees and shrubs down the centre of the transmission line servitude for stringing purposes only. Any tree or shrub in other areas which will interfere with the operation and/or reliability of the Transmission line will be trimmed or completely cleared. The clearing of vegetation will take place, with the aid of a surveyor, along approved profiles and in accordance with the approved EMP, and in accordance with the minimum standards to be used for the vegetation clearing for the construction of the proposed transmission power lines as listed in Table 2.2.

**Table 2.2:** Minimum standards to be used for vegetation clearing for the construction of a new transmission power line

Item	Standard	Follow up
Centre line of the proposed Transmission line	Clear to a maximum (depending on tower type and voltage) of a 4-8m wide strip of all vegetation along the centre line. Vegetation to be cut flush with the ground. Treat stumps with herbicide.	Re-growth shall be cut within 100 mm of the ground and treated with herbicide, as necessary.
Inaccessible valleys (trace line)	Clear a 1 m strip for access by foot only, for the pulling of a pilot wire by hand.	Vegetation not to be disturbed after initial clearing – vegetation to be allowed to re-grow.
Access/service roads	Clear a maximum (depending on tower type) 6 m wide strip for vehicle access within the maximum 8 m width, including de-stumping/cutting stumps to ground level, treating with a herbicide and re-compaction of soil.	Re-growth to be cut at ground level and treated with herbicide as necessary.
Proposed tower position and proposed support/stay wire position	Clear all vegetation within proposed tower position in an area of 20 x 20 m (self-supporting towers) and 40 x 40 m (compact cross-rope suspension towers) around the position, including de-stumping/cutting stumps to ground level, treating with a herbicide and re-compaction of soil. Allow controlled agricultural practices, where feasible.	Re-growth to be cut at ground level and treated with herbicide as necessary.

Item	Standard	Follow up
Indigenous vegetation within servitude area (outside of maximum 8 m strip)	Area outside of the maximum 8 m strip and within the servitude area, selective trimming or cutting down of those identified plants posing a threat to the integrity of the proposed transmission line.	Selective trimming
Alien species within servitude area (outside of maximum 8 m strip)	Area outside of the maximum 8 m strip and within the servitude area, remove all vegetation within servitude area and treat with appropriate herbicide.	Cut and treat with appropriate herbicide.

Once the centre line has been cleared, the contractor's surveyor will peg every tower position and marks the crossing point with existing fences for new gate installation. Where required, once the tower positions have been marked, the vegetation clearing team will return to every tower position and clear vegetation (in accordance with the specification outlined in the Environmental Management Plan (EMP) for assembling and erection purposes.

» *Foundations*

The choice of foundation is influenced by the type of terrain encountered, as well as the underlying geotechnical conditions. Geotechnical requirements for all tower types are catered for by using various foundation types, which are designed to withstand conditions varying from hard rock to waterlogged marshes. The main types of foundations include piles, pad-and-chimney, and rock anchors. The actual size and type of foundation to be installed will depend on the type of tower to be erected, and the actual sub-soil conditions. Strain towers require more extensive foundations for support than in-line suspension towers, which contribute to the construction expenses.

The construction of foundations is the slowest part of the line construction, and is typically started some time ahead of tower erection. Prior to filling of the foundations and tower erection, excavated foundations are covered or fenced in, in order to safe-guard unsuspecting animals and people from injury. The foundations also represent the biggest unknown in the cost and construction time, since access to the tower sites is required for earth-moving machinery and concrete.

All foundation excavations are back-filled, stabilised through compaction, and rehabilitated at ground level.

» *Insulators and Hardware*

The insulators and hardware are used to connect the conductors to the towers. The main types are glass, porcelain, and composite insulators.

Glass and porcelain have been used for many years, and are the most common. They are, however, heavy and susceptible to breakage by vandals, as well as contamination by pollution. Composite insulators have a glass-fibre core with silicon sheds for insulation. The composite insulators are light-weight and resistant to both vandalism and pollution. They are, however, more expensive than the more common glass insulators.

» *Conductors*

The conductors are made of aluminium with a steel core for strength. Power transfer is determined by the area of aluminium in the conductors. Conductors are used singularly, in pairs, or in bundles of three, four or six. The choice is determined by factors such as audible noise, corona, and electro-magnetic field mitigation.

Many sizes of conductor are available, the choice being based on the initial and life-cycle costs of different combinations of size and bundles, as well as the required load to be transmitted.

## 2.6. Servitude Negotiation and the EIA Process

Transmission power lines are constructed and operated within a servitude (110 m wide for 2X400kV lines) that is established along the entire length of the power line. Within this servitude, Eskom Transmission has certain rights and controls that support the safe and effective operation of the power line. The process of achieving the servitude agreement is referred to as the Servitude Negotiation (Acquisition) Process, or simply just the negotiation process. The following important points relating to the negotiation process should be noted:

- » Servitude negotiation is a private matter between Eskom Transmission and the relevant (affected) landowner.
- » The negotiation process involves a number of stages (see below), and culminates in the 'signing' of a servitude. Here Eskom Transmission enters into a legal agreement with the landowner.
- » The servitude is registered as a 'right of way', and Eskom do not (purchase the land but the right to built and transmit electricity over the property) servitude from the landowner. Compensation measures are agreed in each case.
- » The agreements will detail such aspects as the exact location and extent of the servitude, and access arrangements and maintenance responsibilities, as well as any specific landowner requirements.
- » The negotiation process may take place at any time in the planning of a new power line (this is mostly after the EIA report/Environmental Authorisation when the preferred alternative is known..

- » This process must be completed (i.e. the agreement must be signed) with the relevant landowner before construction starts on that property.
- » The negotiation process is undertaken directly by Eskom Transmission either by its employees or a contract negotiator negotiating on behalf of Eskom and is independent of the EIA process. It is important that the aims of the two processes are seen as separate.

The EIA process has become important in the initial planning and route selection of new transmission lines. For this reason, it is usually preferable that the negotiation process begins after the EIA has been completed. At this stage there is greater confidence in the route to be adopted, and it would be supported by environmental authorisation. However, it may be required that the negotiation process begins earlier, and may begin before, or run in parallel with the EIA process. This may be due to urgent timeframes for the commissioning of the new power line, knowledge of local conditions and constraints, etc. Eskom Transmission has a right to engage with any landowner at any time, though they do so at risk if environmental authorisation has not been awarded.

### ***2.6.1. The Negotiation Process***

Eskom Transmission, often with assistance from contract negotiators is responsible for the negotiation process for all new transmission power lines. It is critical that the process is correctly programmed and incorporated into the planning of a new line. The negotiation process involves the following steps:

- i. Initial meeting with the landowner.
- ii. The signing of an 'option' to secure a servitude (this indicates that the owner will accept that the power line will traverse his property, subject to conditions to be finalised in the negotiation of the servitude agreement). An option is valid for one year.
- iii. Once the route is confirmed (i.e. options are signed with the upstream and downstream landowners), the servitude agreement will be finalised with the individual landowners. This agreement will set out the conditions for the establishment, rehabilitation and maintenance of the servitude, and will be site-specific (as different landowners may have different requirements). Compensation payments would be made when the servitude is registered at the Deeds Office<sup>6</sup>.

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<sup>6</sup> Compensation will be based on present day property valuations for all properties obtained from registered evaluators. Eskom only pays compensation for the strip of land that is affected at 100% of present day property value. In cases where properties are significantly affected, Eskom may consider purchasing the whole property at present day market value. All improvements will be valued. Sentimental value is not considered in any valuations as it is not measurable. Valuations are done according to the Expropriation Act.

- iv. Once construction is complete and the land rehabilitated to the landowners satisfaction (and as agreed prior to construction), the landowner signs a 'Final Release' certificate. Until the 'Final Release' certificate has been signed, Eskom Transmission remains liable for the condition of the land.
- v. Once the clearance certificate is signed, the responsibility for the power line and servitude is handed over to the regional Eskom Transmission office.

## 2.7. Project Operation Phase

The expected lifespan of the proposed transmission power line and substation is between 35 and 40 years, depending on the maintenance undertaken on the power line and substation structures.

During the life-span of the transmission power line and substation, on-going maintenance is performed. Power line inspections are undertaken on an average of 1 – 2 times per year, depending on the area. During this maintenance period, the power line is accessed via the access routes, as agreed with affected landowners during the negotiation phase. During maintenance activities on the substation, components may require replacement in order to significantly extend the lifespan of the substation. Maintenance of the power line and substation is required to be undertaken in accordance with the specifications of the Environmental Management Plan (EMP) which forms part of this EIA Report (refer to Appendix O).

The creation of additional employment opportunities during the operational phase of the power line and substation will be limited, and will be restricted to skilled maintenance personnel employed by Eskom.

### **2.6.1. Servitude Maintenance Responsibilities**

The management of a transmission power line servitude is dependent on the details and conditions of the agreement between the landowner and Eskom Transmission, and are therefore site-specific. These may, therefore, vary from one location to another. However, it is a common occurrence that there is a dual responsibility for the maintenance of the servitude:

- » Eskom Transmission will be responsible for the tower structures, maintenance of access roads, watercourse crossings, and gates and fences relating to servitude access.
- » The landowner will retain responsibility for the maintenance of the land and land use within the servitude (e.g. cropping activities, veld management, etc.).

Exceptions to the above may arise where, for example dual use is made of the access roads and gates or specific land use limitations are set by Eskom Transmission within the servitude which directly affects the landowner (e.g. forestry). Maintenance responsibilities are, ultimately, clearly set out in the servitude agreement.

## APPROACH TO UNDERTAKING THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE

## CHAPTER 3

An Environmental Impact Assessment (EIA) process refers to the process (dictated by the EIA Regulations) which involves the identification of and assessment of direct, indirect and cumulative environmental impacts associated with a proposed project. The EIA process comprises two phases: **Scoping Phase** and **EIA Phase**. The EIA process culminates in the submission of an EIA Report (including a draft environmental management plan (EMP) to the competent authority for decision-making. The EIA process is illustrated below:



The EIA process for the proposed Tshwane Strengthening Project has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations.

### 3.1. Phase 1: Scoping Study

The Scoping Study, which commenced in April 2009, provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern.

The Scoping Report aimed at detailing the nature and extent of the proposed Tshwane Strengthening Project, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs). In accordance with the requirements of the EIA Regulations, feasible project-specific alternatives (including the 'do nothing' option) were identified for consideration within the EIA process.

The draft EIR compiled was made available at public places for I&AP review and comment from the 03 March to 07 April 2010. All the comments, concerns and suggestions received during the Scoping Phase and the draft report review period were included in the final Scoping Report. The Final Scoping Report and Plan of Study for EIA were submitted to the National Department of Environmental Affairs and Tourism (DEA) and the Gauteng Department of Agriculture and Rural Development (GDARD) in September 2009. The Final Scoping Report was accepted by DEA, as the competent authority in January 2010 (refer to Appendix B). In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project.

### **3.2. Phase 2: Environmental Impact Assessment**

Through the Scoping Study, feasible alternatives were identified for further investigation in the EIA Phase of the process. These alternatives are described in Chapter 2 of this report. A number of issues requiring further study for all components of the project (i.e. the substation and power lines) were highlighted. A comparative assessment of identified issues associated with the identified feasible alternatives has been undertaken within the EIA phase of the process (refer to Chapter 6).

The EIA Phase aimed to achieve the following:

- » Provide an overall description and assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
- » Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed Tshwane Strengthening Project.
- » Comparatively assess identified feasible alternatives put forward as part of the project.
- » Nominate a preferred power line alternative corridor and substation site for consideration by DEA.
- » Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
- » Undertake a fully inclusive public involvement process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA addresses potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction, operation and decommissioning, and aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

### 3.3. Overview of the EIA Phase

The EIA Phase has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of NEMA. Key tasks undertaken within the EIA phase included:

- » Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
- » Undertaking a public involvement process throughout the EIA process in accordance with Regulation 56 of Government Notice No R385 of 2006 in order to identify any additional issues and concerns associated with the proposed project.
- » Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 59 of Government Notice No R385 of 2006).
- » Undertaking of independent specialist studies in accordance with Regulation 33 of Government Notice No R385 of 2006.
- » Preparation of this Draft EIA Report in accordance with the requirements of the Regulation 32 Government Notice No R385 of 2006.

These tasks are discussed in detail below.

#### **3.3.1. Authority Consultation**

As Eskom is a state-owned enterprise (SoE), the National DEA is the competent authority for this application. A record of all authority consultation undertaken prior to the commencement of the EIA Phase was included within the Scoping Report. Consultation with the regulating authorities (i.e. DEA and GDARD) has continued throughout the EIA process. Authority consultation within the EIA process included the following:

- » Pre-application consultation regarding the proposed project and the EIA process to be undertaken.
- » Submission of applications for authorisation to DEA for the Apollo-Verwoerdburg substation extension and loop-in transmission lines. Copies of these applications were submitted to GDARD. These applications were approved and the reference numbers 12/12/20/1470 (transmission power lines), and 12/12/20/1471 (Kwagga-Phoebus power lines) and 12/12/20/1524 (Kwagga-Phoebus substations) were allocated to the project. Authorisation was thus granted to continue with the Scoping Phase of the project.
- » Ongoing consultation with the regulating authorities regarding the EIA process and specific requirements in this regard.
- » Submission of the Final Scoping Report to DEA and GDARD and receipt of approval letter in February 2010.

- » A consultation meeting in order to discuss the proposed project, alternatives identified, the public consultation process undertaken and the issues identified for consideration in the EIA process, should the authorities require.

The following will also be undertaken as part of this EIA process:

- » Submission of a Final Environmental Impact Assessment (EIA) Report following the 30-day public review period.
- » A consultation meeting with DEA and GDARD in order to discuss the findings and conclusions of the EIA Report.

A record of all authority consultation undertaken prior to the commencement of the EIA Phase was included within the Scoping Report. A record of the consultation in the EIA process is included within Appendix B.

### ***3.3.2. Comparative Assessment of Alternatives***

The following project alternatives were investigated in the EIA (refer to Figure 2.4):

- » Power line corridors 1, 2, 3 and 3a
- » There is only one feasible site for the extension of the Verwoerdburg substation north of the existing substation

These alternatives are described in detail in Chapter 2 of this report.

### ***3.3.3. Public Involvement and Consultation***

The aim of the public participation process was primarily to ensure that:

- » Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.
- » Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
- » Comment received from stakeholders and I&APs was recorded and incorporated into the EIA process.

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA study were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to Appendix C for a listing of recorded parties and landowner consultation map). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and

registration of I&APs has been ongoing for the duration of the EIA process and the project database has been updated on an on-going basis. A total of 89 parties have registered their interest in the project to date.

In order to accommodate the varying needs of stakeholders and I&APs, as well as ensure the relevant interactions between stakeholders and the EIA specialist team, the following opportunities were provided for I&APs issues to be recorded and verified through the EIA phase, including:

- » Focus group meetings (pre-arranged and stakeholders invited to attend).
- » One-on-one consultation meetings and telephonic consultation sessions (consultation with various parties, for example with directly affected landowners, by the project participation consultant as well as specialist consultants).
- » Written, faxed or e-mail correspondence.

Records of all consultation undertaken in the EIA phase of the process are shown in Table 3.1 below and within Appendix D.

**Table 3.1:** Record of Meeting held during the EIA process

Meeting	Organisation/stakeholder	Date
Internal Stakeholder Meeting	City of Tshwane Electricity	22 June 2009
Local Authority Meeting	City of Tshwane Open Space Planning Department	21 August 2009
Focus Group Meeting	Wildlife and Environment Society of South Africa (WESSA) and AgriGAUTENG	28 July 2009, 12 August 2009 and 20 January 2010
Public Meeting	Interested and Affected Parties (Community)	12 August 2009

### ***3.3.4. Identification and Recording of Issues and Concerns***

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into Comments and Response Reports (refer to Appendix E for the Comments and Response Reports compiled from both the Scoping and EIA Phases). A summary of the key issues raised to date includes:

- » Social and socio-economic issues
- » Visual issues
- » Biodiversity issues
- » EIA process comments/issues

- » Technical comments/issues
- » Issues related to the proposed route alternative corridors
- » Servitude comments/concerns
- » Compensation comments/concerns
- » Existing infrastructure
- » Proposed/planned infrastructure/developments
- » Eskom distribution related issues
- » Communication issues

Where possible, comprehensive responses to issues raised have been included in the Comments and Response Report by the EIA project team as well as Eskom Transmission. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

### **3.3.5. Summary of Frequently Raised Issues**

Table 3.2 provides a summary of issues/comments frequently raised through the public participation process regarding the proposed project. Responses regarding the way forward regarding these key issues/comments are also provided.

**Table 3.2:** Summary of key issues raised through the public participation process

<b>Issue/Concern</b>	<b>Reference in SIA and Comments and Responses Report</b>
Although the alternative routes for the project cross-agricultural land, it is well inside the urban edge and most, if not all of the land, already belong to developers. Furthermore, we don't see any intensive farming operations that could be affected by any one of the two routes. [Freek Tomlinson, AGRIGauteng]	<i>Section 3.1.2: Changes in access to resources that sustain livelihoods</i>
We are keen to understand how landowners within the Doornkloof East area are going to be affected by the proposed loop-in power lines and also the beneficiaries of the project. [Herman Joubert, landowner]	<i>Impacts are assessed throughout the SIA report</i>
Why is the alternative route adjacent to the M57 following the existing power lines not included in the maps and the draft scoping report? This alternative seems a better option if one were to consider that the area along the M57 is already transformed. [David Boshof]	<i>Addressed throughout the SIA as an assessment of Alternative 3</i>
We are currently busy with the designs for the development of light industry in our property along one of the proposed loop-in	<i>Section 3.1.2: Changes in access to</i>

line alternatives [Herman Joubert, landowner]	<i>resources that sustain livelihoods</i>
Why is the existing line not being considered as an alternative in order to keep impacts within the already transformed areas. [Nico van Wyk]	<i>Addressed throughout the SIA as an assessment of Alternative 3</i>
The potential impact of the proposed development including the upgrade of the substation on the road users is very important and this should be taken into account during the design phase of the project. [Nico van Wyk]	<i>Section 3.1.2: Change in traffic volumes and patterns on (access) roads</i>

### **3.3.6. Assessment of Issues Identified through the Scoping Process**

Based on the findings of the Scoping Study, the following issues were identified as being of low significance, and therefore not requiring further investigation within the EIA:

- » Potential impacts on topography
- » Potential impacts on transmission infrastructure associated with climate and atmospheric conditions
- » Potential impacts associated with geology and soils

Issues which require further investigation within the EIA phase, as well as the specialists involved in the assessment of these impacts are indicated in Table 3.3.

**Table 3.3:** Specialist studies undertaken within the EIA phase

<b>Specialist Study</b>	<b>Specialist</b>	<b>Qualification and Registration/Affiliation</b>
Biodiversity	Riaan Robbeson of Bathusi Environmental Consulting	MSc Plant Ecology, 8 years experience South African Council of Natural Scientific Professions (SACNASP), Ecological Scientist & Botanical Scientist Reg no: 400005/03
Avifauna	Luke Strugnell and Jon Smallie of Endangered Wildlife Trust	BSc Environmental Management) 2 years experience. South African Council of Natural Scientific Professions (SACNASP) Reg No: 400181/094000/09
Visual impact assessment	Lourens Du Plessis of MetroGIS	BA (Geography and Anthropology) 11 years experience in GIS and visual impact assessment
Heritage Impact	Dr Julius Pretorius	D Phil Archaeology, Member of the Association of Southern African

Assessment		Professional Archaeologists (ASAPA) Member of the South African Archaeological Society, 28 years experience
Agricultural Potential	Garry Paterson of ARC – Institute for Soil, Climate and Water	Pr. Sci. Nat. Over 15 years experience
Social Impact Assessment	Nonka Byker of MasterQ Research	B Psych, NQF Assessor (Institute for People Development, 2005) Member of the Health Professions Council of South Africa (PRC 0000396) 3 years experience

Specialists investigations included desk-top evaluations of existing information (including that provided by land owners during the public participation process), as well as detailed field surveys (including Red Data field survey by the ecologist specialist) of the identified corridors and substation extension site. In undertaking field assessment and public participation, contact was made with all affected land owners.

An external review of the EIA process was undertaken by CEN Integrated Environmental Management Unit. The external reviewer has undertaken review for similar projects including Kyalami Strengthening Project, Mokopane Integration Project etc.

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the Tshwane Strengthening Project Phase 1. Issues were assessed in terms of the following criteria:

- » The **nature**, a description of what causes the effect, what will be affected and how it will be affected.
- » The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international.
- » The **duration**, wherein it is indicated whether:
  - \* the lifetime of the impact will be of a very short duration (0–1 years);
  - \* the lifetime of the impact will be of a short duration (2-5 years);
  - \* medium-term (5–15 years);
  - \* long term (> 15 years); or
  - \* permanent.
- » The **magnitude**, quantified as:
  - \* small and will have no effect on the environment;
  - \* minor and will not result in an impact on processes;
  - \* low and will cause a slight impact on processes;

- \* moderate and will result in processes continuing but in a modified way;
  - \* high (processes are altered to the extent that they temporarily cease); and
  - \* very high and results in complete destruction of patterns and permanent cessation of processes.
- » The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
- \* improbable (probably will not happen);
  - \* improbable (some possibility, but low likelihood);
  - \* Assigned a score of 3 is probable (distinct possibility);
  - \* highly probable (most likely); and
  - \* definite (impact will occur regardless of any prevention measures).
- » The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
- » The **status**, which is described as positive, negative or neutral.
- » The degree to which the impact can be reversed (**reversibility**).
- » The degree to which the impact may cause **loss of irreplaceable resources**.
- » The degree to which the impact can be *mitigated*.

The above criteria will be rated using the criteria indicated in the table below.

Magnitude	Reversibility	Duration	Spatial extent	Probability
5– Very high/ don't know	1-Reversible (regenerates naturally)	5- Permanent	5- International	5- Definite/don't know
4 - High		4- Long term (impact ceases after operational life)	4- National	4- High probability
3 - Moderate	3- Recoverable (needs human input)	3- Medium term (5- 15 years)	3- Regional	3- Medium probability
2 - Low		2- Short term (0-5 years)	2- Local	2- Low probability
1- Minor	5- Irreversible	1 - Immediate	1 – Site only	1-Improbable
0 - None				0 - None

The overall consequence of an impact must be determined by the sum of the individual score for magnitude, reversibility, duration and extent of an impact, multiplied by the probability of the impact occurring.

***Significance = Consequence (severity + reversibility + duration + spatial scale) X Probability***

The significance is then characterised as follows:

- » **More than 60 significance points** indicate **High** environmental significance,
- » **Between 30 and 60 significance points** indicate **Moderate** environmental significance,
- » **Less than 30 significance points** indicate **Low** environmental significance.

The impacts are ranked according to the significance rating results obtained. The relevant mitigation measures recommended are then considered and the significance of the impacts after mitigation determined. The impacts are then being ranked again according to the significance results after mitigation.

A specialist workshop was held on the 14<sup>th</sup> of January 2010, with all the specialists from the EIA team in attendance. The conclusions of each of the specialist studies were discussed and overall recommendation made regarding the preferred corridor for consideration by the competent authority (DEA).

### ***3.3.6. Assumptions and Limitations***

The following assumptions and limitations are applicable to the studies undertaken within this EIA Phase:

- » All information provided by Eskom and I&APs to the Environmental Team was correct and valid at the time it was provided.
- » Should the project be authorised by DEA, the Transmission line corridors identified by Eskom, and investigated through the EIA process are technically and economically viable.
- » Should the project be authorised by DEA, the final power line route will be determined by Eskom through the negotiation process after the EIA process within the nominated preferred power line corridor.
- » Strategic, forward planning deliberations are reflected in the IEP, NIRP and ISEP planning processes and do not form part of this EIA.

### ***3.3.7. Public Review of Draft EIA Report and Feedback Meeting***

This is the **current stage** of the EIA process. This Draft EIA Report will be made available for public review. During this review period, a Public Meeting and a Key Stakeholder Workshop will be held in order to facilitate comments on the Draft EIA Report. All interested and affected parties are invited to attend the public

meeting to be held on 18 March 2010 at Rietvlei Nature Reserve Lecture Theatre at 18h00 – 20h00.

This report has been made available for public review for a 30 day period from 03 **March 2010 to 07 April 2010** at the following locations:

Irene Community Library	Rietvlei Nature Reserve
Centurion Community Library	Kungwini Local Municipality Library
City of Tshwane Metropolitan Municipality, Environmental and Development Planning Department	<a href="http://www.eskom.co.za/eia">www.eskom.co.za/eia</a>
<a href="http://www.savannahSA.com">www.savannahSA.com</a>	

Copies of the draft report will also be made available to the City of Tshwane Metropolitan Municipality and Kungwini Local Municipality. Affected parties and stakeholders will also receive CDs containing the report, on request.

The availability and duration of the public review process was advertised in Rekord Nord, Rekord Wes, Pretoria News, Daily Sun and the Citizen. In addition, all registered I&APs were notified of the availability of the report and public meeting by letter (refer to Appendix D).

### **3.3.8. Final EIA Report**

The final stage in the EIA Phase will entail the capturing of responses from I&APs on the Draft EIA Report in order to refine this report. It is this final report upon which the decision-making environmental Authorities make a decision regarding the proposed project.

## **3.4. Regulatory and Legal Context**

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy transmission project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and local levels.

### **3.4.1. Regulatory Hierarchy**

At National Level, the main regulatory agencies are:

- » *National Energy Regulator of South Africa (NERSA)*: This body is responsible for regulating all aspects of the electricity sector.
- » *Department of Environmental Affairs (DEA)*: This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
- » *Department of Energy (DE)*: This department is responsible for policy relating to all energy forms. It is the controlling authority in terms of the Electricity Act (Act No 41 of 1987).
- » *Department of Transport and Public Works*: This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads (as may be associated with the construction phase) on public roads.
- » *South African Heritage Resources Agency*: This agency is responsible for any heritage resources and the granting of permits in any projects that have any potential impacts on the heritage resources of South Africa.

At Provincial Level, the main regulatory agency is:

- » Gauteng Department of Agriculture and Rural Development (GDARD): This is the provincial authority involved in the EIA process and determines many aspects of Provincial Environmental policy. The department is a commenting authority for this project.

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 and Kungwini Local 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
<i>National Legislation</i>			
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>	National Department of Environmental Affairs and Tourism – lead authority.  Gauteng Department of Agriculture, Conservation and Environment – commenting authority.	The final EIA report will be submitted to DEA and GDARD in support of the <b>application for authorisation</b> submitted in March 2009.
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>	Department of Environmental Affairs (as regulator of NEMA).	While <b>no permitting or licensing requirements</b> 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.

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	<p>» Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that— 5</p> <p>(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;</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> <p>There is <b>no requirement for a noise permit</b> 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 undertaken outside of these times, the</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
			surrounding communities will need to be notified and appropriate approval will be obtained from DEA and the Local Municipality.
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	As no water use (as defined in terms of S21 of the NWA) will be associated with the proposed project, <b>no water use permits or licenses</b> 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 <b>no permitting or licensing requirements</b> 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"> <li>» the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length;</li> <li>» any development or other activity which will change the character of a site exceeding 5 000 m<sup>2</sup> in extent.</li> </ul> The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of	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 <b>permit</b> may, however, be required should any <b>cultural/heritage sites</b> 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>a site exceeding 5 000 m<sup>2</sup>; or the re-zoning of a site exceeding 10 000 m<sup>2</sup> 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 threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of</p>	<p>National Department of Environmental Affairs</p>	<p>Some Red Data species were identified along the proposed alternative 1 and 2 and this means that Eskom might be carrying out restricted activity, as is defined in Section 1 of the Act, a <b>permit</b> may be required to be obtained in this regard.</p> <p><b>Specialist flora and fauna studies</b> 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 <b>permit</b> may be required should any <b>protected plant species</b> within the power line corridors or at the substation site be <b>disturbed or</b></p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	the EIA phase.		<b>destroyed</b> as a result of the proposed development.
Conservation of Agricultural Resources Act (Act No 43 of 1983)	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.	Department of Agriculture	While <b>no permitting or licensing requirements</b> 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.
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 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</p>	Department of Health	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 <b>license</b> is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>be declared to be Group I or Group II hazardous substance;</p> <p>Group IV: any electronic product;</p> <p>Group V: any radioactive material.</p> <p>The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.</p>		
<p>National Road Traffic Act (Act No 93 of 1996)</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.</p> <p>The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is 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</p>	<p>Gauteng Department of Public Transport, Roads and Works (provincial roads)</p> <p>South African National Roads Agency Limited (national roads)</p>	<p>An <b>abnormal load/vehicle permit</b> may be required to transport the various power line and substation components to site for construction. These include:</p> <ul style="list-style-type: none"> <li>» Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads.</li> <li>» Transport vehicles exceeding the dimensional limitations (length) of 22m.</li> </ul>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		
National Environmental Management: Waste Act (Act No 59) of 2008	<ul style="list-style-type: none"> <li>» 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.</li> <li>» The Minister may amend the list by—                             <ul style="list-style-type: none"> <li>(a) adding other waste management activities to the list;</li> <li>(b) removing waste management activities from the list; or</li> <li>(c) making other changes to the particulars on the list.</li> </ul> </li> </ul>	National Department of Environmental Affairs (DEA)	<ul style="list-style-type: none"> <li>» Any person who stores waste must at least take steps, unless otherwise provided by this Act.</li> </ul>
Gauteng Transport Infrastructure Act (Act 8 of 2001) of 2001	<ul style="list-style-type: none"> <li>» 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.</li> </ul>	Gauteng Department of Public Transport, Roads and Works	<ul style="list-style-type: none"> <li>» 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 must be accompanied by a report that addresses the issues listed in that section of the Act. The proposed power line crosses this 200m wide area in respect of route K105. Eskom will undertake this process outside of the EIA process.</li> </ul>

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## **DESCRIPTION OF THE ENVIRONMENT AFFECTED BY 2X400KV TURN-IN POWER LINES AND SUBSTATION EXTENSION**

### **CHAPTER 4**

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This section of the EIA Report provides a description of the environment that may be affected by the proposed Tshwane Strengthening Project Phase 1 (2X 400kV Apollo-Verwoerdburg turn-in power lines and Verwoerdburg substation extension). 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 F – J.

Alternative power line corridors comparatively assessed within this EIA report include alternative 1, 2 as well as alternative 3 following an existing Apollo-Pluto power line (refer to Figure 4.1). Subsequent to the specialist workshop, an additional alternative 3a was included which is a direct line from the Verwoerdburg substation west of the M57 towards the Apollo-Pluto lines. This alternative line was also assessed as part of the EIA process.

#### **4.1. Location and Baseline Environment of the Study Area**

Most of the land within the study area for the Apollo-Verwoerdburg alignment has been either permanently altered by agriculture or is degraded due to urban encroachment in the region with the exception of the Rietvlei Nature Reserve to the east. Most of the area is covered by agricultural holdings and no major industrial centres occur within the study area, although the Clayville Industrial area is not far to the south. Existing power lines traverse the area substantially due to the proximity and size of the Apollo substation.

The substation and expansion site is largely surrounded by an undeveloped open area. Neighbouring residential areas include Doornkloof (approximately 1.5km to the west extending north-northwest), Irene Extension 10 (approximately 1.3km to the northwest), Irene Glen Private Estate (approximately 600m to the north), and Sunlawns Agricultural Holdings (AH) (approximately 4km to the south). Doornkloof Smallholdings (SH) lies approximately 350m to the east, which is an area that is characterised by mixed land use including private residential and light industrial (refer to Figures 4.2 and 4.3).

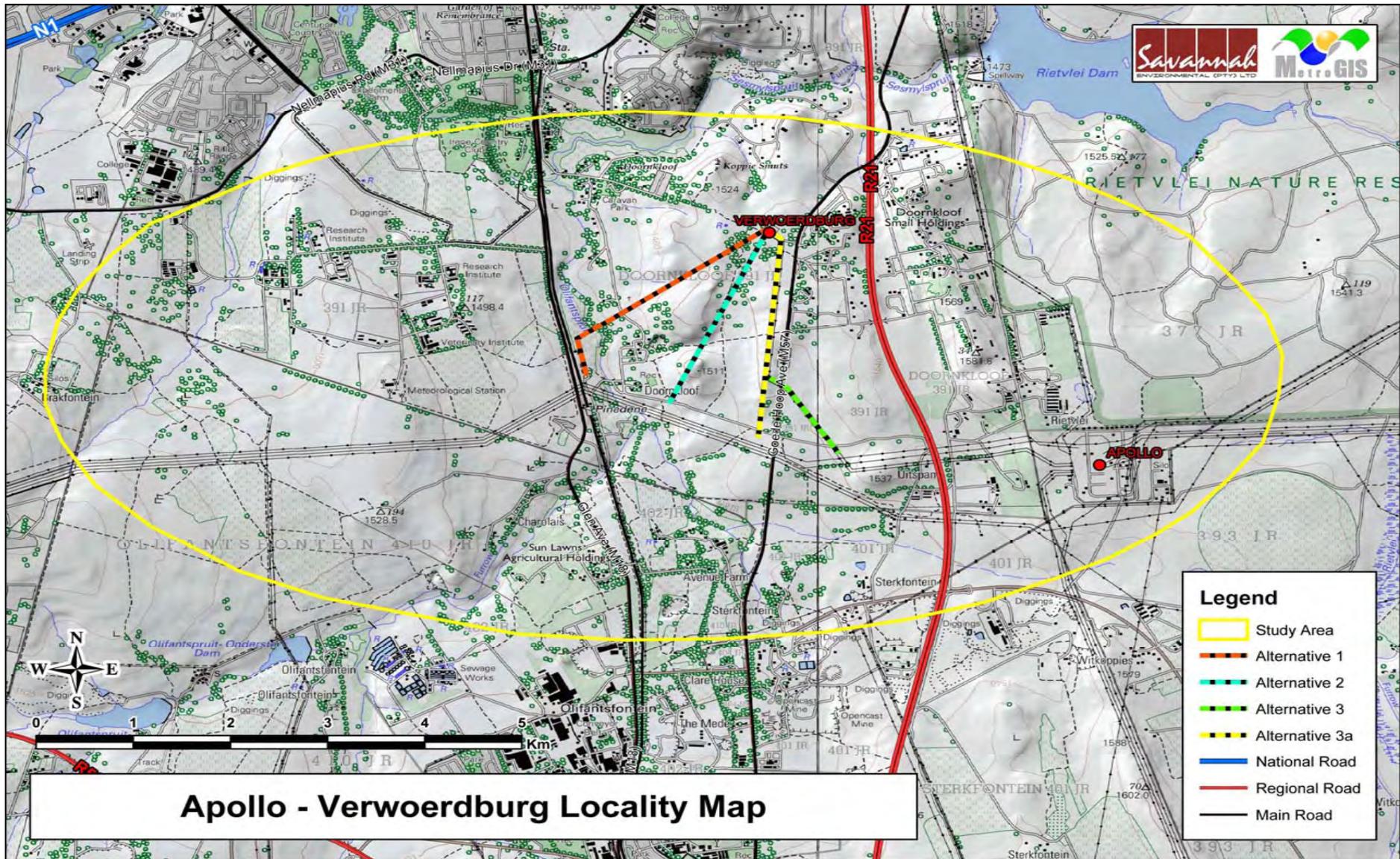
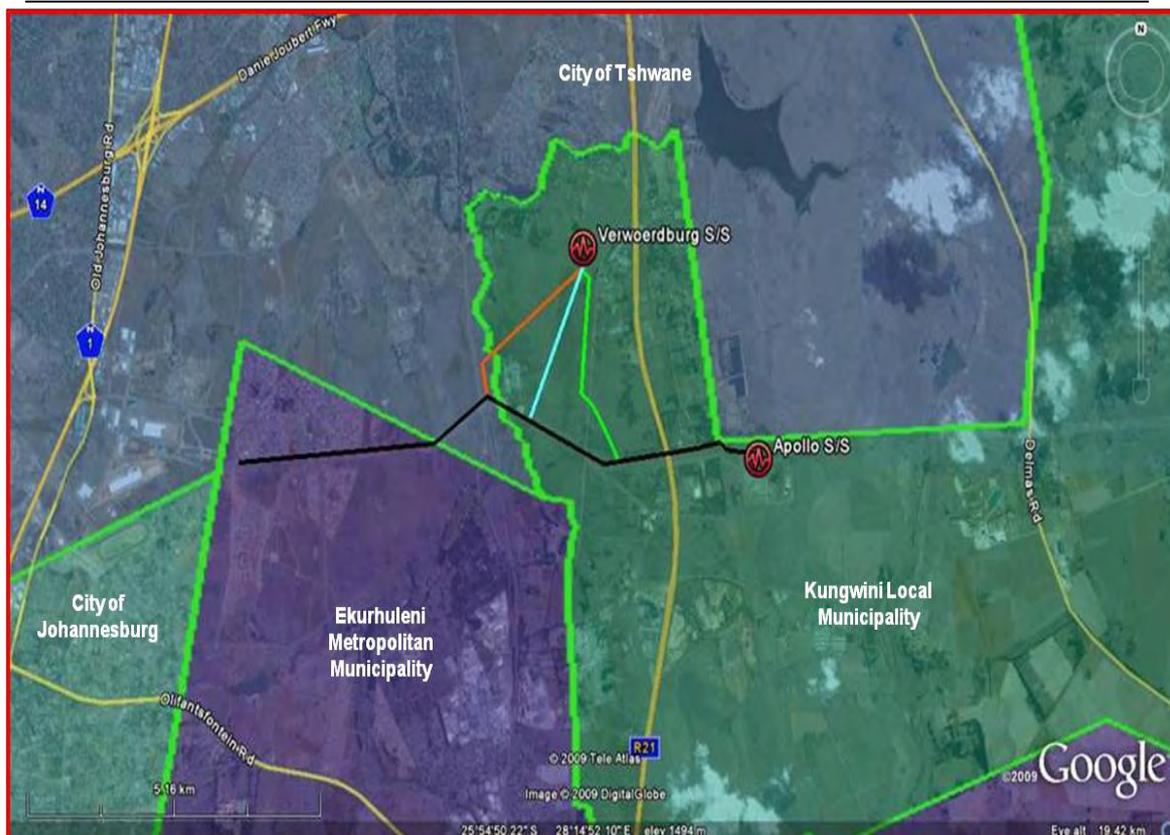


Figure 4.1: Power line Alternative Corridors comparatively assessed during the EIA phase of the process



**Figure 4.2:** An image showing delineation of the City of Tshwane Metropolitan Municipality and the Kungwini Local Municipality in Gauteng and the location of the identified corridors and substation extension.



**Figure 4.3:** Location of the proposed extension to Verwoerdburg substation

#### 4.1. Social Characteristics of the Study Area

Apart from the southern-most tip of **Alternative 1** (at its bend where it runs parallel to Glen Avenue), which is located within the City of Tshwane (CoT) municipal area, the infrastructure development associated with Tshwane Strengthening Project Phase 1 (Apollo- Verwoerdburg component) is located within the Kungwini Local Municipality (KLM) that forms part of the Metsweding District (MD) of the Gauteng Province.

The proposed turn-in power line development corridors are located and pass through land that is characterised by mixed land uses including agriculture, residential and light industry, respectively (refer to Figure 4.4 and 4.5).

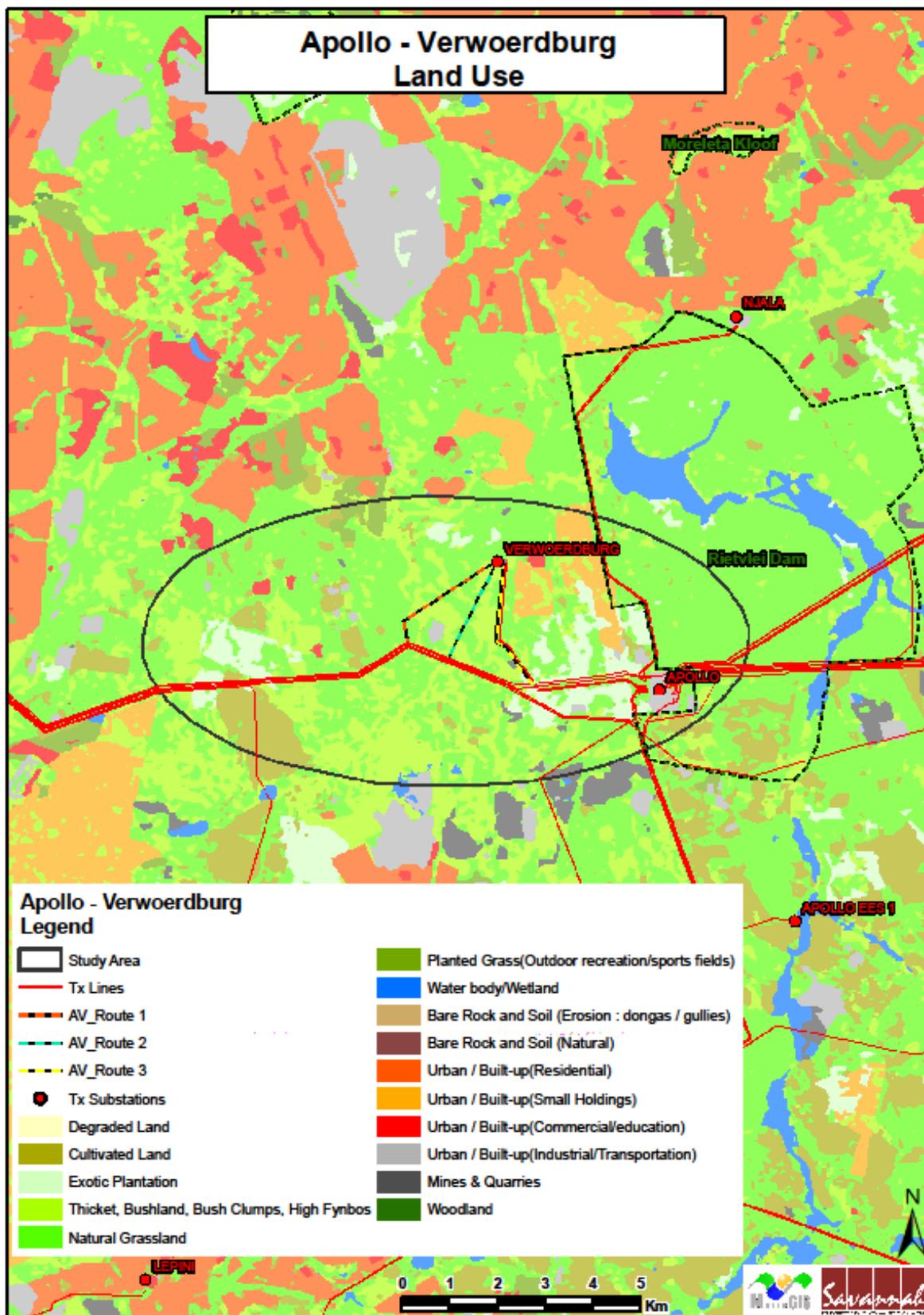


Figure 4.4: Land use map of the study area

#### 4.1.1. Demographic Profile

The KLM covers an area of approximately 2 202km<sup>2</sup> and, according to Community Survey 2007, the area has a total population of 104 150 people. Census 2001 estimated the total population at around 107 543 people. It therefore appears that there is a slight population outflow, even though a review of the KLM IDP of 2006/07 estimated the population growth rate at +5.5%. According to the IDP's calculations, the population in the KLM would have grown from 2001's 107 543 people to approximately 132 848 people by 2006, escalating to approximately 150 507 people by 2011. It therefore appears that the 5.5% population growth rate was a glaring over-estimation on the part of the KLM, as the population size in fact decreased as suggested by the Community Survey 2007 estimation.

The local municipal area is regarded as an urban area in view of the fact that, by 2006/07, an estimated 77.6% of the population lived in urban areas, with the remaining 22.4% residing in rural areas. Based on Community Survey 2007 population data, the population density in the KLM is approximately 47.3 persons per km<sup>2</sup>, but it can be even less in areas that are still developing, such as the immediate area surrounding the proposed development (refer to Figure 4.5).

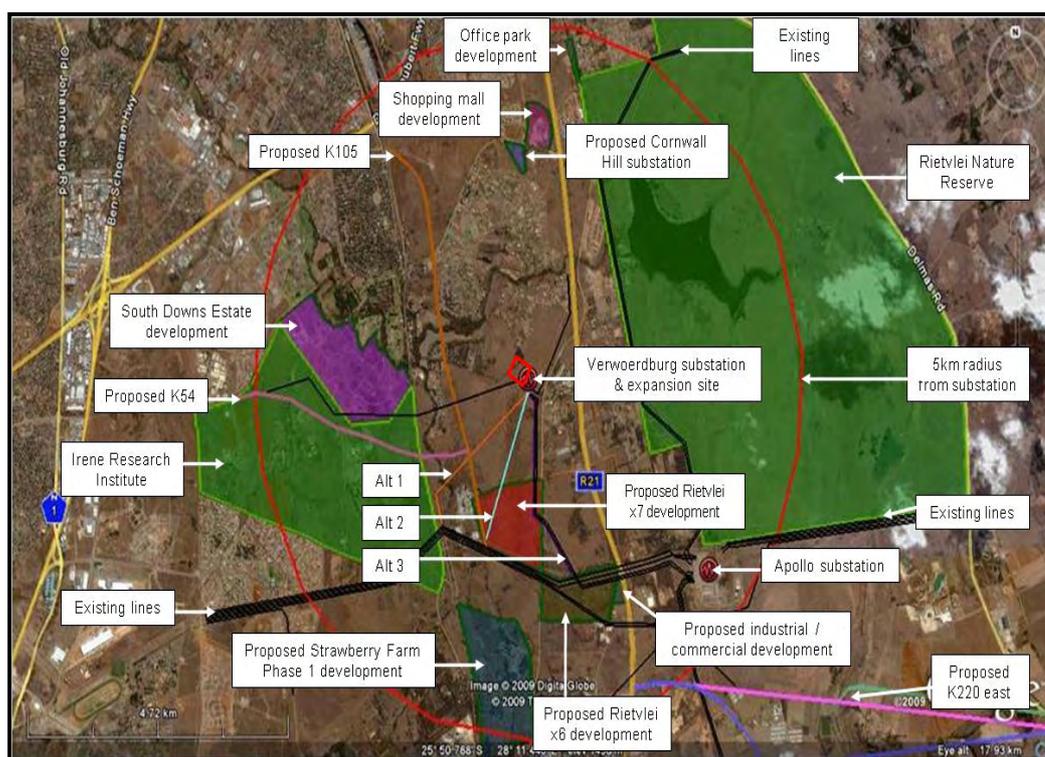


Figure 4.5: Image showing various land uses within the study area

#### **4.1.2. Socio-economic Profile**

The study area is characterised by a high employment rate where the majority (79.4%) of the working age population (ages 15-64, but excluding the not economically active population) is formally employed. This is a significant increase from 2001, when less than half (49.2%) of the economically active population were employed. The majority of those employed (36.1%) are engaged in elementary occupations and is therefore regarded as unskilled to semi-skilled. Although the employment rate exceeds the unemployment rate by far, it is still a point of concern that one in every fifth 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.

The education levels of the population within the Eastern Sub-Region of Region A are higher than the national average which is an indication of the higher income levels in the area. Approximately 60% of the residents have completed secondary school with 14% achieving higher education levels. Approximately 18% have only completed primary school. It is therefore clear that a large proportion of the population in the formal residential areas of the study area are living as affluent, well-educated citizens.

#### **4.1.3. Services and Infrastructure**

The years between 2001 and 2007 saw a steady increase in the delivery of some municipal services to the households within the KLM. Despite the fact that, according to official statistics from StatsSA, there was a decrease in the number of households in the KLM (from 33 598 in 2001 down to 31 666 in 2007), there are still large segments of households within the municipal area that have to do without proper municipal services.

A comparison between Census 2001 and Community Survey 2007 revealed an improvement to the following service areas (expressed as a percentage of the total number of households serviced): Electricity for cooking (from 56.3% to 71.3%), for heating (from 53.8% to 59.4%), and for lighting (from 70.3% to 82.8%). The only other service that improved was the delivery of purified piped water to households or within a 200m radius of every household (from 77.7% to 86.2%). All other service areas deteriorated in the quality and consistency of these services: Refuse removal once a week dropped from 46.7% to 45.4%, and sanitation dropped from 68.0% to 67.4%.

According to the KLM IDP (2008/09), there are no water backlogs in formal areas within the municipality and the six sewerage plants servicing the municipal area are functioning properly. In contrast, the IDP also admits that new housing

developments placed the existing bulk sanitation services under tremendous strain and that the upgrade of the sewerage plants had become a critical issue. In addition, despite the general improvement in the electricity network, the IDP expresses its concern about the state of electrical infrastructure in the area and felt that the time had come for the infrastructure to be either refurbished or replaced.

#### **4.1.4 Heritage Resources**

The Phase I HIA study for the Eskom Project Area revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999), namely:

- » At least two graveyards located near Alternative 01 and Alternative 02 for the 400kV loop-in and loop-out power lines running from the 400kV Apollo-Pluto power line to the Verwoerdburg Substation (refer to Figure 4.6).
- » No heritage resources were observed along Alternative 03 and 03a.

These graveyards were geo-referenced and mapped (Table 4.1 and Photograph 4.1).

**Table 4.1:** Coordinates for two graveyards near Alternatives 01 and 02, two loop-in and loop-out power lines running from the 400kV Apollo-Pluto power line to the Verwoerdburg Substation.

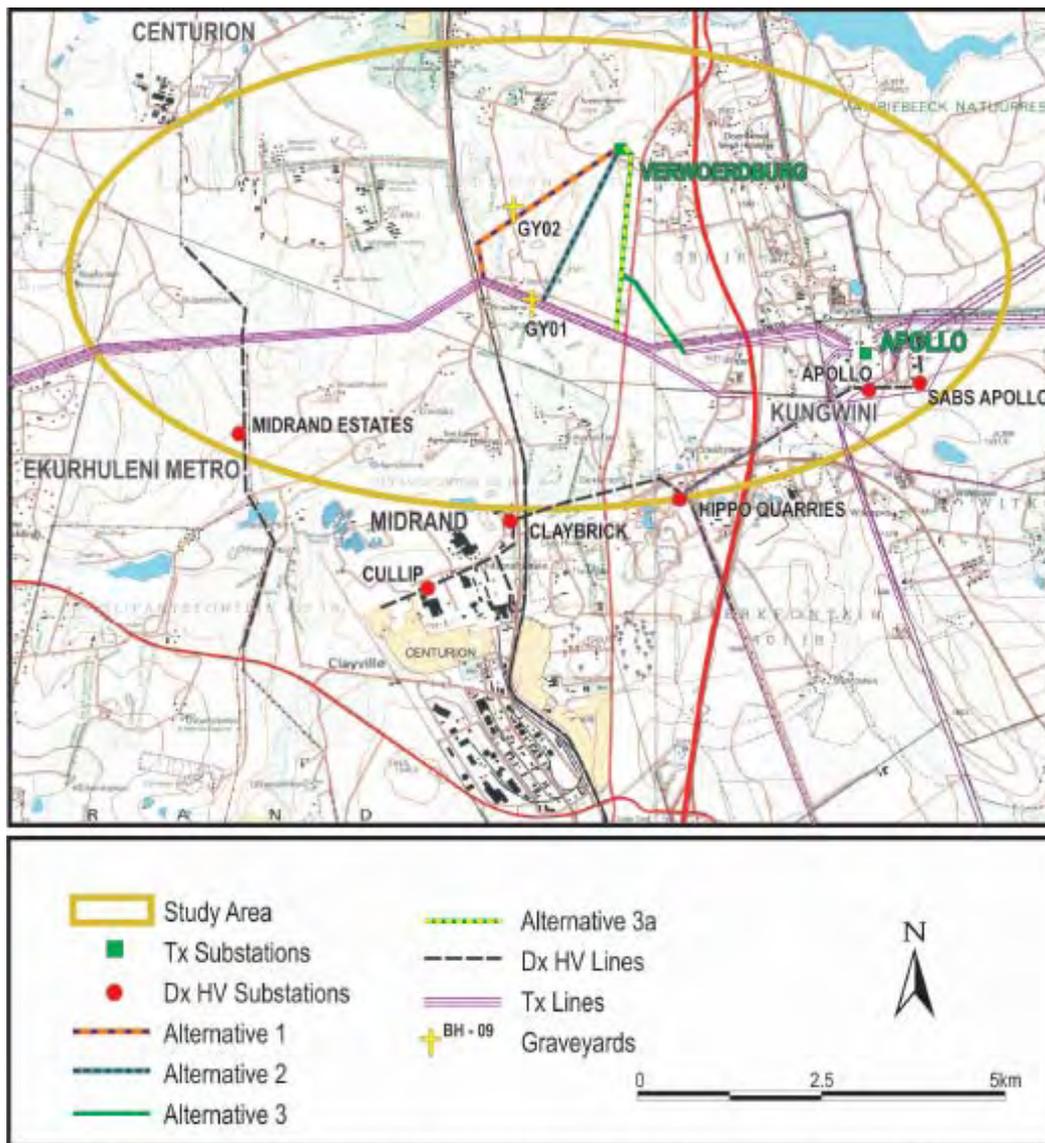
Graveyards	Coordinates
GY01. Approximately 85 graves. Under Eskom's proposed 400kV transmission line.	25° 54.794S' 28° 14.087E'
GY02. Approximately 20 graves in open veld.	25° 54.127S' 28° 13.958E'



**Photograph 4.1:** Image showing GY01 near Alternative 01 holds approximately 85 graves



**Photograph 4.2:** Image showing GY02 along alternative 2 which holds approximately 25 graves



**Figure 3-** Two graveyards located in close proximity to Alternative 01 and Alternative 02, two loop-in and loop-out power lines running between the 400kV Apollo-Pluto power line and the Verwoerdburg Substation (above).

**Figure 4.6:** Heritage resources recorded in the study area

## 4.2. Biophysical Characteristics of the Study Area

### ***4.2.1. Geographical Profile (Topography and Surface Water Hydrology)***

The topography of the study area can be described as an undulating plain with an elevation above sea level ranging from 1330 m in the west to 1585 m in the south. Areas of surface water that will potentially be affected by the proposed line variants include a perennial river (Oliphantspruit River) west of the site. According to the GDARD database, Class 3 ridges are present within all of the proposed power line servitudes. The regional vegetation in which the proposed lines are situated is named the Carletonville Dolomite Grassland (Vulnerable status).

The study area is situated in the Sesmyl Spruit drainage system, flowing in an east-west direction from regions south of the Rietvlei Dam where it flows into the Jukskei River west of Centurion. The Kaal Spruit, also known as the Olifantspruit, is a prominent tributary of the system and originates in the Kaalfontein region south of the study area. These streams are perennial and quick flowing drainage courses.

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 are 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 corridor options will potentially affect a Class 3 ridge. Significant ridge areas are present in the middle sections of Alternative Routes 1 and 2.

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. 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. 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.

#### 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 4.2.

**Table 4.2:** Climate Data

Month	Average Rainfall (mm)	Average Min. Temp (°C)	Average Max. Temp (°C)	Average frost dates
Jan	118.8	13.8	27.0	Start date: 13/5 End date: 13/9 Days with frost: ± 115
Feb	93.3	13.1	26.3	
Mar	79.3	11.6	24.9	
Apr	39.6	7.6	23.0	
May	19.7	3.0	20.3	
Jun	6.8	-0.7	17.7	
Jul	8.8	-0.8	17.5	<b>Heat units (hrs &gt; 10°C)</b>
Aug	8.4	1.8	20.6	Summer (Oct-Mar): 1 719  Winter (Apr-Sept): 305
Sep	22.1	6.1	23.6	
Oct	64.1	10.4	26.0	
Nov	109.1	11.9	25.9	
Dec	110.2	13.2	26.8	
<b>Year</b>	<b>680.2 mm</b>	<b>15.4 °C (Average)</b>		

The long-term average annual rainfall is 680.2 mm, of which 574.9 mm, or 84.5%, falls from October to March. Temperatures vary from an average monthly maximum and minimum of 27.0°C and 13.8°C for January to 17.5°C and -0.8°C for July respectively. The extreme high temperature that has been recorded is 38.9°C and the extreme low -13.3°C. Frost occurs every year on approximately 115 days on average between May and September.

##### 4.2.2.1. Ecological Profile

The proposed power line corridor options comprise significant areas of importance in terms of C-PLAN. In addition, some of the identified corridors (corridor 1 and 2) crossed areas of high biodiversity. Attributes that will potentially be affected include the following:

- » ridges;
- » perennial rivers;
- » non-perennial rivers;

- » primary vegetation;
- » RD Mammal;
- » RED Invertebrate historic location;
- » Red Data plant confirmed location;
- » Red Data plant historic location;
- » Red Data plant metapopulation;
- » Orange Data plant confirmed location;
- » Orange Data plant historic location; and
- » Orange Data plant metapopulation.

Areas of surface water that will potentially be affected by the corridor options include a perennial river and non-perennial stream. A Class 3 ridge will potentially be affected by some of the corridor options, particularly in the middle sections of Alternative Routes 1 and 2. The current status of the region is relatively transformed, with some areas of remaining natural habitat remaining in the region. Urbanisation, stands of exotic trees and agriculture represents the major land transformation effects within the region. Road infrastructure has caused a relative high degree of habitat fragmentation and isolation. The three corridor options are situated within the Carletonville Dolomite Grassland vegetation type. This vegetation type is regarded as Vulnerable.

The biophysical sensitivity of the corridor options is largely determined by the transformation status of the area. Natural habitat associated with ridges and wetlands are regarded as highly sensitive, and existing information indicates a high biophysical sensitivity within the northern part of the corridor options. Alternative Route 1 and Alternative Route 2 comprise the highest total of Medium-high and High biophysical sensitivities when added together, although Alternative Route 3 comprises the second highest areas of High biophysical sensitivity.

Available data on the SANBI database indicates the presence of approximately 906 species within the ¼-degree grid (2528CC) in which the study area is situated. The prominence of herbs, shrubs, grasses and geophytes indicates a high diversity of habitat types, dominated by a grassland physiognomy. The high floristic diversity provides indication that extensive parts of the study area comprises pristine habitat. Numerous invasive and exotic species are however present throughout the region. A total of 133 plant families are represented in the study area, including Poaceae, Fabaceae, Asteraceae and Cyperaceae.

### **Habitat Types**

An analysis of aerial photographs and results of the field surveys revealed the following floristic habitat types within the corridor options:

- » Degraded Grassland Habitat Medium with low Floristic Sensitivity;

- » Natural Grassland Habitat with medium-high Floristic Sensitivity;
- » Ridge Habitat Type with High Floristic Sensitivity;
- » Stands of Exotic Trees with low Floristic Sensitivity;
- » Transformed Areas with low Floristic Sensitivity; and
- » Wetland Habitat Types with medium-high Floristic Sensitivity.

Naming precedence of faunal habitat types are in accordance with the floristic habitat types identified previous sections, including:

- » Grassland Habitat (Natural and Degraded) Medium characterised by high Faunal Sensitivity
- » Ridge Habitat Type characterised by high Faunal Sensitivity
- » Stands of Exotic Trees characterised by low Faunal Sensitivity
- » Transformed Areas characterised by low Faunal Sensitivity
- » Wetland Habitat Types characterised by medium-high Faunal Sensitivity

## Habitats

The corridor options will potentially affect a Class 3 ridge. Significant ridge areas are present in the middle sections of Alternative corridor 1 and 2.

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 are 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. 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. It follows that ridges will be characterized by a particularly high biodiversity; as such their protection will contribute significantly to the conservation of biodiversity in Gauteng.

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 (*Chrysochrysis 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.

Alternative Route 3 comprises no high sensitivity areas, rendering this option more suitable for the proposed development than either of the other two options, which comprises relative large areas of high faunal sensitivities. The current status of grassland habitat within existing servitudes (Alternative Route 3) indicates that it is possible to mitigate against expected impacts within a grassland habitat.

- » A total of 58 butterfly species are listed for the Q-grid 2528CC, including one Red Data species, namely the Marsh Sylph (*Metisella meninx*).
- » A total of 12 frog species are listed for the Q-grid 2528CC, including one Red Data species, namely the Giant Bullfrog (*Pyxicephalus adspersus*).
- » A total of 45 reptile species are listed for the Q-grid 2528CC. No Red Data reptile species are regarded likely to occur in the study area.
- » A total of 80 mammal species are listed for the region of the study area, including 19 Red Data species.

Alternative Route 1 is regarded the most diverse in terms of available faunal habitat and is expected to exhibit the highest faunal diversity. However, none of the Red Data species listed for the general area are highly likely to be found in the study area. One species of concern is however considered a likely inhabitant, namely *Ichnestoma stobbiai*.

Alternative Route 2 is regarded the second-most diverse in terms of available faunal habitat of the three corridor options. It is likely to host all of the terrestrial species found in the study area of Alternative Route 1, but lack the aquatic and amphibian species limited to the wetland habitat found within Alternative Route 1. It is also considered a likely host of *Ichnestoma stobbiai*.

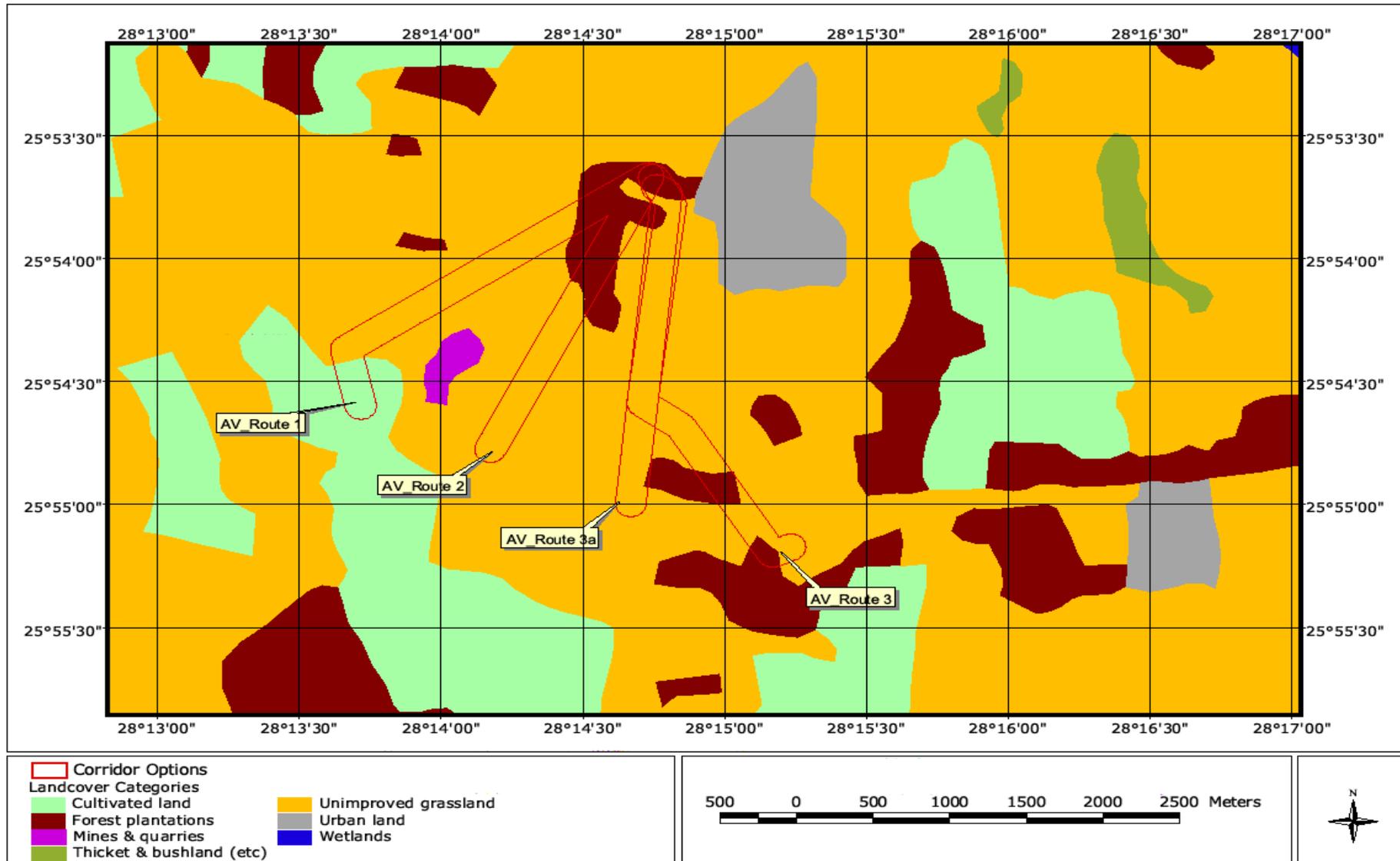
Alternative Route 3 is the least diverse in terms of faunal habitat. It is likely to host all of the terrestrial grassland species found in the general study, but will lack the aquatic and amphibian species limited to the wetland habitat as well as the ridge specialist species found on the dolomite Ridge Habitat of Alternative Routes 1 and 2.

While alternative Route 3a hosts all of the terrestrial grassland species found in the general study, it lacks the aquatic and amphibian species limited to the wetland habitat as well as the ridge specialist species found on the dolomite Ridge Habitat of Alternative Routes 1 and 2.

Results of the respective floristic and faunal sensitivity analysis are combined to present an overview of the ecological sensitivity of the habitat types identified in the assessment (refer to Figure 4.7). The following ecological sensitivities are ascribed to habitat types:

- |                              |                                     |
|------------------------------|-------------------------------------|
| » Degraded Grassland Habitat | Medium-high Ecological Sensitivity; |
| » Natural Grassland Habitat  | Medium-high Floristic Sensitivity;  |
| » Ridge Habitat Type         | High Floristic Sensitivity;         |
| » Stands of Exotic Trees     | Low Floristic Sensitivity;          |
| » Transformed Areas          | Low Floristic Sensitivity; and      |
| » Wetland Habitat Types      | Medium-high Floristic Sensitivity.  |

The integrated floristic sensitivity map is regarded representative of the biodiversity sensitivity of the area, indicating that Alternative Routes 1 and 2 are not regarded suitable for the proposed development as a result of the presence of various Red/ Orange Data flora species and communities within these two corridor options. Alternative Route 3 and 3a are therefore recommended for the proposed development, although fairly extensive Medium-high ecological sensitivity areas are present within this option. Evidence of existing lines along the Alternative Routes 3 and 3a option bears sufficient evidence to the potential to mitigate expected impacts.



**Figure 4.7:** Land cover of the study area

Extensive areas within the study area are transformed and some parts of remaining natural habitat is highly fragmented and isolated. However, the largest extent of the study area comprises natural habitat that is characterised by high continuity, i.e., much of the transformation is nodal in nature and while high levels of transformation is present, a high level of continuity is also noted, implying that organisms are able to migrate extensive distances without having to cross any unnatural borders (moderate habitat isolation). The proposed development is not expected to contribute towards local and regional levels of fragmentation and isolation.

The three corridor options are situated within the Carletonville Dolomite Grassland vegetation type. This vegetation type is present on slightly undulating plains dissected by prominent rocky chert ridges. Species-rich grasslands form a complex mosaic pattern dominated by many species. It is regarded as Vulnerable; small extents are conserved in statutory reserves, including Sterkfontein Caves, Oog van Malmanie, Abe Bailey, Boskop Dam Schoonspruit, Krugersdorp, Olifantsvlei and Groenkloof. Almost a quarter is already transformed by cultivation, urban sprawl or by mining activity as well as the building of the Boskop and Klerkskraal Dams. The endemic species *Delosperma davyi* occurs in this vegetation type. Available data on the SANBI database indicates the presence of approximately 906 species within the ¼-degree grid (2528CC) in which the study area is situated. This high floristic diversity is the result of highly diverse biophysical attributes, including soils, geology, micro-climatic conditions, moisture regimes, slopes, aspect, rockiness, soil depth, etc. A dissemination of the growth forms that occur in the region is presented in Table 3. The prominence of herbs (344 species, 38.0%), shrubs (113 species, 12.5%), grasses (128 species, 14.1%) and geophytes (105 species, 11.6%) indicates a high diversity of habitat types. The high diversity of species also provides indication that extensive parts of the study area comprises habitat of a pristine nature in which the natural diversity of the region is reflected. The contribution of weeds and invasive species is also noted and numerous invasive and exotic species are present throughout the region.

A total of 133 plant families are represented in the study area. Prominent families include Poaceae (128 species, 14.1%), Fabaceae (93 species, 10.3%), Asteraceae (89 species, 9.8%) and Cyperaceae (48 species, 5.3%). An analysis of aerial photographs and results of the field surveys revealed the following communities and variations within the proposed corridors (refer to Figure 4.7):

- » Degraded Grassland Habitat;
- » Natural Grassland Habitat;
- » Ridge Habitat Type;
- » Stands of Exotic Trees;
- » Transformed Areas; and

» Wetland Habitat Types.

The extent of habitat types within the corridor options is presented in Table 4.3

**Table 4.3:** Extent of habitat types in the study area

<b>Extent of habitat types within corridor sections</b>				
<b>Habitat Type</b>	<b>Corridor 1</b>	<b>Corridor 2</b>	<b>Corridor 3</b>	<b>Corridor 3a</b>
Degraded Grassland Habitat	12.3 ha	2.8 ha	7.0 ha	37 ha
Natural Grassland Habitat	17.5 ha	5.8 ha	41.0 ha	36.4 ha
Ridge Habitat Type	12.0 ha	20.2 ha	0.0 ha	0.1 ha
Stands of Exotic Trees	6.4 ha	13.6 ha	9.3 ha	5.2 ha
Transformed Areas	2.5 ha	2.6 ha	4.7 ha	0.9 ha
Wetland Habitat Types	3.2 ha	0.0 ha	0.0 ha	0.0 ha
<b>Total</b>	<b>53.9 ha</b>	<b>45.0 ha</b>	<b>62.0 ha</b>	<b>42.6 ha</b>

### Floristic and Faunal Sensitivity Analysis in the study area

The extent of biophysical sensitivities within the respective corridor options are calculated in Table 4.4, indicating that Alternative corridor 1 and Alternative corridor 2 comprises the highest total of High and Medium-high biophysical sensitivities when added together (25.8 ha and 23.2 ha respectively); although Alternative corridor 3 and 3a comprise the second highest extent of High sensitivity areas (7.6 ha).

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.

This assessment indicates the high sensitivity of Alternative 1 and Alternative 2 in terms of biophysical attributes. Certain biophysical attributes within Alternatives 3 and 3a are regarded highly sensitive, but mitigation against significant impacts is regarded possible and either of these routes is regarded suitable in terms of biophysical habitat sensitivities.

Extension of the existing Verwoerdburg Substation is not expected to result in adverse impacts within high biophysical sensitivity areas. The area immediately adjacent to the existing Verwoerdburg Substation is regarded transformed and degraded.

### Floristic and Faunal Sensitivity Analysis in the study area

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sensitivities when added together (25.8 ha and 23.2 ha respectively); although Alternative corridor 3 and 3a comprise the second highest extent of High sensitivity areas (7.6 ha).

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This assessment indicates the high sensitivity of Alternative 1 and Alternative 2 in terms of biophysical attributes. Certain biophysical attributes within Alternatives 3 and 3a are regarded highly sensitive, but mitigation against significant impacts is regarded possible and either of these routes is regarded suitable in terms of biophysical habitat sensitivities.

Extension of the existing Verwoerdburg Substation is not expected to result in adverse impacts within high biophysical sensitivity areas. The area immediately adjacent to the existing Verwoerdburg Substation is regarded transformed and degraded.

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

Section	Low/ Sensitivity	No Medium Sensitivity	Medium-high Sensitivity	High Sensitivity
Alternative 1	17.8 ha	10.3 ha	10.7 ha	15.1 ha
Alternative 2	16.3 ha	5.4 ha	20.2 ha	3.1 ha
Alternative 3	1.9 ha	40.4 ha	0.0 ha	7.6 ha
Alternative 3a	40.8 ha	34.2 ha	0.1 ha	7.2 ha

**Table 4.5:** Floristic sensitivity of habitat types within the study area

Criteria	RD species	Landscape sensitivity	Status/Ecological quality	Species composition	Functionality/ fragmentation	TOTAL	SENSITIVITY INDEX	SENSITIVITY CLASS
<b>Community</b>	<b>Criteria Ranking</b>							
Degraded Grassland Habitat	3	3	4	5	2	100	34%	Medium-low
Natural Grassland Habitat	8	8	8	9	7	235	76%	Medium-high
Ridge Habitat Type	10	10	10	9	9	285	92%	High
Stands of Exotic Trees	2	2	2	1	1	53	17%	Low
Transformed Areas	1	1	1	2	3	35	11%	Low
Wetland Habitat Types	6	10	5	6	8	202	65%	Medium-high

Faunal sensitivities are based on the assessment of the following habitat attributes:

- » Current biophysical habitat status;
- » Ecological linkages to other areas of suitable faunal habitat (migration potential);
- » Red Data probabilities.

The calculation of faunal sensitivities are presented in Table 4.6 and visually presented in Figure 4.6. 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.

**Table 4.6:** Faunal Habitat sensitivity for the study area

Community	Status	Linkage	RD Likelihood	Average	Sensitivity Class
Grassland Habitat	8	6	8	73%	Medium-High
Ridge Habitat Type	9	8	10	90%	High
Stands of Exotic Trees	2	2	1	17%	Low
Transformed Areas	1	1	0	7%	Low
Wetland Habitat Types	4	9	9	73%	Medium-High

These habitat types are often associated with environmental features that are also regarded as sensitive, such as riparian zones, aquatic habitat and rocky outcrops (ridges). The extent of habitat sensitivities within the respective corridor options is indicated in Table 4.7. It is evident that Alternatives 3 and 3a comprise extremely little high sensitivity areas, rendering these options more suitable for the proposed development than either of the other two options, which comprises relative large areas that are regarded high in faunal sensitivities. The status of grassland within existing servitudes indicates that it is regarded possible to mitigate expected impacts within a grassland habitat.

**Table 4.7:** Extent of faunal habitat sensitivities within corridor options

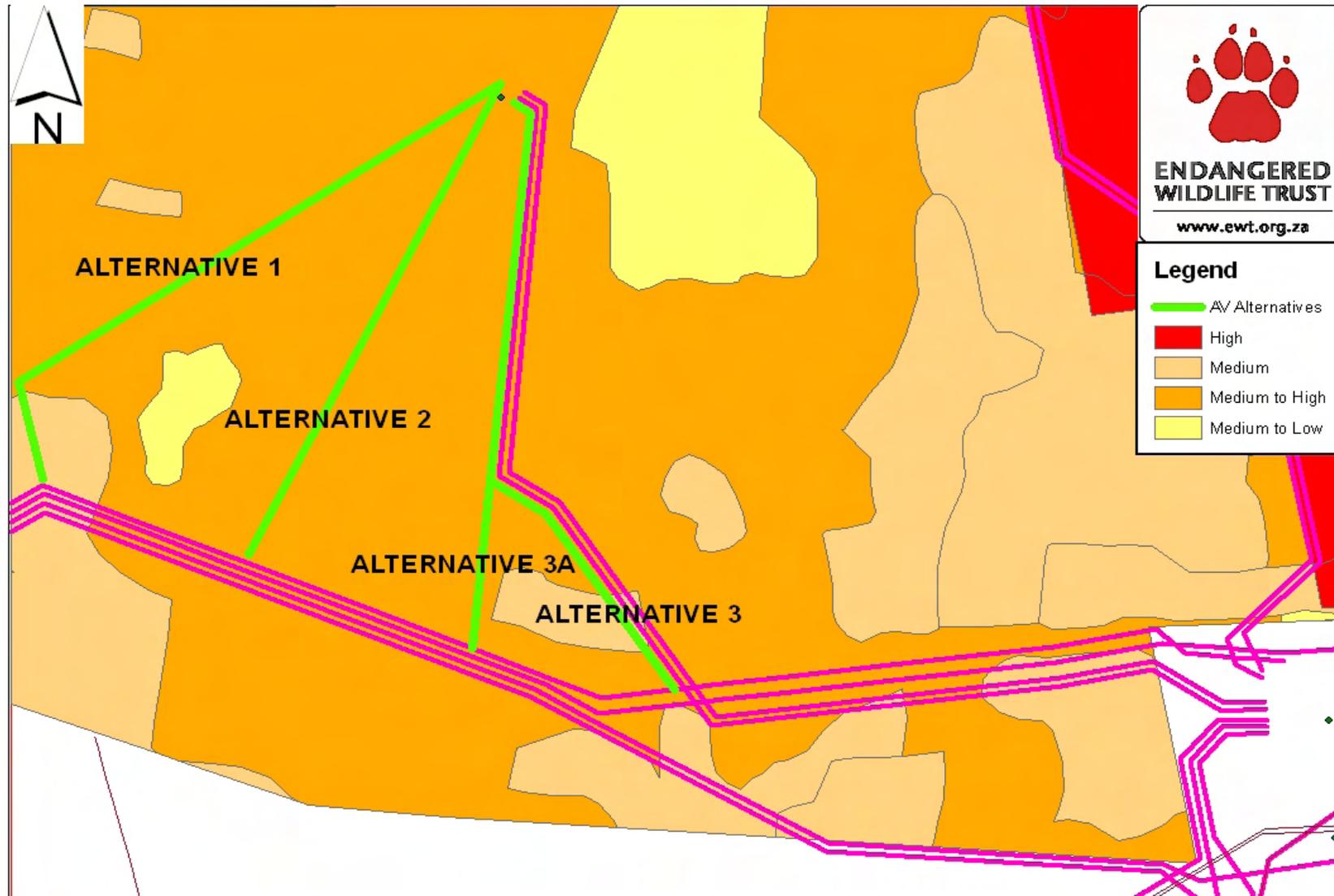
Corridor Option	Low	Medium-high	High
Alternative 1	8.9 ha	33.0 ha	12.0 ha
Alternative 2	16.2 ha	8.6 ha	20.2 ha
Alternative 3	14.0 ha	48.0 ha	0.0 ha
Alternative 3a	6.1 ha	40.1 ha	0.1 ha

Extension of the existing Verwoerdburg Substation is not expected to affect highly sensitive faunal habitat. The area adjacent to the existing Verwoerdburg substation does not exhibit any faunal attributes of importance.

As can be seen in the Figure 4.7, it is evident that the region is relatively transformed, with only some areas of remaining natural habitat remaining in the region. Urbanisation, stands of exotic trees and agriculture represents the major land transformation effects within the region. Road infrastructure has caused a relative high degree of habitat fragmentation and isolation. The following species are regarded representative of the Carletonville Dolomite Grassland vegetation type. Examples of these birds include the Blue Crane, African Grass Owl, White-bellied Khoraan, Secretarybird, White Stork and Abdims Stork. Avifaunal micro-habitats identified within the study area include (refer to Figure 4.7):

- » **Grassland Patches:** The low reporting rate for these species (Harrison *et al* 1997) is evidence of the impact that the surrounding developments are having on the birds that would, under optimum conditions, inhabit these open areas.
- » **Ridge Habitat:** These areas are, similarly to the wetland areas, regarded as being extremely sensitive in terms of the conservation targets of GDARD since they provide for high spatial heterogeneities, and are thereby likely to sustain populations of conservation important invertebrate species such as the rock scorpion *Hadogenes* spp and baboon spiders of the genera Harpactira (both genera are currently protected by Schedule B1 of the list of threatened and protected species issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004).

From a functional perspective, hills and ridges are important landscape features assisting winged invertebrates in locating potential mating partners.



**Figure 4.8:** Avifauna Sensitive Areas identified for the Pretoria SEA (2008)

On a landscape scale, ridges facilitate animal dispersal to other nearby rocky outcrops and ridges (so-called “stepping stones”) and thereby function as important ecological linkages. These micro habitats have been taken into account in identifying the sensitive areas within this study area.



**Photograph 4.3:** Typical grassland patches in the study area

All the soils around the Verwoerdburg substation are shallow and/or rocky, and have a low potential for arable agriculture. There is thus no limitation to the expansion of the substation as far as soils and agricultural potential is concerned.

In the immediate vicinity of the proposed alternatives, most of the soils are shallow (<400 mm) on rock, with much surface rock outcropping. Alternative 1 crosses a narrow band of deeper soils, close to the Olifantsspruit stream. Further to the south and south-west, deeper, red soils occur, while to the east, zones of moderately deep, red and yellow-brown soils are found. A variety of soil types occur in the study area, which derived from the weathering of dolomite. Rocky outcrops occur on the ridges traversed by the proposed alternative corridor 2. High potential soils were also found on the western part of the site (refer to Table 4.8 and Figure 4.9).

**Table 4.8:** Agricultural Potential

<b>Agricultural Potential Class</b>	<b>Soil Mapping Units</b>	<b>Effective Depth (mm)</b>
<b>HIGH</b>	Deep to moderately deep Hutton & Avalon soils; no or few physical limitations	600-1200

<b>MODERATE</b>	Moderately deep or variable depth soils; limited depth and occasionally heavy texture	300-1200
<b>LOW</b>	Shallow, gravelly soils, often with some rock; severe depth limitation	< 600
<b>ROCKY</b>	Significant rock outcropping (>40%), usually shallow soils with severe depth limitation	< 300
<b>WET AREAS</b>	Low-lying areas, soils prone to seasonal waterlogging or flooding	< 300
<b>WASTE</b>	Industrial waste areas, such as mine dumps or slimes dams etc	-
<b>URBAN</b>	Housing, industrial, mining, commercial areas etc; not surveyed	-

The soils of the study area are strongly related to the underlying geology and most of the dolomite is overlain by shallow red-brown gravelly soils. The soils are generally less than 500 mm deep (ECO Assessments, 2007). The parent material of the area comprises of dolomite and chert of the Malmani Subgroup, Chuniespoort Group (Geological Survey, 1978).

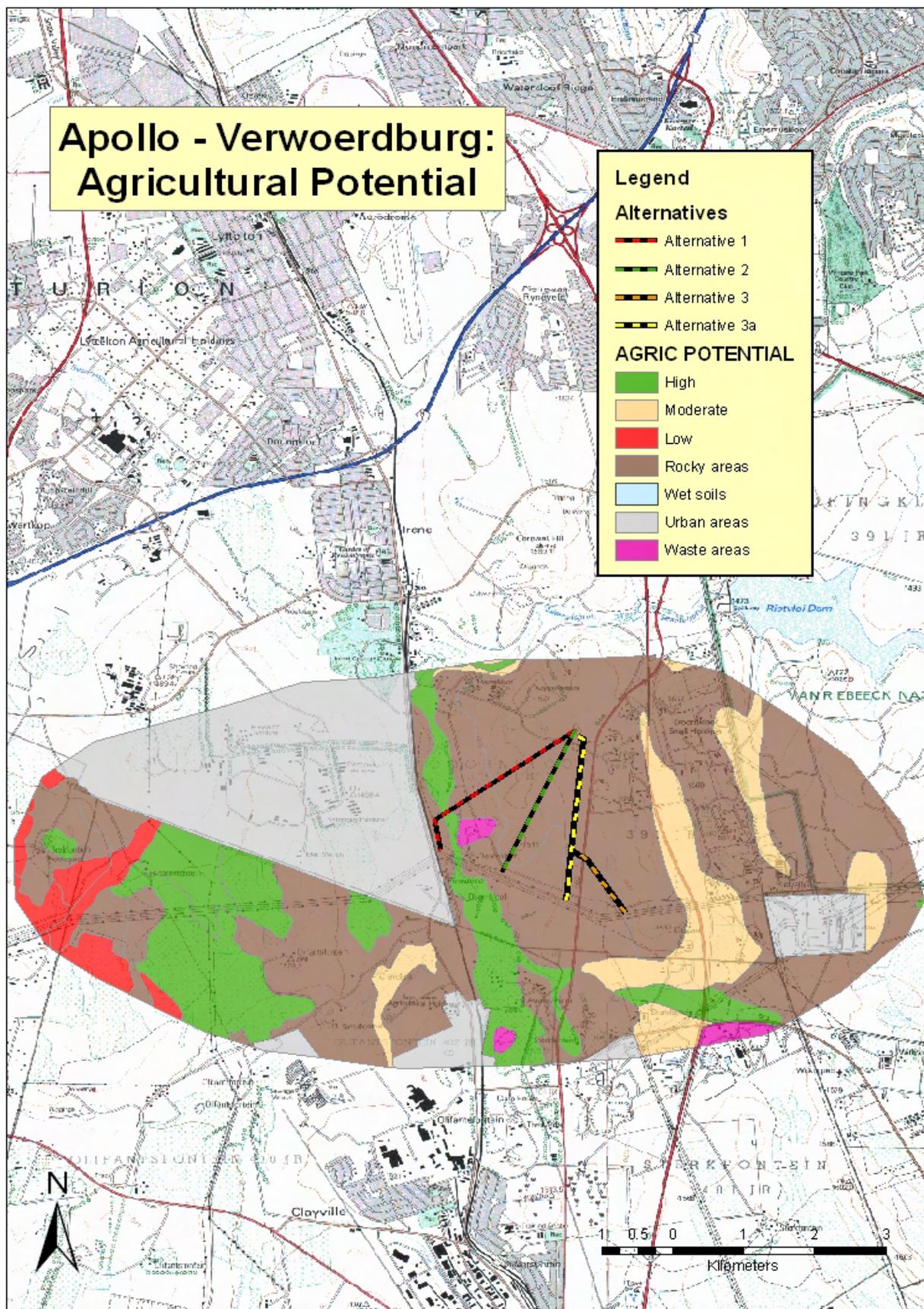


Figure 4.9: Soil Map in the study area

## **ASSESSMENT OF IMPACTS: VERWOERDBURG SUBSTATION EXTENSION AND TURN-IN AND OUT POWER LINES**

### **CHAPTER 5**

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In order to strengthen the supply of electricity to the Pretoria region, Eskom proposes the construction and operation of a number of new substations and transmission power lines within the Tshwane municipal area with the aim to reinforce the existing electricity supply, primarily to this municipal area. This proposal forms part of the **City of Tshwane Electricity Supply Plan Scheme (CTESPS)**, and includes the extension of the Verwoerdburg substation and 400kV Apollo-Pluto turn-in transmission power lines. Eskom envisages that these developments will meet the metropolitan area's increased demand for electricity, as well the power needs of the Gautrain operation.

One feasible site north-west of the existing Verwoerdburg substation was identified for the expansion of this existing substation. This site is investigated in detail in the EIA Phase of the process. Three alternative corridors were identified and assessed for the turn-in power lines.

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed site for the extension of the existing Verwoerdburg substation and transmission turn-in lines, and to make recommendations for the management of these impacts for inclusion in the draft Environmental Management Plan (refer to Appendix L).

#### **5.1. Assessment of Potential Impacts on Ecology**

Rating of impacts is based on the estimated effect that construction and operation of proposed turn-in power lines and the substation extension will have on terrestrial biodiversity and ecological attributes of the study area. No impacts were identified that could lead to a beneficial impact on the identified habitat type within the study area since the proposed development is largely destructive. Potential impacts include the following, but are not necessarily limited to:

- » Direct impacts:
  - Destruction of threatened flora & fauna species & associated habitat;
  - Direct impacts on common fauna species;
  - Destruction of sensitive/ pristine regional habitat types;
- » Indirect Impacts:
  - Impacts on surrounding habitat/ species;
- » Cumulative Impacts:
  - Impacts on local and national conservation obligations & targets;
  - Increase in local and regional fragmentation/ isolation of habitat; and
  - Increase in environmental degradation.

Expected impacts are mostly as a result of the physical disturbance of surface areas and clearance of servitudes during the construction period. Impacts within the Ridge Habitat are regarded to be highly significant and expected impacts are regarded as unacceptable, particularly since various Red/ Orange Data plant species are known to occur within this environment (refer to Appendix F). Corridor options that comprise highly sensitive habitat types are therefore regarded unsuitable for the proposed development and the 'No Go' option is therefore recommended for Alternative Routes 1 and 2 from a biodiversity perspective.

Impacts within the remainder of the area, Alternative Route 3 and alternative 3a recommended subsequent to the EIA specialist workshop are regarded to be of moderate nature and the implementation of generic mitigation measures is expected to minimise likely impacts within these environments (refer to biodiversity specialist report contained within Appendix F).

Impacts during the operational phase of the project are mostly restricted to the maintenance procedures within the servitudes as well as latent effects of habitat alteration. Impacts are generally regarded to be of a moderate nature and the implementation of generic mitigation measures are expected to decrease the significance of impacts to an acceptable level within Alternative Route 3.

Impacts on flora and fauna on site are expected to occur mainly in the construction phase of the substation and the turn-in power lines. The assessment of impacts associated with the extension of the substation also takes the construction and operation of proposed power lines into consideration. The potential presence of Red Data in close proximity to the substation site does not influence the site selection process.

In the event of decommissioning of the infrastructure, impacts are expected to be similar to those experienced during the maintenance phase (i.e. as a result of disturbance habitats and ecosystems).

#### **5.1.1. Nature of Potential Impacts of the proposed substation extension and associated 2X400kV turn-in/out Apollo-Pluto power lines**

##### ***5.1.1.1. Destruction of Threatened Flora & Fauna Species & Associated Habitat***

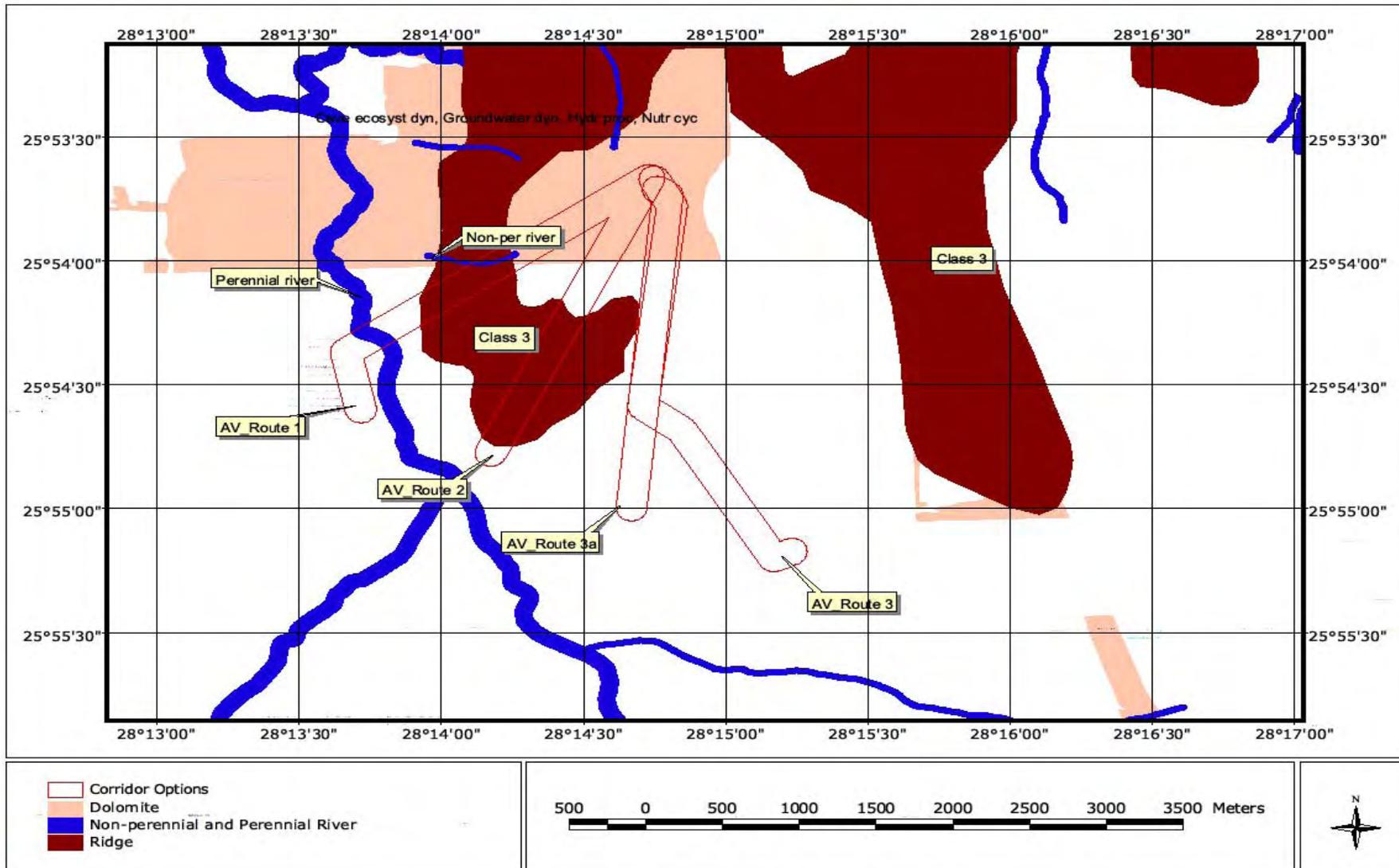
The loss of Red Data or Threatened species or areas that are suitable for these species is a significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they are

frequently an indication of pristine habitat conditions. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance.

Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Habitat changes, mostly a result of human interferences and activities, are one of the greatest reasons for these species having a threatened status. Surface transformation activities within habitat types that are occupied by flora species of conservation importance will definitely result in significant and permanent impacts on these species and their population dynamics. Effects of this particular impact are usually permanent and recovery or mitigation is generally not perceived as possible.

One of the greatest drawbacks in terms of limiting this particular impact is that extremely little information is generally available in terms of the presence, distribution patterns, population dynamics and habitat requirements of Red Data flora species. However, in this particular instance, a Red/ Orange Data investigation revealed the presence and extent of various important species within some of the corridor options. Eliminating these options as viable corridors for the proposed project, as a result of significant impacts on conservation important species, therefore becomes possible. Furthermore, by applying ecosystem conservation principles to this impact assessment and subsequent planning and development phases, resultant impacts will be limited to a large extent.

Direct threats to threatened fauna species is regarded low in probability, mainly as a result of the ability of fauna species to migrate away from areas where impacts occur. Probably the only exception to this statement will be in the event where extremely localised habitat that are occupied by threatened fauna species are impacted by construction and operational activities to the extent that the habitat no longer satisfy the habitat requirements of the particular species. This impact is highly likely to occur as a result of the known presence of Red/ Orange Data flora species within the corridor options. It is highly likely to result in significant and severe impacts and is therefore likely to result in the recommendation of 'No Go' options for some of the corridor options (refer to Figure 5.1).



**Figure 5.1:** C-Plan Sensitivities within the study area

### **5.1.1.2. Direct Impacts on Common Flora & Fauna Species**

The likelihood of direct impact affecting common fauna species is relatively low as a result of the ability of animal species to migrate away from direct impacts. The tolerance levels of common animal species occurring in the study area and impacts resulting from the proposed development is of such a nature that surrounding areas will suffice in habitat requirements of species forced to move from areas of impact during periods of impacts, while affected areas are likely to become repopulated subsequent to high impact periods.

It is likely that common flora species are widespread and occur fairly abundantly in adjacent habitat. The possibility of the proposed power lines and substation affecting common flora species, to the extent that their conservation status might change, is regarded highly unlikely.

This impact, although highly likely to occur, is likely to result in fairly low significance.

### **5.1.1.3. Destruction of Sensitive/ Pristine Regional Habitat Types**

The loss of pristine natural regional habitat types identified within the study area represents loss of habitat and biodiversity on a regional scale. Sensitive habitat types include ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is usually ascribed to floristic communities and faunal assemblages of these areas as they contribute significantly to the biodiversity of a region. Furthermore, these habitat types are generally isolated and are frequently linear in nature, such as rivers and ridges. Any impact that disrupts this continuous linear nature will risk fragmentation and isolation of existing ecological units, affecting the migration potential of some fauna species adversely, pollinator species in particular.

Considering the relative high fragmentation and isolation factors in the general surrounds, the presence of sensitive and pristine habitat types, a high conservation value is ascribed to these areas. The pristine status of natural grassland habitat within the study area is an important factor that is likely to result in strong recommendations pertaining to the suitability of certain corridor options. Impacts within these areas are most likely to result in severe and significant impacts.

#### ***5.1.1.4. Impacts on Local and National Conservation Obligations & Targets***

This impact is regarded as a cumulative impact since it affects the status of conservation strategies and targets on a local, regional and national level and is viewed in conjunction with other types of local and regional impacts that affect areas of conservation importance. Impacts that could potentially affect the status of protected areas are regarded unacceptable and should be avoided at all costs. Natural habitat in the general surrounds of areas of conservation importance act as a buffer for these areas and also as a potential source of genetic variability, particularly in the case of relatively small conservation areas.

The importance of extensive parts of the study area has been confirmed in the Red/ Orange Data flora assessment as well as in this biodiversity assessment. Potential impacts on these areas of conservation importance is likely to result in severe and significant impacts (refer to Figure 5.1).

#### ***5.1.1.5. Increase in Local & Regional Fragmentation/ Isolation of Habitat***

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size. The danger in this type of cumulative impact is that effects are not known, or not visible; with immediate effect and normally when these effects become visible they are beyond repair. Linear developments such as roads affect the migratory success of animals in particular.

An important mitigation measure in this regard is to utilise existing corridors of habitat fragmentation. By aligning new servitudes with existing ones or with roads, current levels of habitat fragmentation will not be increased significantly. In contrast, constructing new power lines through areas of unfragmented habitat, the adverse effects of habitat fragmentation and isolation will be maximised. Therefore, where potential servitudes are presented with similar sensitivities, a potential alignment with an existing servitude might result in one being more suitable for the proposed development than an option affecting an area of largely untransformed habitat. Unfortunately this is not always a clear-cut case as it is heavily dependent on the local and regional sensitivity of the existing line, which might be located in areas of high sensitivity, while a line going through

untransformed habitat might represent impacts of lower significance in terms of other types of impacts.

#### **5.1.1.6. Increase in Environmental Degradation**

Impacts associated with this particular type of development that will lead to initial, incremental or augmentation of existing types of environmental degradation include impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases are these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor. Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

The following series of tables provides a summary of the potential impacts on ecology associated with the extension/construction and operation of the proposed substation and turn-in power lines. Significance of impacts is rated as **high**, **moderate**, or **low** in accordance with the methodology described in Chapter 3 of this report.

#### ***Impact tables summarising the significance of impacts on ecology (with and without mitigation)***

##### ***Impact Assessment for substation extension***

<b><i>Nature of Impact: Impacts on common flora and fauna</i></b>		
Moderate levels of transformation of natural habitat types are associated with this particular development. Transformation of natural environments inevitably result in the establishment of habitat types that are not considered representative of the region. Surrounding areas are frequently invaded by shrubs, woody and weedy pioneer species, affecting the local biodiversity adversely. Similarly, habitat attributes of isolation and migration corridors are adversely affected.		
	<b>Before Mitigation</b>	<b>After Mitigation</b>
<b><i>Extent</i></b>	4 (Regional)	4 (Regional)
<b><i>Duration</i></b>	5 (Long term)	5 (Long term)
<b><i>Magnitude</i></b>	4 (Moderate)	4 (Moderate)
<b><i>Reversibility</i></b>	5 (Irreversible)	5 (Irreversible)
<b><i>Probability</i></b>	5 (Probable)	5 (Probable)
<b><i>Significance</i></b>	<b>90 (High)</b>	<b>90 (High)</b>
<b><i>Status</i></b>	Negative	Negative

<b>Irreplaceable loss of resources?</b>	Yes
<b>Can impacts be mitigated</b>	No
<b>Mitigation</b>	
» Not possible	
<b>Cumulative Impacts</b>	
» Habitat degradation, loss of conservation areas, increase in conservation status of species	
<b>Residual Impacts</b>	
» Degradation of pristine habitat, infestation by weeds and alien species, erosion, species loss.	

**Impact Assessment for turn-in power line alternatives**

<b>Nature of Impact: Destruction of Sensitive Habitats - Impacts of power lines within the corridor alternative 1</b>		
Sensitive habitat types identified in the broader study area include ridges, outcrops, riparian habitat and localised floristic variations of significant physiognomic variation and species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds, having adapted to atypical habitat conditions. A high conservation value is attributed to the floristic communities and faunal assemblages that characterise these areas as they contribute significantly to the biodiversity of a region. These habitat types are furthermore frequently isolated and are mostly linear in nature, such as rivers and ridges. Any impact that disrupts this continuous linear nature will result in fragmentation and isolation of existing ecological units, affecting the migration potential of some fauna species adversely, pollinator species in particular.		
	<b>Before Mitigation</b>	<b>After Mitigation</b>
<b>Extent</b>	4 (Regional)	4 (Regional)
<b>Duration</b>	5 (Long term)	5 (Long term)
<b>Magnitude</b>	4 (Moderate)	4 (Moderate)
<b>Reversibility</b>	5 (Irreversible)	5 (Irreversible)
<b>Probability</b>	5 (Probable)	5 (Probable)
<b>Significance</b>	<b>90 (High)</b>	<b>90 (High)</b>
<b>Status</b>	Negative	Negative
<b>Irreplaceable loss of resources?</b>	Yes	
<b>Can impacts be mitigated</b>	No	
<b>Mitigation</b>		
» Not possible		
<b>Cumulative Impacts</b>		
» Habitat degradation, loss of conservation areas, increase in conservation status of species		
<b>Residual Impacts</b>		
» Degradation of pristine habitat, infestation by weeds and alien species, erosion, species loss.		

<b>Nature of Impact: Removal of Red Data Species</b> The loss of threatened/ protected species or habitat that is suitable for Red Data species represents a	<b>Impacts of power lines within Corridor Alternative Route 2</b>	
	<b>Without Mitigation</b>	<b>With Mitigation</b>

significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as there are generally few of them, but they are extremely important in terms of the biodiversity of an area and high ecological value is placed on the presence of such species in an area. Surface disturbances resulting from the proposed activity represent a significant and important impact on the status and conservation value of pristine regional vegetation types, where present and recovery from these impacts and mitigation of the extent and significance of the impacts are not possible.		
Extent	4 (Regional)	4 (Regional)
Duration	5 (Long term)	5 (Long term)
Magnitude	4 (Moderate)	4 (Moderate)
Reversibility	5 (Irreversible)	5 (Irreversible)
Consequence	18	18
Probability	5 (Probable)	5 (Probable)
<b>Significance</b>	<b>90</b>	<b>90</b>
Status	Negative	Negative
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated	No	
Mitigation	Not possible	
Cumulative Impacts	Habitat degradation, loss of conservation areas, increase in conservation status of species	
Residual Impacts	Degradation of pristine habitat, infestation by weeds and alien species, erosion, species loss.	

<b>Nature of Impacts: Habitat Destruction</b> A possibility exists that due to the transformed nature of the site along this corridor, the site is now devoid of any species of significance. The surrounding areas and species present in surrounding areas have been affected by impacts resulting from the existing infrastructure such as roads and power lines.	<b>Impacts of power lines within Corridor Alternative Route 3</b>	
	<b>Without Mitigation</b>	<b>With Mitigation</b>
Extent	2 (Local)	1 (Local)
Duration	4 (Medium term)	3 (Medium term)
Magnitude	4 (Moderate)	3 (Moderate)
Reversibility	3 (Irreversible, requires human input)	3 (Irreversible, requires human input)

Consequence	13	10
Probability	3 (Probable)	3 (Probable)
<b>Significance</b>	<b>39</b>	<b>30</b>
Status	Negative	Negative
Irreplaceable loss of resources?	No	
Can impacts be mitigated	Yes	
Mitigation	Proper tower placement, limited vegetation maintenance underneath power lines, generic mitigation	
Cumulative Impacts	Infestation by weeds and alien vegetation	
Residual Impacts	Erosion, changes in surface conditions	

<p><b><i>Nature of Impacts: Habitat Destruction</i></b> A possibility exists that due to the transformed nature of the site along this corridor, the site is now devoid of any species of significance. The surrounding areas and species present in surrounding areas have been affected by impacts resulting from the existing infrastructure such as roads and power lines.</p>	<b>Impacts of power lines within Corridor Alternative Route 3a</b>	
	<b>Without Mitigation</b>	<b>With Mitigation</b>
Extent	2 (Local)	1 (Local)
Duration	4 (Medium term)	3 (Medium term)
Magnitude	4 (Moderate)	3 (Moderate)
Reversibility	3 (Irreversible, requires human input)	3 (Irreversible, requires human input)
Consequence	13	10
Probability	3 (Probable)	3 (Probable)
<b>Significance</b>	<b>39</b>	<b>30</b>
Status	Negative	Negative
Irreplaceable loss of resources?	No	
Can impacts be mitigated	Yes	
Mitigation	Proper tower placement, limited vegetation maintenance underneath power lines, generic mitigation	
Cumulative Impacts	Infestation by weeds and alien vegetation	
Residual Impacts	Erosion, changes in surface conditions	

### ***5.1.2. Comparative Assessment of Alternative Turn-in power line corridors***

Impacts within the remainder of the area (Alternative Route 3) are regarded to be of moderate nature and the implementation of generic mitigation measures is expected to minimise likely impacts within these environments. Impacts during the operational phase of the project are mostly restricted to the maintenance procedures within the servitudes as well as latent effects of habitat alteration. Impacts are generally regarded to be of a moderate nature and the implementation of generic mitigation measures are expected to decrease the significance of impacts to a benign status within Alternative Route 3.

### ***5.1.3. Conclusions and Recommendations***

Based on the observed floristic and faunal sensitivities as well as the tabular assessment of potential impacts as detailed above, it is recommended from a biodiversity perspective that the proposed extension to the Verwoerdburg Substation be implemented. This recommendation is influenced by the fact that the extension of the substation would take place within the footprint of an existing substation.

The presence of extensive High sensitivity areas within Alternative Route corridors 1 and 2 renders these corridor options effectively unsuitable for the proposed development from a biodiversity perspective. The High floristic sensitivity within these options is ascribed on the basis of the presence of Red Data flora species, sensitive ridges and pristine vegetation. While extensive Medium-high sensitivity areas are present within Alternative Route corridors 3 and 3a, mitigation of potential impacts on pristine vegetation is regarded possible. Therefore Alternative corridors 3 and 3a are considered acceptable from a biodiversity perspective.

## **5.2. Assessment of Potential Impacts on Avifauna**

All four alternative corridors and the substation site occur on Carltonville Dolomite Grassland and as such it is expected that the grassland birds would be most well represented in this immediate area. Examples of these birds include the Blue Crane, African Grass Owl, White-bellied Khoraan, Secretarybird, White Stork and Abdims Stork.

Substations and power lines can impact avifauna through electrocutions, collisions, habitat destruction or disturbance.

These potential impacts are discussed and assessed in the tables below.

**Electrocutions and collisions** are possible within the substation yard during operation and this is caused by live phases that are close together being bridged by a birds extremities. Substations are generally lit and this can attract certain species however most species impacted on by substations are the less sensitive species and therefore of less concern. Electrocutions are not an issue on these larger lines as the wings of the birds cannot span between the conductors.

During the construction phase and maintenance of power lines and substations, some **habitat destruction and alteration** inevitably takes place. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, through the modification of habitat.

During the construction and maintenance of electrical infrastructure, a certain amount of **disturbance** to the surrounding area results. For shy, sensitive species this can impact on their usual daily activities, particularly whilst breeding. In general terms, one would expect that any species already existing in the study area must have adapted to relatively high levels of disturbance already present.

<b><i>Nature: Electrocution of birds in the substation yard</i></b>		
Bird species such as Blue Crane, African Grass Owl, White-bellied Khoraan, Secretarybird, White Stork and Abdims Stork may utilise the substation yard to feed or nest. Electrocution in the proposed substation HV yard is possible when certain species enter the HV yard.		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	1 (Local)	1 (Local)
<b>Duration</b>	4 (Long term)	4 (Long term)
<b>Magnitude</b>	0	0
<b>Probability</b>	0	0
<b>Significance</b>	0	0
<b>Status</b>	None	None
<b>Reversibility</b>	-	-
<b>Irreplaceable loss of resources</b>	-	-
<b>Can impacts be mitigated</b>	-	-
<b>Mitigation:</b> -		
<b>Cumulative impacts:-</b> None		
<b>Residual impacts:</b> - None		

<b>Nature: Electrocution of birds on the turn-in power lines</b>		
Electrocutions can have a negative impact on avifauna within the substation yards, however this negative impact will almost certainly be limited to non-sensitive species and thus will be of little concern.		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	1 (Local)	1 (Local)
<b>Duration</b>	4 (Long term)	4 (Long term)
<b>Magnitude</b>	0	0
<b>Probability</b>	0	0
<b>Significance</b>	<b>0</b>	<b>0</b>
<b>Status</b>	None	None
<b>Reversibility</b>	-	-
<b>Irreplaceable loss of resources</b>	-	-
<b>Can impacts be mitigated</b>	-	-
<b>Mitigation:</b> -		
<b>Cumulative impacts:</b> - None		
<b>Residual impacts:</b> - None		

<b>Nature: Collisions with the Transmission lines</b>		
	<b>Without mitigation</b>	<b>With mitigation</b>
Extent	1 (Local)	1 (Local)
Duration	4 (Long term)	4 (Long term)
Magnitude	3 (Medium)	2 (Low)
Probability	2 (Improbable)	2 (Improbable)
Significance	<b>26 (Low)</b>	<b>24 (Low)</b>
Status	Negative	Negative
Reversibility	5	5
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes-but not required	
Mitigation: » Not required if alternative 3 and 3a are selected		
Cumulative impacts: » Marginal if placed next to existing lines (Alternative 3)		
Residual impacts: » Medium		

***Nature: Habitat Destruction - substation***

During the construction and maintenance of the substations, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads and the levelling of substation yards. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the power line servitude associated with the turn-in lines, through the modification of habitat.

	<b>Without mitigation</b>	<b>With mitigation</b>
Extent	1 (Local)	1 (Local)
Duration	2 (Short term)	2 (Short term)
Magnitude	3 (Medium)	2 (Low)
Probability	3 (Probable)	2 (Improbable)
Significance	<b>27 (Low)</b>	<b>16 (Low)</b>
Status	Negative	Negative
Reversibility	3 (Reversible, required human input)	3 (Reversible, requires human input)
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	
Mitigation: » Minimal habitat destruction must occur during the clearing of substation yards.		
Cumulative impacts: Marginal because its an extension of an existing substation		
Residual impacts: » There will be medium residual impact as habitat that is removed will not recover fully		

***Nature: Disturbance of birds***

During the construction and maintenance of electrical infrastructure, a certain amount of disturbance results

	<b>Without mitigation</b>	<b>With mitigation</b>
Extent	1 (Local)	1 (Local)
Duration	2 (Short term)	2 (Short term)
Magnitude	2 (Low)	1 (Minor)
Probability	2 (Improbable)	1 (Improbable)
Significance	<b>12 (Low)</b>	<b>5 (Low)</b>
Status	Negative	Negative
Reversibility	1 (Reversible)	1 (Reversible)
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
<b>Mitigation:</b>		

<ul style="list-style-type: none"> <li>» Identify active nests during final walk-through survey</li> <li>» Limit construction and unnecessary driving past nests during breeding times. Nest may need to be relocated, if found.</li> <li>» The minimum amount of vehicles and machines must be used on site and specific care should be taken with these vehicles and machines in and around water courses.</li> </ul>
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> <li>» Marginal if placed next to existing lines (Alternative 3)</li> </ul>
<p>Residual impacts:</p> <ul style="list-style-type: none"> <li>» Low Residual impacts</li> </ul>

***Nature: Faulting-business impact (Impact of birds on quality of supply)***

There are a number of mechanisms through which birds are able to cause electrical faults on power lines. In the case of a bird streamer induced fault, the fault is caused by the bird releasing a 'streamer' of faeces which can constitute an air gap intrusion between the conductor and the earthed structure. The fault appears to flash across the air gap (i.e. between the live conductor and the tower steel work which is earthed) and does not follow an insulator creepage path as observed on pollution faults. Bird species capable of producing large or long streamers are more likely to cause streamer faults.

Bird pollution is a form of pre-deposit pollution. A flashover occurs when an insulator string gets coated with a pollutant, which could comprise the insulation properties of the string. When the pollutant is wetted, the coating becomes conductive, insulation breakdown occurs and flashover results. Since this involves a build up of bird faeces or bird pollution and not a once off event such as a streamer, the size of the bird is less important, although still a factor. Obviously the more an insulator string becomes coated with faeces; the more likely it is that the fault will occur. Larger birds and congregation of birds are likely to result in heavy pollution of insulator strings. Bird nests may also cause faults through nest material protruding and constituting an air gap intrusion.

	<b>Without mitigation</b>	<b>With mitigation</b>
Extent	1 (Local)	1 (Local)
Duration	4 (Medium term)	4 (Medium term)
Magnitude	2 (Low)	1 (Minor)
Probability	2 (Improbable)	1 (Improbable)
Significance	<b>20 (Low)</b>	<b>9 (Low)</b>
Status	Negative for business	Negative for business
Reversibility	3	3
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	Yes

Mitigation:
» Fit bird guards on self support and guyed V towers only if required.
Cumulative impacts:
» Negligible
Residual impacts:
» Low

***Nature: Electrocutation of birds in the substation yard***

Bird species such as Blue Crane, African Grass Owl, White-bellied Khoraan, Secretarybird, White Stork and Abdims Stork may utilise the substation yard to feed or nest. Electrocutation in the proposed substation HV yard is possible when certain species enter the HV yard.

	Without mitigation	With mitigation
Extent	1 (Local)	1 (Local)
Duration	4 (Long term)	4 (Long term)
Magnitude	0	0
Probability	0	0
Significance	<b>0</b>	<b>0</b>
Status	None	None
Reversibility	-	-
Irreplaceable loss of resources	-	-
Can impacts be mitigated	-	-
Mitigation: -		
Cumulative impacts: - None		
Residual impacts: - None		

***Nature: Electrocutation of birds on the turn-in power lines***

Electrocutions can have a negative impact on avifauna within the substation yards, however this negative impact will almost certainly be limited to non-sensitive species and thus will be of little concern.

	Without mitigation	With mitigation
Extent	1 (Local)	1 (Local)
Duration	4 (Long term)	4 (Long term)
Magnitude	0	0
Probability	0	0
Significance	<b>0</b>	<b>0</b>
Status	None	None
Reversibility	-	-
Irreplaceable loss of resources	-	-

Can impacts be mitigated	-	-
Mitigation: -		
Cumulative impacts: - None		
Residual impacts: - None		

<b><i>Nature: Collisions with the Transmission lines</i></b>		
	Without mitigation	With mitigation
Extent	1 (Local)	1 (Local)
Duration	4 (Long term)	4 (Long term)
Magnitude	3 (Medium)	2 (Low)
Probability	2 (Improbable)	2 (Improbable)
Significance	<b>26 (Low)</b>	<b>24 (Low)</b>
Status	Negative	Negative
Reversibility	5	5
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes-but not required	Yes-but not required
Mitigation: Not required if alternative 3 is selected		
Cumulative impacts: Marginal if placed next to existing lines (Alternative 3)		
Residual impacts: Medium		

<b><i>Nature: Habitat Destruction</i></b>		
<p>During the construction and maintenance of the substations, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads and the levelling of substation yards. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the power line servitude associated with the turn-in lines, through the modification of habitat.</p>		
	Without mitigation	With mitigation
Extent	1 (Local)	1 (Local)
Duration	2 (Short term)	2 (Short term)
Magnitude	3 (Medium)	2 (Low)
Probability	3 (Probable)	2 (Improbable)
Significance	<b>27 (Low)</b>	<b>16 (Low)</b>
Status	Negative	Negative
Reversibility	3	3
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes
<p>Mitigation: Environmental best practice must be followed and enforced: existing roads should be used and minimal habitat destruction must occur in or near any water courses. Minimal habitat destruction must occur during the building of the towers and clearing of the servitudes and substation yards. Where possible servitudes should be</p>		

left uncleared and as natural as possible.
Cumulative impacts: Marginal if placed next to existing lines (Alternative 3)
Residual impacts: There will be medium residual impact as habitat that is removed will not recover fully

**Nature: Disturbance of birds**

During the construction and maintenance of electrical infrastructure, a certain amount of disturbance results

	Without mitigation	With mitigation
Extent	1 (Local)	1 (Local)
Duration	2 (Short term)	2 (Short term)
Magnitude	2 (Low)	1 (Minor)
Probability	2 (Improbable)	1 (Improbable)
Significance	<b>12 (Low)</b>	<b>5 (Low)</b>
Status	Negative	Negative
Reversibility	1	1
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	Yes

**Mitigation:**

- » Identify active nests during final walk-through survey
- » Limit construction and unnecessary driving past nests during breeding times. Nest may need to be relocated, if found.
- » The minimum amount of vehicles and machines must be used on site and specific care should be taken with these vehicles and machines in and around water courses.

Cumulative impacts: Marginal if placed next to existing lines (Alternative 3)

Residual impacts: Low Residual impacts

**Nature: Faulting-business impact (Impact of birds on quality of supply)**

There are a number of mechanisms through which birds are able to cause electrical faults on power lines. In the case of a bird streamer induced fault, the fault is caused by the bird releasing a 'streamer' of faeces which can constitute an air gap intrusion between the conductor and the earthed structure. The fault appears to flash across the air gap (i.e. between the live conductor and the tower steel work which is earthed) and does not follow an insulator creepage path as observed on pollution faults. Bird species capable of producing large or long streamers are more likely to cause streamer faults.

Bird pollution is a form of pre-deposit pollution. A flashover occurs when an insulator string gets coated with a pollutant, which could comprise the insulation properties of

the string. When the pollutant is wetted, the coating becomes conductive, insulation breakdown occurs and flashover results. Since this involves a build up of bird faeces or bird pollution and not a once off event such as a streamer, the size of the bird is less important, although still a factor. Obviously the more an insulator string becomes coated with faeces; the more likely it is that the fault will occur. Larger birds and congregation of birds are likely to result in heavy pollution of insulator strings. Bird nests may also cause faults through nest material protruding and constituting an air gap intrusion.

	Without mitigation	With mitigation
Extent	1 (Local)	1 (Local)
Duration	4 (Medium term)	4 (Medium term)
Magnitude	2 (Low)	1 (Minor)
Probability	2 (Improbable)	1 (Improbable)
Significance	<b>20 (Low)</b>	<b>9 (Low)</b>
Status	Negative for business	Negative for business
Reversibility	3	3
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	Yes
Mitigation: Fit bird guards on self support and guyed V towers only if required.		
Cumulative impacts: Negligible		
Residual impacts: Low		

### ***6.2.1. Comparative Assessment for turn-in lines alternative corridors***

Alternative corridor 1 and 2 cross some open grassland, a ridge and a small stream, which is negative for avifauna as these are habitats that are attractive to certain sensitive bird species. These two alternative corridors are therefore not preferred from an avifauna perspective. In addition, these two alternative route corridors some open grassland and a small koppie, which is negative for avifauna as this is a potentially undisturbed area and as such good habitat for a variety of bird species passes over both medium and medium to high sensitive areas and as such has a higher impact whilst alternative corridor 3 and 3a follows the road for the majority of the route, this is positive for avifauna as the disturbance of the road will mean sensitive bird species are unlikely to occur in this area. For this reason, alternative corridor 3 and 3a are preferred corridors from an avifauna perspective.

### ***6.2.2. Conclusion and Recommendations***

Impacts on avifauna as a result of the construction, operation and eventual decommissioning of the substation and turn-in power lines are expected to be of

low significance for all species regardless of the power line corridor alternative selected.

In conclusion, the proposed extension to the Verwoerdburg substation can be initiated with minimal impact to avifauna provided that the recommendations and mitigation measures as recommended by the avifauna specialist are complied with (please refer to Appendix G).

The results of this study show that two preferred route alternatives exist. The first and most preferred alternative is alternative 3. This alternative follows existing lines for the entire length and thus the impact on avifauna in terms of collisions, habitat destruction and disturbance will be significantly lower than the other alternatives considered. The next most preferred alternative is alternative 3a. While this alternative will have slightly higher impacts on avifauna than alternative 3 as a portion of this alternative does not follow an existing line, these are seen as insignificant. Therefore this alternative may also be used with minimal impact on avifauna. These preferred routes follow existing lines and as such all of the impacts associated with power lines will be significantly lower than those associated with alternative 1 and 2. If this route is followed no mitigation is required to minimise the risk of collisions. Even though the area is considered to be disturbed and degraded, care should be taken during construction and maintenance activities to follow environmental best practice and thus reduce the impact of habitat destruction and disturbance.

It is strongly suggested that either Alternative 3 or 3a be used as placing the new lines adjacent to an existing line will, to some extent, mitigate for the impact of collisions.

### **5.3. Assessment of Potential Visual Impacts**

The construction of transmission and substation infrastructure such as the proposed extension of the Verwoerdburg substation in populated areas will always be problematic from a visual impact perspective. The Tshwane Strengthening Project (Apollo-Verwoerdburg component) highlighted this through the number of concerns received from landowners within the study area. The lower density residential areas (agricultural holdings), with a decidedly more rural character, will be more affected by the project infrastructure than the high-density residential areas. This is due to the fact that the higher occurrence of structures and visual clutter within high-density residential areas tend to absorb the visual impact.

### ***5.3.1. Potential Visual Impacts associated with the Construction and Decommissioning Phases of the Verwoerdburg Substation and Turn-in lines***

The construction phase of the substation and turn-in lines will see an increase in activities at the substation site. During this time heavy vehicles will frequent the roads, especially the M57 in the area and may cause, at the very least, a visual nuisance to other road users and landowners in close proximity to the construction activities. In the event of decommissioning of the infrastructure, impacts are expected to be similar to those experienced during the construction phase (i.e. as a result of increased activities on site).

Visual impacts associated with the construction phase (and eventual decommissioning phase), albeit temporary, should be managed according to the following principles:

- » Reduce the construction/decommissioning period through careful planning and productive implementation of resources.
- » Restrict the activities and movement of construction/decommissioning workers and vehicles to the immediate construction/decommissioning site(s).
- » Ensure that the general appearance of construction activities, construction camps (if required) and lay-down areas are maintained by means of the timely removal of rubble and disused construction materials.
- » Restrict construction activities to daylight hours (if possible) in order to negate or reduce the visual impacts associated with lighting.

### ***6.3.2. Potential Visual Impacts associated with the Operational Phase of the Substation and Turn-in Lines***

The construction of transmission infrastructure such as the proposed substation extension and turn-in lines will impose a visual impact on the surrounding area. The lower density residential areas of the study area, with a decidedly agricultural character, will be more affected by the project infrastructure than high-density residential areas. This is due to the fact that the higher occurrence of structures and visual clutter within high-density residential areas tend to absorb the visual impact. Visual impact is generally determined by the visual exposure of the proposed development, viewer incidence/perception, visual distance and the visual absorption capacity of the surrounding area. Impacts are expected where sensitive visual receptors occur. The sensitive visual receptors identified in the study area for the substation and turn-in lines include:

- » Residential areas, light industries and agricultural holdings in the vicinity of the study area.

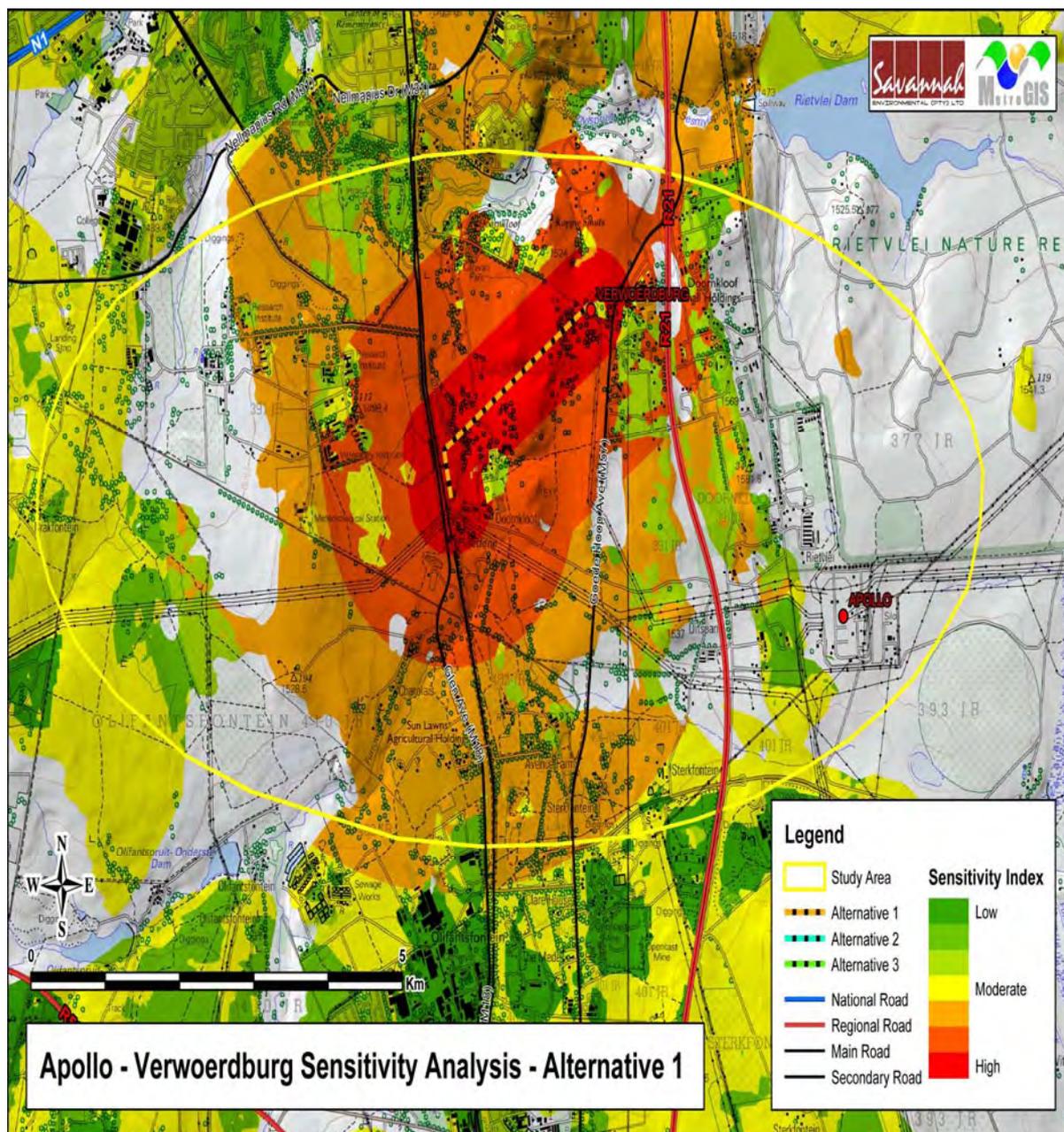
- » Users of provincial/regional road (M57), arterial routes and secondary access roads.
- » Formal protected areas such as the Rietvlei Nature Reserve within and surrounding the study area.

Viewshed analyses of the proposed infrastructure, based on a 20m contour interval (or 5m if available) digital terrain model of the study area, indicate the potential visual exposure (i.e. areas from where the infrastructure could theoretically be visible). The visibility analyses are undertaken at an offset of 20m above average ground level for the substation and at 35m for the transmission line alternatives in order to simulate a worst-case scenario. The viewshed analyses do not include the visual absorption capacity of natural vegetation in the study area. The visual absorption capacity of the vegetation is, however, addressed as a separate issue within this report and does form part of the visual impact assessment criteria.

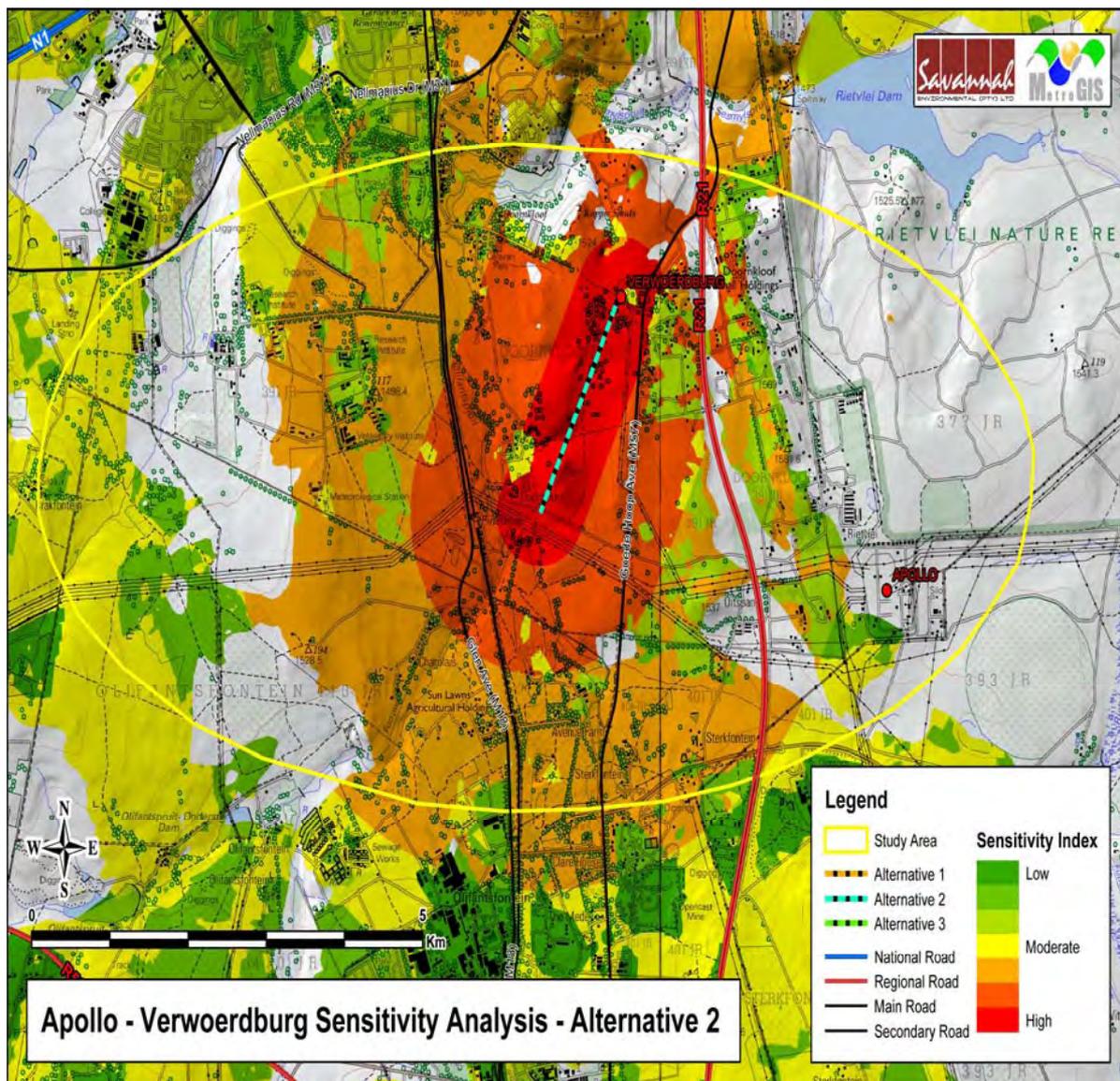
The sensitivity analysis comprises an indexed combination of three different data sets. Firstly, the landuse dataset for the study area is either acquired from an external source or captured from aerial photography or satellite imagery. Landuse types are then categorised and subcategorised depending on visual sensitivity and assigned an index value accordingly. A suitable range of proximity buffers from each alternative is also generated and assigned a similar index value since visual impact decreases with increasing distance. The landuse index is combined with the proximity index to give an overall sensitivity value, which then indicates areas where high sensitivity landuses coincide with the areas of high visual impact. Areas where the features are not visible are then clipped out using the viewshed analysis since no visual impact will occur where the features are not visible. This methodology models any potential visual receptor standing anywhere in the study area and provides a broader estimate of the potential visual intrusion rather than picking out each individual visual receptor and estimating sensitivity for each.

Visibility from the M57 and Rietvlei Nature Reserve is possible but it is envisaged that the future construction of light industry and residential estates will absorb this exposure.

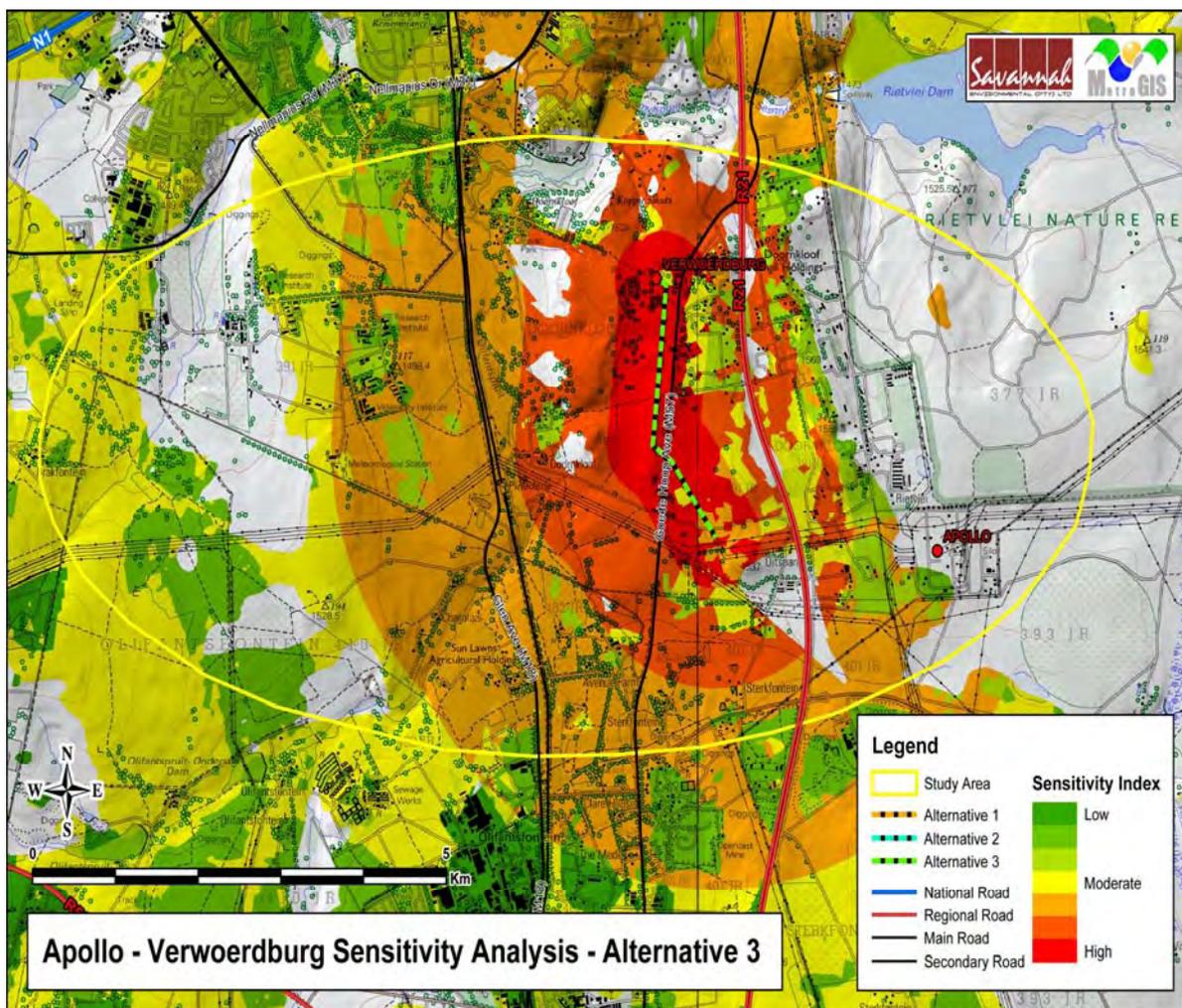
The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed alternative corridors are displayed below in Figure 5.2 - 5.4. Here the weighted impact and the likely areas of impact are indicated as a visual impact index. An area with short distance visual exposure to the proposed substation, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This aids in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.



**Figure 5.2:** Visual Sensitivity Impact Index - Alternative Corridor 1



**Figure 5.3:** Visual Sensitivity Impact Index – Alternative Corridor 2



**Figure 5.4:** Visual sensitivity impact index – Alternative Corridor 3

From the above sensitivity analyses, a clear difference in visual impact of the three alternatives is not obviously apparent. The area calculation (in hectares) below gives a numerical value, and thus a quantifiable value, to compare sensitivities.

Table 5.1 below shows a marginal difference in area covered by each sensitivity category. If the highest and second highest categories are merged to represent where the alignment would have the greatest impact, i.e. in relatively close proximity in areas considered visually sensitive, **alternative 3** (1026.84 ha) is **preferred** on the basis of least overall area of high impact, followed by alternative 2 (1083.19 ha) and alternative 1 (1170.46 ha). Alternative 3 would also be preferable because it follows a path adjacent to an existing power line, thus reducing the cumulative impact caused by adding to an existing impact. It should be noted, however, that there are no fatal flaws from a visual impact standpoint.

**Table 5.1:** Comparative Sensitivity Category Area Calculations

Sensitive Index	Alternative 1	Alternative 2	Alternative 3
<b>Low</b>	1766.34	1818.91	1609.73
	1662.89	1945.98	2580.56
	4039.19	4032.64	3987.25
<b>Moderate</b>	7068.87	7001.21	7659.15
	2011.92	2124.23	2283.96
	844.78	796.31	729.07
<b>High</b>	325.68	286.88	297.77

There is no comparative study for the substation upgrades since the proposed development is only an extension of an existing substation and no feasible alternatives have been identified. It is expected that the upgrades/extension are largely governed by site-specific technical constraints of the substation layout.

The following series of tables provides a summary of the potential visual impacts associated with the construction and operation of the proposed substation and the power lines. The primary visual impact, namely the appearance and dimensions of the substation infrastructure, is very difficult to mitigate. Therefore, the potential visual impacts are only assessed without mitigation in the tables below.

*Please note that due to the declining visual impact over distance, the **extent** (or spatial scale) rating is reversed (i.e. a localised visual impact has a higher value rating than a national or regional value rating). This implies that the visual impact is highly unlikely to have a national or international extent, but that the local or site-specific impact could be of high significance.<sup>7</sup>*

**Impact tables summarising the significance of visual impacts associated with the operation of the proposed substation and the turn-in power lines**

<b>Nature of Impact:</b>				
Potential visual impact of the proposed turn-in line alternatives on users of the main and arterial roads				
	Alignment 1	Alignment 2	Alignment 3	Alignment 3a
<b>Extent</b>	Local <b>(4)</b>	Local <b>(4)</b>	Local <b>(4)</b>	Local <b>(4)</b>
<b>Duration</b>	Long term <b>(4)</b>	Long term <b>(4)</b>	Long term <b>(4)</b>	Long term <b>(4)</b>
<b>Magnitude</b>	Minor <b>(1)</b>	Minor <b>(1)</b>	Minor <b>(1)</b>	Minor <b>(1)</b>
<b>Probability</b>	High <b>(4)</b>	High <b>(4)</b>	High <b>(4)</b>	High <b>(4)</b>
<b>Significance</b>	Moderate <b>(48)</b>	Moderate <b>(48)</b>	Moderate <b>(48)</b>	Moderate <b>(48)</b>

<sup>7</sup> This is only applicable to the visual impact assessment study

<b>Status (positive or negative)</b>	Negative	Negative	Negative	Negative
<b>Reversibility</b>	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
<b>Irreplaceable loss of resources?</b>	No	No	No	No
<b>Can impacts be mitigated during operational phase?</b>	No	No	No	No
<b>Mitigation:</b> Mitigation is not possible.				
<b>Cumulative impacts:</b> The construction of numerous towers will increase the cumulative visual impact of existing power lines that traverse the study area.				
<b>Residual impacts:</b> N.A.				

<b>Nature of Impact:</b> Potential visual impact on receptors within residential areas				
	Alignment 1	Alignment 2	Alignment 3	Alignment 3a
<b>Extent</b>	Local (4)	Local (4)	Local (4)	Local (4)
<b>Duration</b>	Long term (4)	Long term (4)	Long term (4)	Long term (4)
<b>Magnitude</b>	Low (2)	Low (2)	Low (2)	Low (2)
<b>Probability</b>	High (4)	High (4)	High (4)	High (4)
<b>Significance</b>	Moderate (52)	Moderate (52)	Moderate (52)	Moderate (52)
<b>Status (positive or negative)</b>	Negative	Negative	Negative	Negative
<b>Reversibility</b>	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
<b>Irreplaceable loss of resources?</b>	No	No	No	No
<b>Can impacts be mitigated during operational</b>	No	No	No	No

<b>phase?</b>				
<b>Mitigation:</b> Mitigation is not possible.				
<b>Cumulative impacts:</b> The construction of numerous towers will increase the cumulative visual impact of existing power lines that traverse the study area.				
<b>Residual impacts:</b> N.A.				

<b>Nature of Impact:</b> Potential visual impact on residents in close proximity to the proposed Verwoerdburg substation extension	
<b>Extent</b>	Local (4)
<b>Duration</b>	Long term (4)
<b>Magnitude</b>	Minor (1)
<b>Probability</b>	High probability (4)
<b>Significance</b>	Moderate (48)
<b>Status (positive or negative)</b>	Negative
<b>Reversibility</b>	Recoverable (3)
<b>Irreplaceable loss of resources?</b>	No
<b>Can impacts be mitigated during operational phase?</b>	No
<b>Mitigation:</b> The possible increase of the substation footprint might present new visual impacts. Since the infrastructure is not expected to be taller than a single storey, tree line planting can be effectively used to screen the substation upgrades.	
<b>Cumulative impacts:</b> The possible widening of the substation footprint will increase the cumulative visual impact of existing substation.	
<b>Residual impacts:</b> N.A.	

### 5.3.3. Comparative Assessment

The visual impact of a 400kV turn-in power lines is definite, long-term, and not given to effective mitigation, but is otherwise entirely limited to the local context. If the highest and second highest categories are merged to represent where the alignment would have the greatest impact, i.e. in relatively close proximity in areas considered visually sensitive, **alternative 3 and 3a** (1026.84 ha and ) **are**

**preferred** on the basis of least overall area of high impact, followed by alternative 2 (1083.19 ha) and alternative 1 (1170.46 ha). Either alternative 3 or 3a would also be preferable because they follow a path adjacent to an existing power line for the majority of the route, thus increasing the cumulative impact caused by adding to an existing impact. However, the cumulative impact on the broader scale might be reduced. It should be noted, however, that there are no fatal flaws from a visual impact standpoint.

#### ***5.3.4. Conclusion and Recommendations***

The visual impact of a 400kV transmission line is definite, long-term, and not given to effective mitigation, but is otherwise entirely limited to the local context. The results of the sensitivity analyses indicate that the most **preferred alignment is Alternative 3** based on total area of high visual impact and cumulative impact of existing power lines, although there are no fatal flaws eliminating any alternatives. The second most preferred alternative is **3a** although there is not a major difference between these two alternatives in terms of visual impact index.

The upgrade to the Verwoerdburg substation is not likely to cause a major change in the landscape, if at all. However, should there be an increase in the footprint area to an extent that presents a significantly new visual impact, mitigation in the form of visual absorption from planted tree lines is usually an effective and relatively cheap method of offsetting this negative visual impact.

- » The primary visual impact, namely the appearance and dimensions of the substation infrastructure, is very difficult to mitigate. The functional design of the structures and the dimensions of the substation are unlikely to be changed in order to reduce visual impacts.
- » Mitigation of the visual impact through conventional visual impact mitigation measures (i.e. vegetation screening, landscaping or design) is highly unlikely to succeed due to the inherent functional design of the substation structures.
- » The sites proposed for the placement of Verwoerdburg substation extension are both located adjacent to sensitive visual receptors that may experience night time visual impacts in the form of glare or light trespass. Careful planning and sensitive placement of security and operational light fixtures for the substation, designed to contain rather than spread the light, is therefore imperative. The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, decommissioning activities, etc. may be possible and should be implemented and maintained on an on-going basis.

#### 5.4. Assessment of Potential Impacts on soils and Agricultural Potential

In the immediate vicinity of the proposed alternatives, most of the soils are shallow (<400 mm) on rock, with much surface rock outcropping. Alternative 1 crosses a narrow band of deeper soils, close to the Olifantsspruit stream. Further to the south and south-west, deeper, red soils occur, while to the east, zones of moderately deep, red and yellow-brown soils are found.

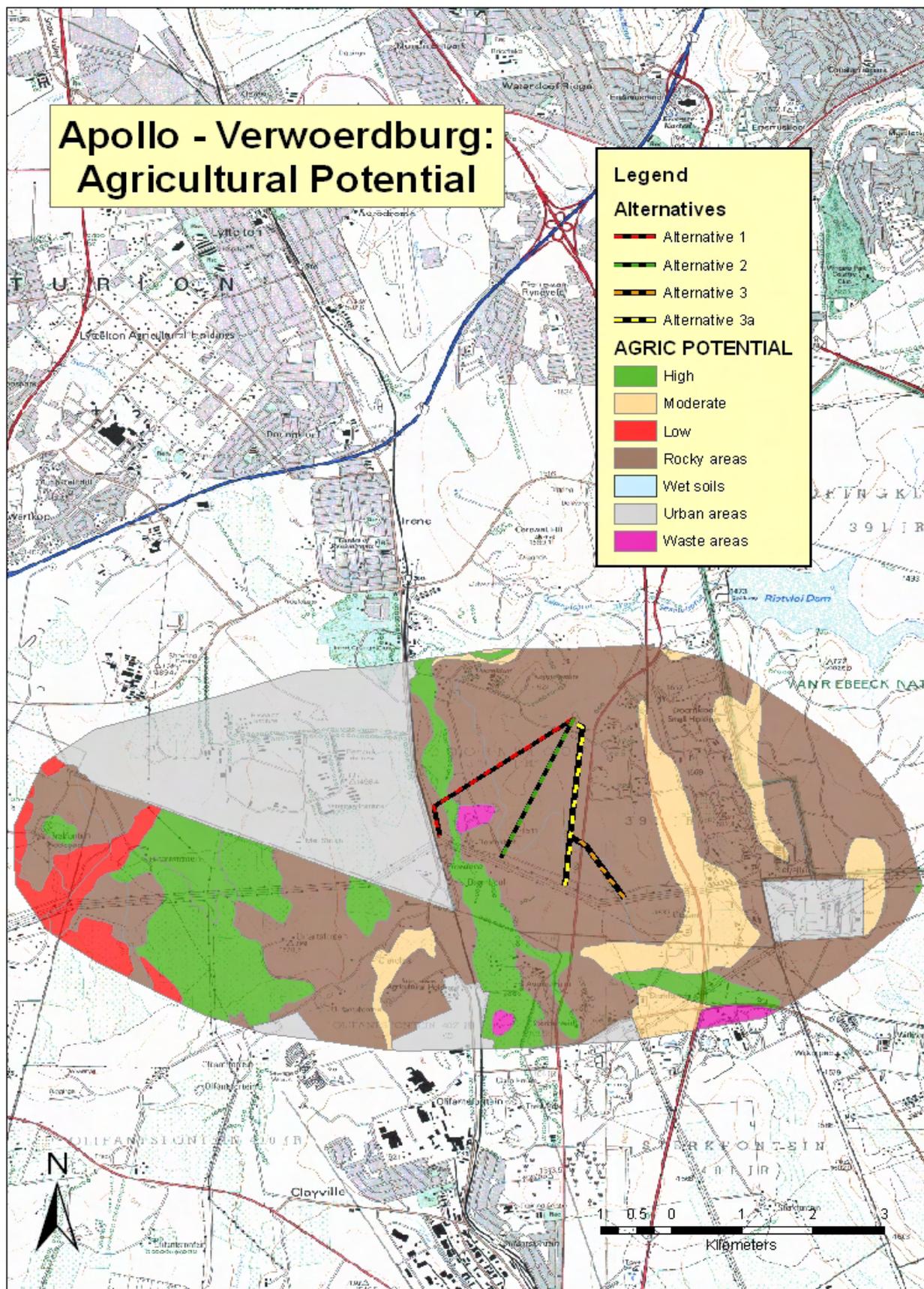
All the soils around the Verwoerdburg substation are shallow and/or rocky, and have a low potential for arable agriculture. There is thus no limitation to the expansion of the substation as far as soils and agricultural potential is concerned.

Due to the shallow nature of the soils, no impacts on agricultural potential are anticipated as a result of the proposed project. From the soil map in Figure 5.5, it can be seen that the dominant class of broad agricultural potential is low, except for the narrow band of higher potential soils close to the stream, on Alternative 1. For this reason, in comparing the alternatives, it would seem that the most suitable route would be either Alternative 2 or Alternative 3/3a, where all of the soils are shallow and rocky, with a low agricultural potential.

##### 5.4.1. Conclusion and Recommendations

Due to the shallow nature of the soils, no impacts on agricultural potential are anticipated as a result of the proposed project. Due to the presence of a narrow band of higher potential soils close to the stream along Alternative 1, this alternative is not preferred. All other alternatives assessed are considered to be acceptable from an agricultural potential perspective.

From the soil map in Figure 6.5, it can be seen that the dominant class of broad agricultural potential is low, except for the narrow band of higher potential soils close to the stream, on Alternative 1. For this reason, in comparing the alternatives, it would seem that the most suitable route would be either Alternative 2 or Alternative 3/3a, where all of the soils are shallow and rocky, with a low agricultural potential.



**Figure 5.5:** Soil Map in the Apollo-Verwoerdburg Area

## 5.5. Assessment of Potential Impacts on Heritage Resources

The Phase I HIA study for the Eskom Project Area revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999). The following known heritage resources occur in the study area (Apollo-Verwoerdburg):

- » At least two graveyards located near Alternative 01 (~85 graves) and Alternative 02 (~20 graves) for the 400kV loop-in and loop-out power lines running from the 400kV Pluto-Apollo power line to the Verwoerdburg Substation.

All graveyards and graves can be considered to be of high significance and are protected by various laws. Legislation with regard to graves includes Section 36 of the National Heritage Resources Act (No 25 of 1999) whenever graves are older than sixty years. The act also distinguishes various categories of graves and burial grounds.

Other legislation with regard to graves includes those which apply when graves are exhumed and relocated, namely the Ordinance on Exhumations (No 12 of 1980) and the Human Tissues Act (No 65 of 1983 as amended).

It is unlikely that either Graveyard 01 or Graveyard 02 will be directly impacted when either Alternative 01 or Alternative 02 is constructed for the proposed loop-in power line between the 400kV and the Verwoerdburg Substation due to the following reasons:

- » Graveyard 01 is located at a safe distance to the north of Alternative 01 and can thus be avoided by the power line.
- » Graveyard 02 is located at a safe distance to the west of Alternative 02 and can thus be avoided by the power line
- » No heritage resources were observed along Alternative 03 and 03a.

### 5.5.1. Conclusions and Recommendations

All graveyards and graves can be considered to be of high significance and are protected by various laws. Legislation with regard to graves includes Section 36 of the National Heritage Resources Act (No 25 of 1999) whenever graves are older than sixty years. The act also distinguishes various categories of graves and burial grounds. Against this background, alternative 3 and 3a will have no impact to the heritage resources on site.

## 5.6. Assessment of Potential Social Impacts

Impacts on the social environment as a result of the proposed expanded substation and turn-in lines are expected to occur during both the construction and operation phases (as well as during the eventual decommissioning of the infrastructure). The construction phase associated with the proposed substation and turn-in lines is expected to last for approximately 12 months.

The Social Impact Assessment considers the following:

- » Demographic processes (Change in population size, density and/or demographic profile). Table 3 from the Specialist Social Impact Assessment report in Appendix M provides the number of construction workers anticipated on site during construction.
- » Economic processes (the way in which people make a living and the economic activities in the society)
- » Geographic processes (land use patterns)
- » Empowerment, institutional and legal processes (the ability of people to be involved and influence decision making process and role and efficiency and operation of governments and other organisations),
- » Socio-cultural process (the way in which humans behave, interact and relate to each other and their environment and the belief and value systems which guide these interactions)

Considering all these processes, potential social health impacts will also be assessed. A distinction was made between the change process and impacts. A change process is defined as a change that takes place within the receiving environment as a result of a certain intervention. A potential social impact follows as a result of the impact once it is experienced as such by an individual/household/community/organisation on a physical and cognitive level.

Potential impacts (with and without mitigation) specific to the substation site and turn-in lines are summarised in the tables below. In order to assess the corridor alternatives in respect of their anticipated social impacts, a distinction is made between the following impacts:

- » **Category 1:** Impacts that are not expected to differ between the proposed corridor alternatives, e.g. the number of construction workers that will be needed for the proposed project remains the same, irrespective of the chosen alternative.
- » **Category 2:** Impacts that are expected to differ between the proposed alternative Corridors, e.g. the number of households to be resettled increases if the development traversed densely populated areas as opposed to skirting populated areas.

### ***5.6.1. Geographic Change Processes***

The following geographic change processes are likely to occur:

- » Change in access to resources that sustain livelihoods; and
- » Land acquisition and disposal, including availability of land.

A change in the surrounding land use of an area associated with a linear development, such as a transmission power line, is often a gradual process that in the end could set an unintentional precedent for further land use changes. Often these additional land use changes are of a similar nature than the original development, e.g. the placement of a new transmission power line next to an existing transmission power line, as is the case with Alternative 3 and 3a. Usually, depending on the results of the various specialist studies, the placement of new infrastructure within an existing 'disturbed corridor' is preferred as it reduces the impact on sense of place by avoiding green field areas.

<b>GEOGRAPHIC CHANGE PROCESS</b>	
<p><b>Summary of change process:</b> The proposed 400kV turn-in/out transmission lines will be operated within a servitude of 110m in width. Although most land uses are still permitted within the servitude (except permanent structures and human occupation), the landowner has to comply with the requirements set forth by Eskom to ensure the safe operation of the lines. The landowner therefore has to factor transmission line towers and the servitude into future land use, which changes the way in which the landowner used to use the land, e.g. a row of houses that has to be removed from a development to make way for the servitude. As Eskom already owns the site for the substation extension, the impact of land use changes on this particular property will be limited.</p>	
<p><b>Nature of impact:</b> A loss of land impacts financially on a private landowner who is limited in terms of the land uses within the servitude area.</p>	
<p><b>Site characteristics:</b> At present there are no land use activities taking place in the area surrounding the substation. Future planning includes a number of mixed land use developments, e.g. residential developments, office and retail developments, road developments, etc. The turn-in transmission line route alternatives 1 and 2 mostly traverse 'green field' areas (i.e. areas where no similar infrastructure is present; also earmarked for future development), whereas alternative 3 and 3a – although it also traverses a development area - is located next to two existing transmission lines, which was factored into the development plans for the affected property.</p>	
<p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>• The use of alternative 3 and 3a will minimise the extent of the expected impacts as it is located next to existing infrastructure of a similar nature, and preferred by the affected landowner who has factored the existing transmission lines into his development plans.</li> <li>• The affected landowner has prepared all the required documentation for township establishment and at the time of the study, was in the process of lodging a formal application with the local municipality for township establishment (Rietvlei extensions 6 and 7). It is therefore vital to consult with the landowner on a continuous basis and to communicate any route deviations to the landowner to ensure that the infrastructure does not cause extensive alterations to the development's site layout plan.</li> <li>• Land rehabilitation should take place upon completion of the</li> </ul>	<p><b>Enhancement measures:</b></p> <ul style="list-style-type: none"> <li>• N.A.</li> </ul>

construction process to ensure that the land is returned to the landowner in the same condition as prior to construction, unless otherwise agreed with the landowner in question.								
Rating Scale	Substation		Alternative 1		Alternative 2		Alternative 3	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
<b>Extent</b>	Local [2]	Site [1]	Local [2]	Site [1]	Local [2]	Site [1]	Local [2]	Site [1]
<b>Duration</b>	Short [2]	Short [2]	Very short [1]	Very short [1]	Very short [1]	Very short [1]	Very short [1]	Very short [1]
<b>Magnitude</b>	Low [4]	Low [4]	Very high [10]	Moderate [6]	Very high [10]	Moderate [6]	Moderate [6]	Low [4]
<b>Reversibility</b>	Reversible [1]	n/a	Recoverable [3]	n/a	Recoverable [3]	n/a	Recoverable [3]	n/a
<b>Probability</b>	Improbable [2]	Improbable [2]	Highly probable [4]	Probable [3]	Highly probable [4]	Probable [3]	Highly probable [4]	Improbable [2]
<b>Significance</b>	<b>Low [18]</b>	<b>Low [18]</b>	<b>High [64]</b>	<b>Low [24]</b>	<b>High [64]</b>	<b>Low [24]</b>	<b>Medium [48]</b>	<b>Low [12]</b>
<b>Status</b>	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
<b>Cumulative impacts:</b>								
<ul style="list-style-type: none"> <li>Based on the number of development projects in the area, land use change seems inevitable. The loss of land due to the current project is minimal when compared to the other development projects in the area.</li> </ul>								
<b>Residual impacts:</b>								
<ul style="list-style-type: none"> <li>A precedent for land use change has been set.</li> </ul>								
<b>Links:</b>								
<ul style="list-style-type: none"> <li>Impacts due to land use (geographic) change processes links to economic change processes (compensation for servitude), emancipation and empowerment processes (negotiations), and socio-cultural processes (change in sense of place).</li> </ul>								

### **5.6.2. Demographic Change Processes**

It is expected that the expansion of the substation together with the construction of the turn-in/out transmission lines will lead to a temporary change in the population size of the affected area and also, possibly, to the composition of the local population. In this regard, the following demographic change processes are likely to occur:

- » An influx of construction workers;
- » An influx of unemployed job seekers; and
- » In one instance, the possible relocation of an individual household (should Alternative 1 be adopted).

The construction of a substation as well as that of a transmission lines requires skilled workers. In all probability, these skills will not be present in the area, resulting in the fact that a contractor will bring in his own workforce – people who do have the required skills, but who are normally also not from the local area. However, a construction team consists of a certain number of people (the size of the team depends largely on the type of construction required) and they enter the area with a very specific purpose. The time they spend in the area is clearly defined and often controlled as such (e.g. construction workers arrive on site in the morning and depart from the area in the evening), and due the nature of their work, their contact with the local community is limited.

Once the project has been completed, construction workers who form part of a contractor's permanent workforce will move on to a next project and will seldom stay in the area. At the peak of construction the number of construction workers on site is estimated to be around 145 people (of which about 60 will be at the substation site and the other 85 will be spread out across the length of the turn-in lines). Because the construction workers will commute to site, it is expected that the influx of construction workers will have a negligible effect on the highly urbanised host community.

Unlike the regulated circumstances surrounding a construction team, the influx of job seekers is unregulated and often very difficult to control. It is also very difficult to predict how many job seekers could be expected and the extent to which they can change the size and composition of the local population, as the intensity of the effect will be influenced by the actual number of job seekers.

Given the skills required for the respective construction processes, it is highly unlikely that a job seeker will find formal employment by loitering at the construction camp or site. The unemployed job seekers then become a burden to the host community, as they do not have the means to sustain themselves, and then become dependent on others (usually people who themselves only have

limited resources). The presence of job seekers can also lead to the expansion of the informal settlement located approximately 3.5km south of the Verwoerdburg substation. This settlement also appears to encroach upon an existing transmission line servitude, which creates a health and safety risk for people living on the outer edges of the settlement.

DEMOGRAPHIC CHANGE PROCESS								
<b>Summary of change process:</b> Construction workers enter the area on a temporary basis and will not have an effect on the population size. Job seekers might also enter the area, but usually the number is restricted to individuals.								
<b>Nature of impact:</b> Generally speaking, accelerated population growth creates unexpected demands on local resources. However, this will not be the case with the current project, as the size of the construction team is too small and their time spent in the area too limited to have any real effect on the local population size. Individual job seekers will also not contribute to accelerated population growth.								
<b>Site characteristics:</b> The local population consists of mostly medium to high income groups. The area itself is currently undergoing a transformation due to the large number of developments, but this is due to people moving into the area on a permanent basis (e.g. residents in new developments).								
<b>Mitigation measures:</b>					<b>Enhancement measures:</b>			
<ul style="list-style-type: none"> <li>Do not create false expectations – inform local job seekers upfront about the skilled nature of the construction and the low likelihood of employing an unskilled and/or inexperienced workforce.</li> <li>Also inform local communities that contractors have a permanent workforce and that they will mostly likely make use of this workforce, which will further reduce the possibility of local employment.</li> <li>Discourage job seekers to travel to the area by advertising in the local and/or regional press before construction commences to show that all positions have been filled and that there are no further job opportunities available.</li> </ul>					<ul style="list-style-type: none"> <li>None.</li> </ul>			
Rating Scale	Substation		Alternative 1		Alternative 2		Alternative 3 and 3a	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
<b>Extent</b>	Local [2]	Site [2]	Local [2]	Site [1]	Local [2]	Site [1]	Local [2]	Site [1]
<b>Duration</b>	Short [2]	Very short [1]	Short [2]	Very short [1]	Short [2]	Very short [1]	Short [2]	Very short [1]
<b>Magnitude</b>	Moderate [6]	Low [4]	Moderate [6]	Low [4]	Moderate [6]	Low [4]	Moderate [6]	Low [4]
<b>Reversibility</b>	Recoverable [3]	n/a	Recoverable [3]	n/a	Recoverable [3]	n/a	Recoverable [3]	n/a

<b>Probability</b>	Improbable [2]	Very improbable [1]	Improbable [2]	Very improbable [1]	Improbable [2]	Very improbable [1]	Improbable [2]	Very improbable [1]
<b>Significance</b>	<b>Low [26]</b>	<b>Low [7]</b>						
<b>Status</b>	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
<b>Cumulative impacts:</b>								
<ul style="list-style-type: none"> <li>The influx of job seekers to other development projects in the area – job seekers might go around looking for work on all these projects.</li> </ul>								
<b>Residual impacts:</b>								
<ul style="list-style-type: none"> <li>Job seekers who remain in the area despite being unable to secure any employment, increasing the dependency ratio on the local authority.</li> </ul>								
<b>Links:</b>								
<ul style="list-style-type: none"> <li>Impacts due to demographic change processes in turn links to institutional and legal change processes (change in housing needs/demands, change in community infrastructure), and socio-cultural processes (dissimilarity in social practices, conflict, and safety and crime impacts).</li> </ul>								

### **5.6.3. Economic change processes**

The EIA study identified the following economic change processes as likely to occur:

- » Enhanced / reinforced economic opportunities;
- » Change in the employment equity of vulnerable groups; and
- » Change in occupational opportunities.

In addition to the identified change processes mentioned above, the SIA study also considered enhanced electricity supply and economic growth as an additional change processes on a more macro-scale. These change processes will be discussed separately together with a detailed assessment of the expected impact as a result of the change process taking place.

The construction phase of the project for both the substation and the turn-in/out lines will create an estimated 425 job opportunities over the length of the contract period. Most of these jobs will have an average contract period of 2-3 months. Due to the skilled nature of the construction processes, only experienced/skilled workers are used, usually in the form of the contractor's own permanent workforce. According to an Eskom official, contractors seldom employ casual workers from the local community, mainly because of the skills levels required, and the sensitive nature of the material used in these installations (i.e. the copper wiring often gets stolen).

In addition to direct employment opportunities, construction activities usually also lead to indirect employment opportunities, which can be either formal or informal. Indirect formal employment refers to direct employment by the contractor but not as part of the actual construction team, e.g. support staff such as messengers and personal assistants. Indirect informal employment relate to entrepreneurial services that are not directly employed by the contractor or linked with the construction activities, e.g. domestic services, food stalls, etc. at either the construction camp or the construction site.

A drawback is that most of the employment opportunities created by the construction of the proposed substation and turn-in/out lines will be temporary in nature and will only last for the duration of the construction period. However, on a more positive note, it means that a group of people have not only acquired a new skill, but have also gained some work experience, which will make them more 'marketable' in future.

Most, if not all, economic activities are dependent on a reliable electricity supply. This and other resources such as water and fuel enable normal economic growth. Normal economic activities, e.g. industry and businesses, are affected when

electricity is not available. The economic impact on such services increases the longer services such as electricity are unavailable. Services become unreliable or unavailable when the demand for such services exceeds the supply, resulting in load shedding, as was the case in South Africa in the beginning of 2008.

The proposed extensions to the substation and the associated turn-in/out transmission lines will enhance the electricity supply to the City of Tshwane, which in turn will indirectly stimulate economic growth as the supply can meet the demand, allowing businesses and industries to expand. Growing businesses and industries create additional employment opportunities, which enhance economic growth, permitting a positive economic impact to filter down to a more grassroots level.

<b>ECONOMIC CHANGE PROCESS</b>	
<p><b>Summary of change process:</b> The construction and maintenance of the proposed substation extensions and turn-in/out transmission lines will create an estimated 425 job opportunities. Employment enhances economic equities, even if it is over the short-term. Members of vulnerable groups will have equal opportunity to apply for local positions, but such persons often do not apply as they are 'trapped' within their traditional role of housekeeper, caregiver, etc. A change in occupational opportunities is an indirect result of the project as auxiliary services are required during the construction phase, such as shelter, food, etc. A reliable electricity supply stimulates economic growth.</p>	
<p><b>Nature of impact:</b> Employment first and foremost has an economic impact on the individual and his/her nuclear family. In addition to securing an income, employment (direct formal or indirect informal) also creates a sense of self-worth and offers the individual the opportunity to extend his/her skills base and to gain some experience – this makes people more 'marketable' for future jobs. On a macro scale, the availability of electricity enhances economic growth, which creates more job opportunities with a positive economic impact. On the whole, negative economic impacts will be confined to single landowners.</p>	
<p><b>Site characteristics:</b> The local population consists of mostly medium to high income groups. According to the latest census results (2001), the surrounding areas are characterised by high employment rates, e.g. 86.2% for Doornkloof and 96.4% for Irene. It can be expected that the employment rate in the informal settlement will be significantly lower.</p>	
<p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>• Regarding the informal trade: Make use of a permit system and only allow vendors with a valid permit to supply goods and services. Such a system can also assist in controlling access to and from the construction sites and camp by knowing who the vendors are and who the loiterers are, and it can aid in preventing conflict amongst vendors due to an over-supply of the same product.</li> <li>• Payment should comply with applicable Labour Law legislation in terms of minimum wages.</li> <li>• Where required, workers must be registered with any and all official bodies as required by law, e.g. Income Revenue Services, Unemployment Insurance Fund, etc. This will enable the worker to claim from the UIF as a means of continuous financial support when</li> </ul>	<p><b>Enhancement measures:</b></p> <ul style="list-style-type: none"> <li>• Contractors must be contractually obliged to appoint local labour wherever possible.</li> <li>• Give preferential treatment to local entrepreneurs and/or subcontractors to supply goods and services.</li> <li>• Females should be encouraged to apply for positions.</li> <li>• Individuals with the potential to develop their skills further should be afforded training opportunities, where possible.</li> </ul>

his/her position on the construction team either becomes redundant or once the construction phase comes to an end.								
Rating Scale	Substation		Alternative 1		Alternative 2		Alternative 3 and 3a	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
<b>Extent</b>	Local [2]	National [4]	Local [2]	National [4]	Local [2]	National [4]	Local [2]	National [4]
<b>Duration</b>	Very short [1]	Long term [4]	Very short [1]	Long term [4]	Very short [1]	Long term [4]	Very short [1]	Long term [4]
<b>Magnitude</b>	Low [4]	Moderate [6]	Low [4]	Moderate [6]	Low [4]	Moderate [6]	Low [4]	Moderate [6]
<b>Reversibility</b>	Recoverable [3]	n/a	Recoverable [3]	n/a	Recoverable [3]	n/a	Recoverable [3]	n/a
<b>Probability</b>	Improbable [2]	Probable [3]	Improbable [2]	Probable [3]	Improbable [2]	Probable [3]	Improbable [2]	Probable [3]
<b>Significance</b>	<b>Low [20]</b>	<b>Medium [42]</b>	<b>Low [20]</b>	<b>Medium [42]</b>	<b>Low [20]</b>	<b>Medium [42]</b>	<b>Low [20]</b>	<b>Medium [42]</b>
<b>Status</b>	Positive	Positive						
<b>Cumulative impacts:</b>								
<ul style="list-style-type: none"> <li>None</li> </ul>								
<b>Residual impacts:</b>								
<ul style="list-style-type: none"> <li>Increased capacity resulting in a stable network that can facilitate economic growth.</li> </ul>								
<b>Links:</b>								
<ul style="list-style-type: none"> <li>Economic change processes link to geographic change processes (change in access to resources that sustain livelihoods), and demographic processes (influx of job seekers to an area with a growing economy).</li> </ul>								

#### **5.6.4. Socio-cultural Change Processes**

As indicated in Chapter 4, a high income residential estate (Irene Glen Private Estate) lies to the north of the Verwoerdburg substation adjacent to Hennops River. The estate has strict security measures with only one access road off the R21 with access control measures that limit access to mostly residents and their visitors. The estate has board of directors and a homeowners association who regulate the functioning of the estate through enacted rules and regulations, including aspects such as rules of conduct, security measures, rules pertaining to tenants, visitors, contractors and employees, rules pertaining to the letting and reselling of a property, building guidelines, etc. Residents voluntarily abide by these rules, which in turn enhance a sense of community through the practise of 'good neighbourliness' where residents do not live in isolation or detract from the estate's shared wellbeing, but rather contribute to each other's quality of life. The sense of community is further fostered through a monthly newsletter, a local newspaper called "The Glen," and a homeowner's association website.

To the west of the substation site lays the residential area of Doornkloof. This is an 'open' high-income residential area (as opposed to the access-controlled setting of an estate). The area also has a homeowners association and, based on the activity on their website, appears to be a very active community 'watchdog' that is constantly participating in EIA processes and informing residents on new developments in the area and the progress made on local projects. Apart from local development projects, the website also contains other notices and updates of importance to residents and at the time of the study, contained over 100 such notices, dating back as far as 2004.

Doornkloof Smallholdings to the east of the substation site is characterised by mixed land use including residential, light industrial and commercial uses, religious areas and other uses such as a youth/church camping ground. This implies that the area has a constant through-flow of people such as groups making use of the camping ground for a weekend, or employees arriving or departing from their place of work, or people attending church or church activities once or twice a week. As such the area does not really have a dominant resident local community, but this does not in any way exclude the possibility that other land-users in the area could still have a sense of 'business community' (although the high walls and locked gates would suggest a certain degree of isolation between the various types of land uses and ultimately the people occupying the properties during certain times of the day/week).

Large portions of the open land surrounding the substation and the proposed turn-in/out route alignments have been earmarked for future mixed land-use developments. As the study area forms part of a bigger geographical area that is currently experiencing huge development pressure, the landowner(s)/

developer(s) are in an ideal position to benefit substantially from mixed land-use developments on their properties. It is therefore not likely that these property owners will have a strong sense of place attachment, as their main aim is not to reside in the area themselves, but rather to develop and sell off the land, after which they will in all probability withdraw from the area.

As per the results of the EIA study, the following socio-cultural change processes are likely to occur:

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

These change processes will be discussed separately together with a detailed assessment of the expected impact as a result of the change processes occurring.

Dissimilarity in social practices occurs when there are different values, social standards, religious beliefs, etc. between a large group of newcomers to an area and that of the area's local residents. In theory the existence of two groups with different social practices living alongside each other should not in itself be the cause of problems – it is when the one group attempts to exert power over the other group or where different cultural values are not respected, that conflict situations arise. Such conflict situations can turn violent and often require third party intervention.

The potential impact on socio-cultural behaviour and the related perception of environmental changes can have either a positive or a negative impact on sense of place (e.g. peace of mind vs. frustration/anger). The introduction of a new project to the area can be viewed as a positive impact if people perceive the project as infrastructural and/or economic development that is not intrusive on their lives and do not cause them immediate danger. Potential negative impacts include the visual impact and the resultant intrusion on sense of place.

<b>SOCIO-CULTURAL CHANGE PROCESSES</b>	
<p><b>Summary of change process:</b> The arrival of people who are not from the area can lead to conflict if there is dissimilarity in social practices and if such differences are not respected. Family structures can be altered where the breadwinner is absent for prolonged periods of time and in cases of HIV transmission, the family structure can further be altered. Due to the fact that existing infrastructure of a similar nature is already present in the area, it is unlikely that the project will alter the way in which people relate to each other and their environment, and therefore unlikely to affect their sense of place.</p>	
<p><b>Nature of impact:</b> Conflict affects a community's group cohesion and way of life. Apart from the obvious health impacts associated with illnesses such as HIV, it also bears an economic impact when people become too ill to work – on the macro economy as well as the micro economy of the family who loses their source of income, which affects their livelihood. People lose their sense of belonging and place attachment, resulting in a loss of sense of place.</p>	
<p><b>Site characteristics:</b> The area is characterised by medium to high-income groups, which functions within the traditional family unit. Residents seem to have a strong sense of place attachment due to the unique characteristics of the area with amenities like the Rietvlei Nature Reserve close by. However, it should be noted that the area is undergoing immense development – it therefore appears that the transformation of the area is unavoidable.</p>	
<p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>• The use of Alternative 3 and 3a will reduce the potential impact on sense of place, as it is located next to existing infrastructure of a similar nature (i.e. sense of place on his alternative has already been altered).</li> <li>• Launch a STI and HIV/AIDS awareness campaign to educate construction team members and the local community on this issue. Identify and train peer educators and provide the necessary resources (posters, information booklets, referral sources for VCT, etc.) to ensure an effective campaign.</li> <li>• Avoid potential conflict situations that can arise from limited employment opportunities by using a fair and transparent recruitment process. Consider implementing the use of a rotary employment scheme, if and where feasible, to extend employment opportunities to more individuals.</li> </ul>	<p><b>Enhancement measures:</b></p> <ul style="list-style-type: none"> <li>• None</li> </ul>

<ul style="list-style-type: none"> <li>Do not allow idle loitering of job seekers, or other individuals who are not involved with the project, at either the construction site or the construction camp. This is to prevent a potential increase in opportunistic crimes.</li> <li>Implement a project information centre at the site offices where local residents can obtain information on the progress of the construction process and on what to expect in future (for example the types of activities that will take place and when and how these will be executed). Also, display and/or inform local residents of current changes and future possibilities associated with the project. The information centre can also serve as a central point where residents can complain or bring problem areas associated with the construction process under the project manager's attention. The information centre must be easily accessible to the public and can operate on a part-time basis, but the centre's hours of operation must be clearly displayed and/or communicated to the local community.</li> </ul>								
Rating Scale	Substation		Alternative 1		Alternative 2		Alternative 3	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
<b>Extent</b>	Local [2]	Site [1]	Local [2]	Site [1]	Local [2]	Site [1]	Local [2]	Site [1]
<b>Duration</b>	Short [2]	Very short [1]	Short [2]	Very short [1]	Short [2]	Very short [1]	Short [2]	Very short [1]
<b>Magnitude</b>	Moderate [6]	Low [4]	High [8]	Moderate [6]	High [8]	Moderate [6]	Moderate [6]	Low [4]
<b>Reversibility</b>	Recoverable [3]	n/a	Recoverable [3]	n/a	Recoverable [3]	n/a	Recoverable [3]	n/a
<b>Probability</b>	Improbable [2]	Very improbable [1]	Probable [3]	Improbable [2]	Probable [3]	Improbable [2]	Improbable [2]	Very improbable [1]
<b>Significance</b>	<b>Low [26]</b>	<b>Low [6]</b>	<b>Medium [45]</b>	<b>Low [16]</b>	<b>Medium [45]</b>	<b>Low [16]</b>	<b>Low [26]</b>	<b>Low [6]</b>

Status	Negative							
<p><b>Cumulative impacts:</b></p> <ul style="list-style-type: none"> <li>• A wide range of development projects is taking place in the area that all contribute to the transformation of the area.</li> </ul>								
<p><b>Residual impacts:</b></p> <ul style="list-style-type: none"> <li>• An increase in the HIV infection rate.</li> <li>• Vulnerable families.</li> <li>• A loss of place attachment and sense of place.</li> </ul>								
<p><b>Links:</b></p> <ul style="list-style-type: none"> <li>• Socio-cultural change processes links to demographic change processes (population growth and decline), economic change processes, and empowerment and emancipation processes (people are disempowered when they are forced to remain in a destructive cycle).</li> </ul>								

### ***5.6.5. Conclusions in terms of Impacts on the Social Environment***

As could be expected, the construction phase is characterised by a number of negative social impacts, which is mainly due to the nature of the activities that take place during this phase. Although the expected social impacts associated with the construction phase are mostly negative across all the change processes, these impacts are for the most part only temporary in nature and as such and expected to only last over the construction period.

Even though all of the identified social impacts can be mitigated or enhanced successfully, it can only be done if Eskom, or its appointed contractor(s), commit to the responsibility of ensuring that the level of disturbance brought about to the social environment by the more negative aspects of the project, is minimised as far as possible.

Overall, based on the conclusions and findings of this report, the upgrade of the Verwoerdburg substation and the construction and operation of the proposed turn-in/out lines do not pose any social impacts that are deemed irreversible, fatally flawed, or severely detrimental to the social environment. However, this finding is subject to the implementation of, and adherence to, the identified mitigation measures contained in this report, and as recommended for inclusion in the EMP. In addition, the social specialist strongly recommends the following:

- » Ensure that social issues identified during the EIA phase are addressed during construction. This could be done by engaging social specialists where necessary or by ensuring that ECOs used during construction have the necessary knowledge and skills to identify social problems and address these when necessary. Guidelines on managing possible social changes and impacts could be developed for this purpose.
- » Always inform landowners on any construction activity to start on their property. Prepare them on the number of people that will be on the property and on the activities they will engage in.
- » Ensure that Eskom employees are aware of their responsibility in terms of Eskom's relationship with landowners and communities surrounding power lines. Implement an awareness drive to relevant sections to focus on respect, adequate communication and the 'good neighbour principle.'
- » Incorporate all mitigation measures in the SIA that are relevant to the construction phase in the EMP to ensure these are adhered to by Eskom and the contractor.

Based on the results of the SIA, the use of Alternative 3 and 3a are preferred. This alternative is located adjacent to two existing transmission lines and a metropolitan road (M57), which places alternative 3 within a disturbed corridor. The use of a disturbed corridor implies that people living in the area are used to presence of the lines and therefore an additional line is less likely to change their perception of their area as when the line is placed across a previously undisturbed area (as is the case for most of alternatives 1 and 2). The relocation of structures will not be required with the use of alternative 3 and 3a, whereas there is a distinct possibility that a household would have to be relocated if alternative 1 was implemented. In addition, the affected landowner indicated that alternative 3 will have the least effect on his development plans, as the existing lines have already been factored into the development's site layout plan.

## CONCLUSIONS AND RECOMMENDATIONS

## CHAPTER 6

The conclusions and recommendations of this EIA are a result of the assessment of the impacts identified by the specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

### 6.1. Overview of the Proposed Project

In order to reinforce the existing Transmission network in the Tshwane Region, Eskom Transmission is currently proposing the construction of a 400kV transmission power line between the existing Apollo and Pluto substations. In addition, increased demand for a reliable electricity supply in the Central Grid has necessitated that Eskom Transmission improves the reliability and capacity of the transmission network in the area. Further, upgrade of the 400/132kV Verwoerdburg substation and establishment of a new Phoebus substation is also being proposed in the area in order to improve the reliability and quality of supply problems in the Tshwane area. Various transmission options were investigated by Eskom Distribution network planning, the investment and a new Transmission network was preferred as the most suitable long-term solution. Eskom Transmission is therefore proposing the construction of the **Tshwane Strengthening Project Phase 1**.

In total, **approximately 36 km of new power line** is proposed as part of the entire Tshwane Strengthening project Phase 1. The purpose of this project is to:

- » Improve the reliability of the existing Central Transmission network.
- » Improve the voltage regulation on the Central Grid Distribution and City of Tshwane Metropolitan Municipality network.
- » Create additional Transmission network capacity which will supply the increasing electricity demand in the Central Grid.

As part of its assessment of supply requirements, and as a result of the projected load growth of the Gauteng region, Eskom have determined that additional transmission capacity will be required in the Tshwane Region area by the year 2013. For this reason, Eskom Transmission is proposing the **Tshwane Strengthening Project**. Figure 6.1 and 6.2 provide an indication of the study area considered within the EIA process for this proposed project. This report focuses on the following components:

- » **The extension and upgrade of the existing Verwoerdburg Substation.**

- » Construction of **2x 400kV loop-in lines from the existing Apollo–Pluto** transmission line which will feed into the Verwoerdburg Substation, a distance of approximately ~4 km.

The Environmental Impact Assessment (EIA) for the proposed Tshwane Strengthening Project Phase 1 has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

The EIA Phase aimed to achieve the following:

- » Provide an overall assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
- » Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed project.
- » Comparatively assess identified feasible alternatives put forward as part of the project.
- » Nominate a preferred power line alternative corridor for consideration by the decision-making authorities (i.e. DEA and GDARD).
- » Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
- » Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

The following site location for the proposed substation expansion and power line alternative corridors have been considered within this EIA process (refer to Figure 6.1 and 6.2):

- » A potential site for the establishment of the proposed extension to Verwoerdburg substation. This site is located north-west of the existing Verwoerdburg substation, and it is owned by the applicant, Eskom Holdings.
- » Three turn-in transmission line development corridors in order to link the Apollo-Pluto power lines with the Verwoerdburg substation.

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

## **Evaluation of the Proposed Project**

The preceding chapters of this report together with the specialist studies contained within Appendices F-K provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the EIA process by providing a summary of the conclusions of the assessment of the proposed substation site and alternative transmission line corridors identified for the 400kV transmission power lines. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental consultants during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.



**Figure 6.1:** Image showing the location of the proposed extension of Verwoerdburg substation

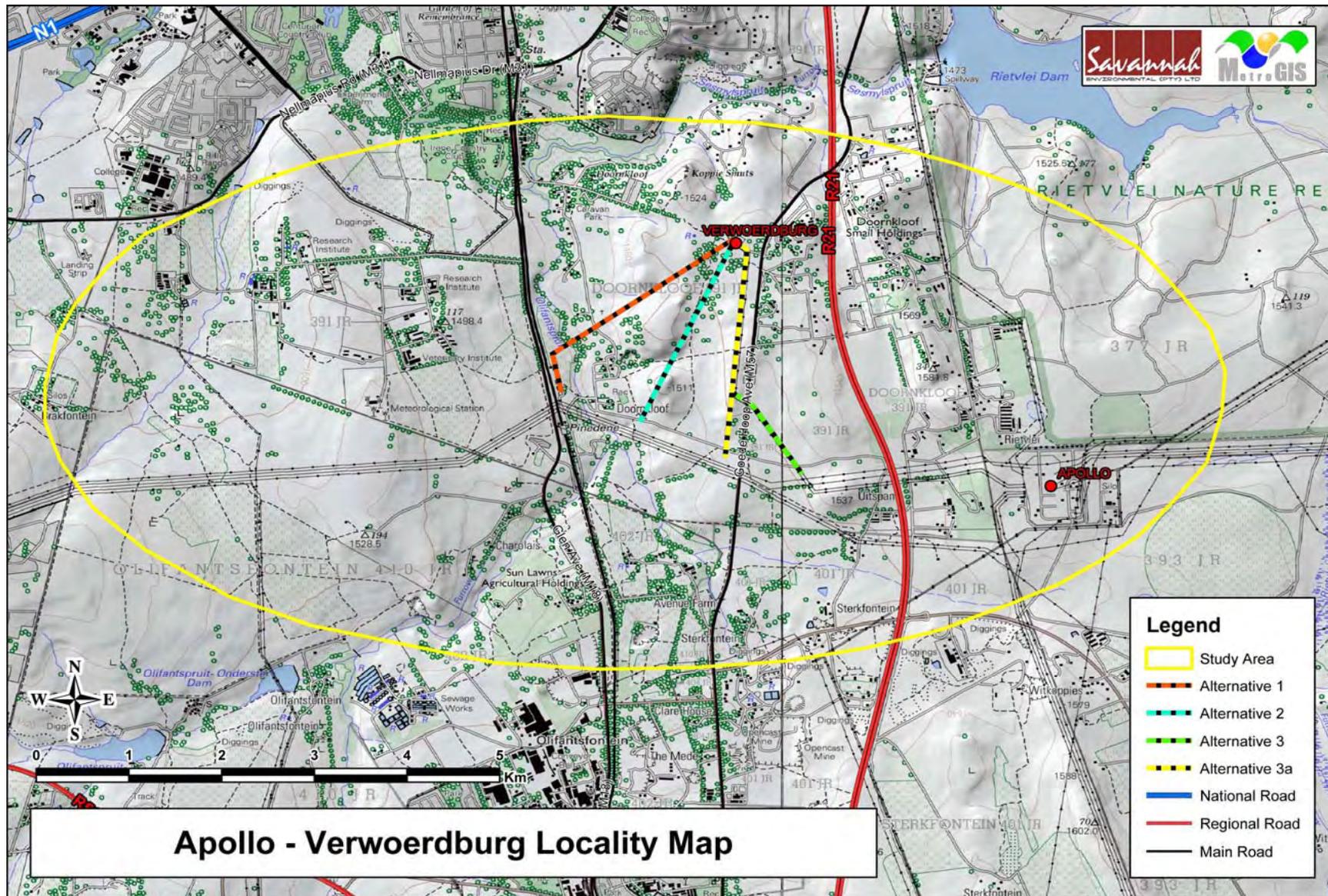


Figure 6.2: Map showing nominated alternatives considered in the EIA Study

### ***6.1.1. Conclusions and Recommendations drawn from the Assessment of the proposed extension of the Verwoerdburg Substation***

The majority of potential impacts identified to be associated with the construction and operation of the proposed substation are anticipated to be localised and restricted to the existing substation site footprint. No environmental fatal flaws were identified to be associated with the site. This is largely due to the fact that the extension of the substation at this site is within the existing substation site footprint, which is already transformed as well as the fact that it would be associated with minimum disturbance to environment. For this reason, the majority of the specialists recommended that the proposed extension be implemented within this proposed development footprint.

Some areas requiring mitigation have been highlighted. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (EMP) included within Appendix L.

The majority of potential impacts identified to be associated with the construction and operation of the proposed substation are anticipated to be localised and restricted to the existing substation site footprint. No environmental fatal flaws were identified to be associated with the site. However some areas requiring mitigation have been highlighted. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (EMP) included within Appendix O.

### ***6.1.2. Conclusions and Recommendations drawn from the Assessment and Comparison of the Turn-In Transmission Power Line Alternatives***

From the conclusions of the specialist studies undertaken, the following has been recommended regarding the power line corridors investigated:

- » In terms of impacts on biodiversity, alternatives 1 and 2 are considered to be “**no go areas**” because of the ecological attributes and sensitivities along these corridors. For this reason, **alternative corridor 3 and 3a** are preferred with moderate to low ecological sensitivity.
  
- » In terms of avifauna, the first and most preferred alternative is **alternative 3**. This alternative follows existing power lines for the entire length and thus the impact on avifauna in terms of collisions, habitat destruction and disturbance will be significantly less. The next most preferred alternative is **alternative 3a**. While this alternative will have slightly higher impacts than alternative 3 these impacts are seen as insignificant and thus this alternative may also be used with minimal

impact on avifauna. Alternatives 1 and 2 are not preferred due to the sensitive habitats which are crossed by these corridors.

- » From a visual sensitivity analysis undertaken, the preferred alignment is **Alternative 3** based on total area of high visual impact and cumulative impact of existing power lines, although there are no fatal flaws eliminating the three (alternative 1, 2 and 3a) alternatives.
- » In terms of Agricultural Potential, in comparing the alternatives, the most suitable route would be either **Alternative 2** or **Alternative 3/3a**, where all of the soils are shallow and rocky, with a low agricultural potential. Alternative 1 is not preferred due to an area of higher potential in the vicinity of the river.
- » From a Heritage Impact assessment, no heritage resources were identified along alternative corridor 3 and 3a. Graveyards were identified to be located in the vicinity of Alternatives 1 and 2. Against this background, the preferred alternative **corridors are 3 and 3a**.

From the conclusions of the specialist workshop undertaken, it was concluded that Alternative corridor 1 and 2 are not recommended for development due to the unacceptably high impacts on the biophysical environment as well as the impacts on the social environment. Therefore, development within these two corridors should be avoided. Alternative corridor 3 was nominated as the preferred alternative by the majority of the specialists. Impacts associated with Alternative 3a are not expected to differ significantly from those associated with Alternative 3. Therefore, this alternative is considered acceptable from an environmental perspective.

As Alternative 3a is shorter than Alternative 3 and would eliminate the need for a bend (and an associated self-supporting tower), this alternative is preferred from an economic and technical perspective. Therefore, from a holistic perspective (i.e. considering technical, ecological, social and economic criteria), **Alternative 3a** is nominated as the preferred alternative (refer to Figure 6.3).

It is considered vital that construction of the two turn-in power lines within this corridor take the recommended conditions identified by the specialist studies in to consideration. Should the project be authorised by DEA, the final routing of the turn-in power lines within the nominated preferred corridor should be undertaken in consultation with the affected landowners and the following specialists.

- » Biodiversity specialist
- » Avifauna specialist
- » Heritage specialist

In addition, once the final turn-in transmission power line alignment has been negotiated and the tower positions surveyed and pegged, a walk-through survey must be undertaken by the specialists in order to minimise potential environmental impacts associated with the proposed project.

## 6.2. Overall Conclusion (Impact Statement)

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

- » Although some impacts of potential high significance are associated with the transmission lines and substation, there are no environmental fatal flaws that should prevent the proposed turn-in power lines and substation from being constructed on the proposed alignment and the proposed substation extension site respectively, provided that the recommended mitigation measures are implemented.
- » No issues of significance were identified to be associated with the proposed extension of the Verwoerdburg substation.
- » Alternative corridor 1 and 2 are not preferred from the conclusions of the majority of the specialists. This alternative corridor was only preferred from an agricultural potential perspective.
- » The majority of the specialists recommended that alternative 3 be nominated as the preferred alternative followed by alternative corridor 3a.
- » From a holistic perspective, **Alternative Corridor 3a** is nominated as the preferred corridor for the construction of the proposed turn-in transmission power lines.
- » The significance levels of the majority of identified negative impacts can be mitigated and minimised by implementing the recommended mitigation measures

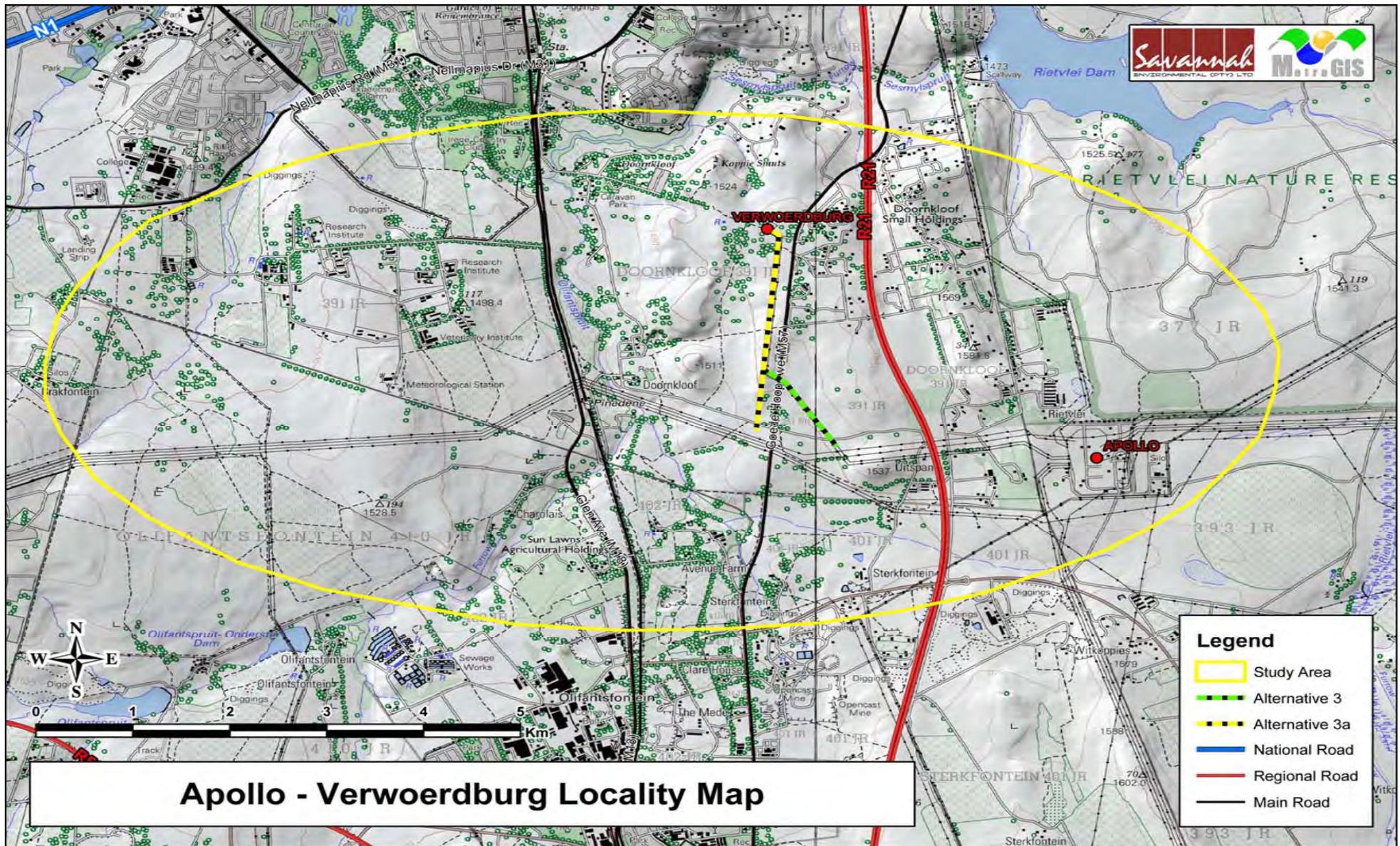


Figure 6.3: Nominated preferred alternatives for the Apollo-Verwoerdburg power line

### 6.3. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the proposed substation extension, construction and operation of the turn-in transmission power lines, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Tshwane Strengthening Project Phase 1, Apollo-Verwoerdburg component (EIA Ref 12/12/20/1470) be authorised by DEA to include the following:

- » Extension/upgrade of the Verwoerdburg substation at proposed site north of the existing substation.
- » Construction of 2X 400 kV turn-in transmission power lines looping in and out of the Apollo-Pluto transmission lines within **Alternative Corridor 3a**. Eskom must negotiate the most appropriate route within this corridor with the affected landowners.

The following conditions of this recommendation must be included within the authorisation issued:

- » All mitigation measures detailed within this report and the specialist report contained within Appendices F to K must be implemented.
- » The draft Environmental Management Plan (EMP) as contained within Appendix L of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed Tshwane Strengthening Project Phase 1 (Apollo-Verwoerdburg component), and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases (for Construction and Operation) of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
- » Applications for all other relevant and required permits required to be obtained by Eskom must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site and disturbance of protected vegetation.
- » During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
- » The EMP for construction must be updated to include site specific information and specifications resulting from the final walk-through surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction on site.

- » Utilisation of cross-rope suspension tower structures is recommended where possible rather than the conventional self-supporting strain towers that are more obstructive
- » Mitigation of the visual impact through conventional visual impact mitigation measures (i.e. vegetation screening, landscaping or design) is highly unlikely to succeed due to the inherent functional design of the substation structures and transmission line infrastructure. The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an on-going basis.
- » The process of communication and consultation with the community representatives must be maintained after the closure of this EIA process, and, in particular, during the construction phase associated with the proposed project.
- » Finally to ensure that social impacts are mitigated during construction and operation, it is recommended that the following be implemented and monitored by an ECO;
  - o A social management Plan during construction and operation
  - o A decommissioning and Closure Plan
  - o A stakeholder Engagement Plan
  - o A grievance mechanism for the construction and operation phases

**REFERENCES AND INFORMATION SOURCES USED FOR  
COMPILATION OF THE DEI REPORT**

**CHAPTER 7**

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