

# NALEDZI

**Environmental Consultants cc.**

Reg. 2003/089035/23

## **FINAL ENVIRONMENTAL IMPACT REPORT**

### **PROPOSED CONSTRUCTION OF A NEW 2X400kV POWER LINE FROM GLOCKNER SUBSTATION TO ETNA SUBSTATION, GAUTENG PROVINCE, SA**

**PREPARED FOR:**

**ESKOM HOLDINGS LIMITED**

P.O. Box 1091

Johannesburg

2000

South Africa

**PREPARED BY:**

**NALEDZI ENVIRONMENTAL CONSULTANTS**

Suite #320, Postnet Library Gardens  
P/Bag X9307  
Polokwane, 0700  
South Africa

Tel: (015) 296 3988  
Fax: (015) 296 4021  
e-mail: [info@naledzi.co.za](mailto:info@naledzi.co.za)

## **VOLUME 1: MAIN REPORT**

**OCTOBER 2007**

## **VOLUMES OF THE ENVIRONMENTAL IMPACT REPORT**

---

### **VOLUME 1: MAIN REPORT**

This volume contains the following appendices:

Appendix 1: Scoping Report Acceptance from DEAT

Appendix 2: Application Form Acknowledgement Letter

Eight figures, including Figure 8 (Locality Map with Corridors) also form part of this volume

### **VOLUME 2: PUBLIC PARTICIPATION REPORT**

### **VOLUME 3: SPECIALIST REPORTS**

### **VOLUME 4: DRAFT ENVIRONMENTAL MANAGEMENT PLAN**

## PROJECT INFORMATION

TITLE	Proposed Construction of 2x400kV Power Lines from Glockner substation to Etna substation in the Gauteng Province of South Africa
APPLICANT	Eskom Holdings Limited
ENVIRONMENTAL CONSULTANTS	Naledzi Environmental Consultants
REPORT DATE	31 October 2007

**REPORT COMPILED BY:** Khangwelo Desmond Musetsho



.....  
Khangwelo Desmond Musetsho (CEAPSA, SAIEES)  
Senior Environmental Scientist and Managing Director

### EXPERTISE AND QUALIFICATIONS

**Desmond Musetsho** is a Senior Environmental Scientist and currently the Managing Director of Naledzi Environmental Consultants. He has over 6 years of experience in the field of Integrated Environmental Management, both on a project and management level. Mr. Musetsho holds a Professional Bachelor of Environmental Management (Hons) Degree from the University of Venda and is currently completing his Masters in Environmental Sciences. He has extensive experience in Environmental Impact Assessments, development of management plans, development and implementation of Environmental Management Programmes for construction, and facilitation of public processes and workshops. Desmond is a Certified Environmental Assessment Practitioner (ICB-EAPSA) and an Environmental Scientist (SAIEES).

## **EXECUTIVE SUMMARY**

---

### **INTRODUCTION**

Naledzi Environmental Consultants (NEC) has been appointed by Eskom Holdings Limited to conduct an Environmental Impact Assessment (EIA) for the proposed 2x400kV Power Lines from Glockner Substation to Etna Substation. The said EIA is being carried out as per the requirements of Regulations 27 to 36 of the Regulations compiled in terms of Chapter 5 of the National Environmental Management Act, 1998 (Act 107 of 1998).

This Final Environmental Impact Report (FEIR) details the conclusions of the second stage of the EIA study, which entails a number of specialist studies aimed at assessing the potential impacts identified during the scoping phase. This stage also recommends the alternatives that were found to be preferred after taking into consideration the entire specialist inputs and the views of the public.

### **BACKGROUND AND THE NEED FOR THE PROJECT**

Electricity cannot be stored, it is therefore necessary to generate and deliver power 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 power stations to major substations around the country. At these substations voltage is reduced for distribution to smaller substations, from where electricity is distributed to industries, businesses, homes and farms throughout the country.

If Eskom is to honour its mandate and commitment to meet the increasing needs of end-users, it has to establish and expand its infrastructure of both transmission/distribution power lines and substations on an ongoing basis. As a result of an increase in load, it is necessary to reinforce the existing electrical infrastructure.

A need was identified for Eskom Transmission to augment the existing electricity infrastructure within the Vaal/West Rand area of the Gauteng Province. Eskom Transmission is to build a double circuit 400kV power line between the existing Etna Substation and Glockner Substation.

It is expected that the average growth in load demand in the Vaal and West Rand area will be in the order of 1.5% per annum from 2006 to 2026, i.e. over the 20-year Eskom Planning Period. It is also reported that since 1995, there has been a marked increase in load demand at Taunus Substation, which primarily supplies Soweto and its surrounding areas.

This load build-up, which reached a combined peak of almost 1000MW in 2005, has resulted in a significant increase in the amount of power flowing from Lethabo Power Station to Taunus and Etna Substations, via Eiger and Brenner Substations. Load flow studies indicated that the peak power flowing from Eiger Substation towards Etna and Taunus Substations is expected to be as high as 700MW during the winter period of 2006 (under system healthy conditions).

The analysis showed, therefore, that it was sensible to consider alternative ways in which power from Lethabo Power Station could be more effectively delivered to these two substations, which in this case was to build more power lines between the two substations.

## **THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS**

Building the above mentioned power lines falls within 'listed activities', as defined by the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations of 2006. Listed activities are activities, which may have potentially detrimental impacts on the environment and therefore require environmental authorization from the competent authority.

In this case, the primary listed activity is the transmission and distribution of above ground electricity with a capacity in excess of 120kV. Since the applicant is Eskom (a Parastatal), the National Department of Environmental Affairs and Tourism (DEAT) was identified as the competent regulatory authority. Environmental Impact Assessment is a two phased process (Scoping Phase and Environmental Impact Reporting Phase). This report is the result of the second phase, although it considers the inputs from the scoping phase as well.

In the Scoping Phase, information was gathered, and together with specialist and technical input, used to identify potential impacts associated with the proposed project, and to highlight areas, which should be avoided in order to minimize these biophysical and social impacts.

## **PUBLIC PARTICIPATION PROCESS**

A public participation process was undertaken to identify issues and concerns of key stakeholders and interested and affected parties. The results were documented in the Scoping Report. The public participation process included consultation with the municipalities, government departments, non-governmental organizations and environmental groups as well as an extensive effort to identify potentially affected individuals and the general public. This included the distribution of documents by mail, e-mail, use of printed media, telephonic conversations, one-on-one meetings, focus group meetings and public meetings.

The public participation process for the EIA does not include the final servitude negotiation with the landowners who will be directly affected by the proposed development. The servitude negotiation process will be done by an Eskom negotiator once an authorization has been received from the Department of Environmental Affairs and Tourism. The Eskom negotiator however has been involved in discussions and meetings which were aimed at identifying different options or routes. Issues raised by stakeholders and an indication of how they were addressed have been recorded in an Issues and Response Report.

## **DESCRIPTION OF THE STUDY AREA AND ANTICIPATED IMPACTS**

The study area is a stretch of land between the existing Etna Substation and the existing Glockner Substation. This piece of land traverses the City of Johannesburg and Sedibeng District Municipality's jurisdiction. The upper part of the study area (the area where Etna Substation is located) that falls under the City of Johannesburg comprises Lenasia, Ennerdale and Orange Farm, both falling under Region G of the City of Johannesburg. The lower part falls within the Sedibeng District Municipality, and specifically within the Emfuleni and Midvaal Local Municipalities.

Etna substation is located (**26°23' 7.61"s and 27°52' 31.33"e**) some 26km southwest of Johannesburg. It is also approximately 15km from Lenasia and approximately 5km from Ennerdale, within the City of Johannesburg area of jurisdiction. Glockner substation on the other hand is located (**26°36' 17.28"s and 27°59' 12.78"e**) in the Rothdene area of the Midvaal Local Municipality. The climate in the area under study is characteristic of the highveld. It has warm summers with showers and thunderstorms commonly occurring in the late afternoon with rainfalls that vary between 700mm and 800mm. The winters are cool and dry.

The study area falls within the Grassland Biome, which covers the high central plateau of South Africa. Most of the area is covered by Cymbogon Themeda Veld Type 48b, Northern Variation. Setaria grass species and Themeda and Eragrostis species dominate this veld type. Normally occurring trees and shrubs are limited to specialised niches, such as riverine fringes.

On a broader scale, the area under study is used mostly for two major land use activities (agriculture and residential), with agricultural activities mostly found towards the eastern side and the residential activities towards the western side. The stretch of land towards Rothdene (Glockner substation) is mostly privately owned while the land towards Lenasia South (Etna substation) is mostly government (state) owned. The area in between the two above is characterised by the presence of Agricultural Holdings/Estates which are scattered almost everywhere.

The scoping process identified a large number of potential environmental impacts anticipated during the implementation of the Glockner-Etna 2x400kV Power line. It is important to highlight that the significant impacts are chosen from a pool of this vast number of identified impacts. It is also vital to point out that the impacts were identified through site visits, internal workshops by the project team and the public participation process.

The following key issues and/or potential impacts were identified for further investigations:

- ❖ Impact on ecological processes
- ❖ Impact on soils and geology (including agricultural potential)
- ❖ Impacts on heritage and archaeological resources
- ❖ Impacts on visual conditions and aesthetics (visual impacts)
- ❖ Impacts on current and future developments (social environment)
- ❖ Impacts on birds (avi-fauna)

## **ALTERNATIVES CONSIDERED**

Three alternative corridors (1km wide) were identified during the scoping phase. The three alternative routes are coloured (Blue-Alternative 1, Pink-Alternative 2 and Yellow-Alternative 3). Detailed description of where the three alternative routes are found and which area they traverse is given in detail in this report.

## **KEY FINDINGS OF THE EIA**

A recommended corridor, that is technically feasible and which avoids most of the significant environmental issues has been identified based on the key outcomes of the specialist studies and a rating of the preferred corridor for key environmental issues. The involvement of the public, with a number of issues raised also influenced the final decision. The following particular aspects should receive attention in the implementation of the Transmission power line project:

- ❖ The final route of the transmission power line should:
  - Be within the recommended corridor
  - Be aligned through the lower lying landforms
  - Cross existing roads as close to 90 degrees as possible
  - Position the towers on a midslope of a landform that rises to a plateau so that the plateau will form a background to the line
- ❖ Vegetation, avi-faunal and heritage resources specialists should undertake a site inspection of each tower position and any new access roads to ensure that no endangered species or heritage resources are compromised
- ❖ No tower or access roads should be placed in wetlands.

## **CONCLUSION**

The EIA team believes that the EIA for the proposed **2 x 400 kV** double circuit power line between Glockner and Etna Substations fulfils the process requirements of current environmental legislation. Issues and associated impacts have been investigated by a team of qualified specialists who have reported on their findings without reservations. Extensive efforts were made to identify and involve potentially affected parties during the public participation process. The public has been afforded opportunities to participate in the EIA. The recommendations set out in the findings section of the EIA are therefore presented for project implementation and the EIR is hereby presented to the relevant authorities (DEAT) for decision making.

## TABLE OF CONTENT

VOLUMES OF THE ENVIRONMENTAL IMPACT REPORT .....	i
PROJECT INFORMATION.....	ii
EXECUTIVE SUMMARY .....	iii
TABLE OF CONTENT .....	vii
LIST OF APPENDICES .....	x
LIST OF TABLES .....	xi
LIST OF FIGURES .....	xii
LIST OF ABBREVIATIONS .....	xiii
DEFINITIONS.....	xiv
<b>1. INTRODUCTION .....</b>	<b>1</b>
1.1 SCOPE OF WORKS.....	1
1.2 ASSUMPTIONS AND LIMITATIONS .....	2
1.2.1 Stage of project and availability of information .....	2
1.2.2 Confidentiality .....	2
<b>2. ENVIRONMENTAL ASSESSMENT PRACTITIONERS .....</b>	<b>3</b>
2.1 BACKGROUND .....	3
2.2 THE STUDY TEAM .....	3
<b>3. NATURE OF THE DEVELOPMENT .....</b>	<b>5</b>
3.1 BACKGROUND .....	5
3.2 THE NEED AND DESIRABILITY OF THE PROJECT .....	5
3.3 STRATEGIC ALTERNATIVES CONSIDERED .....	7
3.3.1 Option 1: Do nothing .....	7
3.3.2 Option 2: New 400kV circuit lines between etna-hera and glockner-hera substations .....	7
3.3.3 Option 3: Build a new 275kV double circuit line between Glockner and etna substations .....	8
3.4 THE ROUTE/CORRIDOR INVESTIGATION PROCESS .....	9
3.4.1 Role of environmental practitioners.....	9
3.4.2 Role of the proponent.....	10
3.4.3 Role of the public.....	10
3.5 ALTERNATIVE CORRIDORS/ROUTES IDENTIFIED .....	11
3.5.1 Alternative route 1 .....	11
3.5.2 Alternative route 2 .....	11
3.5.3 Alternative route 3 .....	12
3.6 THE TECHNICAL DETAILS OF THE PROJECT.....	12
3.6.1 Types of towers/pylons .....	12
3.6.2 Servitude required for the proposed power lines .....	14
3.6.3 Phases of the development.....	15
<b>4. DESCRIPTION OF THE AFFECTED ENVIRONMENT .....</b>	<b>16</b>
4.1 BACKGROUND (LOCATION) .....	16
4.2 BIOPHYSICAL ENVIRONMENT .....	16
4.2.1 Climate.....	16
4.2.2 Topography and major land features .....	16
4.2.3 Fauna and flora .....	16
4.2.4 conservation areas .....	17
4.2.5 Soils.....	17
4.2.6 Geology and geomorphology.....	18



4.2.7	Hydrology and drainage.....	19
4.3	SOCIO-ECONOMIC ENVIRONMENT.....	19
4.3.1	Social and population characteristics.....	19
4.3.2	Housing and basic services .....	21
4.3.3	Land use and properties .....	22
4.3.4	Agriculture .....	23
4.3.5	Existing and future infrastructure/developments.....	23
<b>5.</b>	<b>LEGAL CONSIDERATIONS.....</b>	<b>24</b>
5.1	THE CONSTITUTION ACT, 1996 (ACT NO. 108 OF 1996).....	24
5.2	ENVIRONMENT CONSERVATION ACT, 1989 (ACT NO 107 OF 1989)	24
5.3	NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) .....	25
5.4	NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT NO. 10 OF 2004).....	25
5.5	NAIONAL FOREST ACT, 1998 (ACT NO. 84 OF 1998).....	25
5.6	NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998).....	25
5.7	CONSERVATION OF AGRICULTURAL RESOURCES ACT.....	26
5.8	NATIONAL HERITAGE RESOURCES ACT, 1999 (ACT NO. 25 OF 1999)	27
5.9	NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT, 2003 (ACT NO. 57 OF 2003).....	28
<b>6.</b>	<b>AUHTORITY CONSULTATION AND PUBLIC PARTICIPATION .....</b>	<b>29</b>
6.1	APPLICATION TO THE AUTHORITIES.....	29
6.2	EIA COMMENCEMENT PRESS ADVERTISEMENTS.....	29
6.3	EIA COMMENCEMENT ON-SITE ADVERTISEMENTS .....	29
6.4	IDENTIFICATION OF KEY STAKEHOLDERS AND I&APs.....	29
6.5	FOCUS GROUP MEETINGS.....	29
6.6	KEY STAKEHOLDER WORKSHOP.....	30
6.7	PROJECT PUBLIC MEETINGS ADVERTISEMENTS .....	30
6.8	PLACEMENT OF PROJECT INFORMATION ON ESKOM'S WEBSITE	32
<b>7.</b>	<b>GLOCKNER TO ETNA SPECIFIC ENVIRONMENTAL ASSESSMENT .</b>	<b>33</b>
7.1	SUMMARY PF FINDINGS OF SPECIALIST STUDIES.....	33
7.1.1	Visual impacts.....	34
7.1.2	Soils, geology and agriculture.....	39
7.1.3	Archaeological and/or culturl resources .....	39
7.1.4	Ecology and ecological sensitivity.....	40
7.1.5	Social and economic aspects.....	41
7.1.6	Birds (avi-fauna) and their habitats.....	48
7.2	IMPACT ASSESSMENT, RANKING AND RATING.....	51
7.2.1	Visual character of the area.....	53
7.2.2	Soils, geology and agriculture.....	57
7.2.3	Archaeological and/or culturl resources .....	58
7.2.4	Ecology and ecological sensitivity.....	59
7.2.5	Social and economic aspects.....	65
7.2.6	Birds (avi-fauna) and their habitats.....	70
<b>8.</b>	<b>IMPACTS MITIGATION MEASURES.....</b>	<b>74</b>
8.1	VISUAL IMPACTS.....	74

8.1.1	General .....	74
8.1.2	Transmission Towers .....	74
8.1.3	Access Roads .....	74
8.1.4	Cleared Servitudes .....	74
8.1.5	Construction Camps.....	75
8.2	AGRICULTURAL POTENTIAL, SOILS AND GEOLOGY .....	75
8.3	ARCHAEOLOGY AND HERITAGE RESOURCES .....	75
8.4	ECOLOGY AND ECOLOGICAL SENSITIVITY.....	75
8.5	SOCIAL AND ECONOMIC ENVIRONMENT.....	75
8.5.1	Population change.....	75
8.5.2	Introduction of people dissimilar in demographic profile .....	76
8.5.3	Inflow and outflow of workers .....	76
8.5.4	Residential proximity and/or relocation.....	76
8.5.5	Formation of attitudes against the project.....	77
8.5.6	Employment opportunities.....	77
8.5.7	Disruption in daily living and movement patterns.....	77
8.5.8	Infrastructure, services and farming activities .....	78
8.5.9	Township developments .....	78
8.5.10	Perceptions regarding health and safety .....	79
8.6	BIRDS IMPACTS MITIGATION MEASURES .....	80
8.6.1	Collision with earth wire:.....	80
8.6.2	Disturbance and habitat destruction:.....	80
8.6.3	Streamer related faults on the strain towers:.....	80
<b>9.</b>	<b>IMPACT STATEMENT.....</b>	<b>81</b>
<b>10.</b>	<b>CONCLUSIONS AND recommendations .....</b>	<b>82</b>
<b>11.</b>	<b>REFERENCES .....</b>	<b>83</b>
11.1	VISUAL.....	83
11.2	AGRICULTURE, SOILS AND GEOLOGY .....	84
11.3	ARCHAEOLOGY AND HERITAGE .....	85
11.4	ECOLOGY AND ECOLOGICAL SENSITIVITY.....	86
11.5	SOCIAL AND ECONOMIC .....	86
11.6	BIRDS.....	87

## **LIST OF APPENDICES**

Appendix 1: Scoping Report Acceptance Letter

Appendix 2: Application Form Acknowledgement Letter

## **LIST OF TABLES**

---

- Table 1: Naledzi Environmental Consultants Team
- Table 2: Environmental Assessment Practitioner Contact Details
- Table 3: Population Figures of Municipalities in the area
- Table 4: Gender Statistics
- Table 5: Education Statistics
- Table 6: Basic Services Statistics
- Table 7: List of Newspapers where EIA Commencement was advertised
- Table 8: Municipalities invited to Focus Group Meetings
- Table 9: List of newspapers where public meetings dates/venues were advertised
- Table 10: Newspapers where Draft Scoping Report availability was advertised
- Table 11: Public Places where the Draft Scoping Report was placed
- Table 12: List of Specialists involved in the project
- Table 13: Impact Rating; Landscape
- Table 14: Impact Rating; Visual Impacts on Residents
- Table 15: Impact Rating; Visual Impacts on Tourists
- Table 16: Impact Rating; Visual Impacts on Motorists
- Table 17: Impact Rating; Soils, geology and agriculture
- Table 18: Impact Rating; Heritage and archaeological resources
- Table 19: Impact Rating; Ecology and Sensitivity
- Table 20: Impact Rating; Ridges
- Table 21: Impact Rating; Wetlands and Water Courses
- Table 22: Impact Rating; Rivers and Riparian Habitats
- Table 23: Impact Rating; Pristine Patches of Grassland Habitats
- Table 24: Impact Rating; Faunal Species
- Table 25: Impact Rating; Population Change
- Table 26: Impact Rating; Introduction of people dissimilar in demographic state
- Table 27: Impact Rating; Inflow and outflow of workers
- Table 28: Impact Rating; Residential proximity and/or relocation
- Table 29: Impact Rating; Township developments
- Table 30: Impact Rating; Bird Habitat Destruction
- Table 31: Impact Rating; Bird Habitat Disturbance
- Table 32: Impact Rating; Bird Habitat Destruction A
- Table 33: Impact Rating; Collisions and Disturbance during operation

## **LIST OF FIGURES**

---

Figure 1: Actual Load demand for Taunus and Etna

Figure 2: Current Geographical layout of the Vaal and West Rand CLN networks

Figure 3: Proposed New 400kV DC line between Etna-Hera and Glockner-Hera

Figure 4: Proposed 275/400kV DC between Glockner and Etna

Figure 5: Cross Rope Suspension Tower

Figure 6: Guyed suspension Tower

Figure 7: Self Supporting Tower

Figure 8: Locality Map with Alternative Corridors

## **LIST OF ABBREVIATIONS**

---

<b>AINP:</b>	Archaeo-Infor Northern Province
<b>CLF:</b>	Community Liaison Officer
<b>DEAT:</b>	Department of Environmental Affairs and Tourism
<b>DSR:</b>	Draft Scoping Report
<b>DWAF:</b>	Department of Water Affairs and Forestry
<b>ECO:</b>	Environmental Control Officer
<b>EAP:</b>	Environmental Assessment Practitioner
<b>EIA:</b>	Environmental Impact Assessment
<b>EIR:</b>	Environmental Impact Report
<b>EMP:</b>	Environmental Management Plan
<b>FEIAR;</b>	Final Environmental Impact Assessment Report
<b>I&amp;APs:</b>	Interested and Affected Parties
<b>IEM:</b>	Integrated Environmental Management
<b>kV:</b>	Kilovolts
<b>NEC:</b>	Naledzi Environmental Consultants
<b>NEMA:</b>	National Environmental Management Act, 1998 (Act No.107 of 1998)
<b>NHRA:</b>	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
<b>NWA:</b>	National Water Act, 1998 (Act No.36 of 1998)
<b>PS:</b>	Plan of Study
<b>RSA:</b>	Republic of South Africa
<b>SAHRA:</b>	South African Heritage Resources Agency
<b>SR:</b>	Scoping Report

## DEFINITIONS

---

**Affected Environment:** Those parts of the socio-economic and biophysical environment impacted on by the development.

**Affected public:** Groups, organizations, and/or individuals who believe that an action might affect them

**Alien species:** Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity

**Alternative alignment / corridors:** the identified power line alignments within the study area

**Alternative proposal:** A possible course of action, in place of another, that would meet the same purpose and need. Alternative proposals can refer to any of the following but are not necessarily limited thereto:

- \* Alternative sites for development
- \* Alternative projects for a particular site
- \* Alternative site layouts
- \* Alternative designs
- \* Alternative processes
- \* Alternative materials

**Applicant:** Any person who applies for an authorization to undertake a listed activity or to cause such activity in terms of the relevant environmental legislation. In this case, Eskom is the applicant

**Authorities:** The national, provincial or local authorities, which have a decision-making role or interest in the proposal or activity, in this project, the competent authority is the National Department of Environmental Affairs and Tourism. The term includes the competent authority as well as other authorities.

**Biodiversity:** the variability among living organisms from all sources including *inter alia* terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

**Biome:** A major biotic unit, consisting of plant and animal communities, having similarities in form and environmental conditions, but not including the abiotic portion of the environment

**Decision-making:** The sequence of steps, actions or procedures that result in decisions, at any stage of a proposal.

**Ecology:** the study of the inter relationships between organisms and their environments.

**Ecosystem:** organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space.

**Endangered:** a taxon is endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future

**Environment:** NEMA defines “environment” as “the surroundings within which humans exist and that are made up of the land, water and atmosphere of the earth; micro organisms, plant and animal life; any interrelationships among and between them and the physical, chemical aesthetic and cultural properties and conditions that influence human health and well-being”.

**Environmental Control Officer:** Independent officer employed by the applicant to ensure the implementation of the Environmental Management Plan (EMP) and manage any further environmental issues that may arise.

**Environmental Impact Assessment:** An assessment of the positive and negative environmental consequences of the development of the proposed project. The primary objective of the EIA is to aid decision-making by providing factual information on the assessment of the impacts and determining their significance and on which to base valued judgments in choosing one alternative over another.

**Hillslope Units:** Configuration of the landform consisting of crest, scarp, midslope, footslope and valley bottom

**Horizon contour:** A line that encircles a development site and that follows ridgelines where the sky forms the backdrop and no landform is visible as a background. This is essentially the skyline that when followed through the full 360-degree arc as viewed from a representative point on the site defines the visual envelope of the development. This defines the boundary outside which the development would not be visible.

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

**Interested and affected parties (I&APs):** Individuals, communities or groups, other than the proponent or the authorities, whose interests may be positively or negatively affected by a proposal or activity and/or who are concerned with a proposal or activity and its consequences. These may include local communities, investors, business associations, trade unions, customers, consumers and environmental interest groups. The principle that environmental consultants and stakeholder engagement practitioners should be independent and unbiased excludes these groups from being considered stakeholders.

**Landscape condition:** Refers to the state of the landscape of the area making up the site and that of the study area in general. Factors affecting the condition of the landscape can include the level maintenance and management of individual landscape elements such as buildings, woodlands etc and the degree of disturbance of landscape elements by non-characteristics elements.

**Landscape impact:** Changes to the physical landscape resulting from the development that include; the removal of existing landscape elements and features, the addition of new elements associated with the development and altering of existing landscape elements or features in such as way as to have a detrimental affect on the value of the landscape.

**Lead authority:** The environmental authority at the national, provincial or local level entrusted in terms of legislation, with the responsibility for granting approval to a proposal or allocating resources and for directing or coordinating the assessment of a proposal that affects a number of authorities. In this project, the lead authority is the Department of Environmental Affairs and Tourism



**Magnitude of Impact:** the combination of the intensity, duration and extent of an impact occurring.

**Mitigate:** The implementation of practical measures to reduce adverse impacts.

**Monitoring:** The repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time to assess the efficiency of control measures.

**Preferred (option):** The preferred option, whether in terms of camp siting, road alignment, service alternative e.t.c., refers to the concessionaire's preferred alternative and/or the alternative proposed in the concessionaire's environmental proposal which formed part of the bid process. It does not necessarily refer to the recommended alternative discussed in the Scoping Report.

**Proponent:** Any individual, government department, authority, industry or association proposing an activity (e.g. project, programme or policy). In this project, Eskom is the proponent

**Proposed servitude:** Refers to the proposed final alignment that the transmission line should follow.

**Public:** Ordinary citizens who have diverse cultural, educational, political and socio-economic characteristics. The public is not a homogeneous and unified group of people with a set of agreed common interests and aims. There is no single public. There are a number of publics, some of whom may emerge at any time during the process depending on their particular concerns and the issues involved.

**Role-players:** The stakeholders who play a role in the environmental decision-making process. This role is determined by the level of engagement and the objectives set at the outset of the process.

**Red Data:** A list of species, fauna and flora that require environmental protection, based on the IUCN definitions

**Scoping:** The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an environmental assessment process. The main purpose of scoping is to focus the environmental assessment on a manageable number of important questions. Scoping should also ensure that only significant issues and reasonable alternatives are examined.

**Sensitive area:** a sensitive area or environment can be described as an area or environment where a unique ecosystem, habitat for plant and animal life, wetlands or conservation activity exists or where there is a high potential for ecotourism.

**Significant/significance:** Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgments and science-based criteria (i.e. biophysical, social and economic). Such judgment reflects the political reality of impact assessment in which significance is translated into public acceptability of impacts.

**Species diversity:** a measure of the number and relative abundance of species (see biodiversity).

**Stakeholders:** A sub-group of the public whose interests may be positively or negatively affected by a proposal or activity and/or who are concerned with a proposal or activity and its consequences. The term therefore includes the proponent, authorities (both the lead authority and other authorities) and all interested and affected parties (I&APs). The principle that environmental consultants and stakeholder engagement practitioners should be independent and unbiased excludes these groups from being considered stakeholders.

**Stakeholder engagement:** The process of engagement between stakeholders (the proponent, authorities and I&APs) during the planning, assessment, implementation and/or management of proposals or activities. The level of stakeholder engagement varies depending on the nature of the proposal or activity as well as the level of commitment by stakeholders to the process. Stakeholder engagement can therefore be described by a spectrum or continuum of increasing levels of engagement in the decision making process. The term is considered to be more appropriate than the term “public participation

**Study area:** Refers to the entire study area encompassing all the alternative alignments as indicated on the study area map.

**Sub-station:** a distribution point within the local and national network from which electrical current is rerouted along different power lines as well as distributed to local and municipal networks.

**Threatened species:** Species, which have naturally small populations, and those, which have been reduced to small (often unstable) populations by man's activities

**Transmission line:** Pylons support the 400kV transmission line consisting of steel support structures (supported by guy wires). Transmission lines are suspended between the supports.

**Viewer exposure:** the extent to which viewers are exposed to views of the landscape in the affected area. Viewer exposure considers the visibility of the site, the viewing conditions, the viewing distance, the number of viewers affected the activity of the viewers (tourists or workers) and the duration of the views.

**Viewer sensitivity:** the assessment of the receptivity of viewer groups to the visible landscape elements, visual character and their perception of visual quality and value. The sensitivity of viewer groups depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions.

**Visual absorption capacity (VAC):** the inherent ability of a landscape to accept change or modification to the landscape character and/or visual character without diminishment of the visual quality or value, or the loss of visual amenity. A high VAC rating implies a high ability to absorb visual impacts while a low VAC implies a low ability to absorb or conceal visual impacts.

**Visual amenity:** the notable features such as hills or mountains or distinctive vegetation cover such as forests and fields of colour that can be identified in the landscape and described. Also included are recognised views and viewpoints, vistas, areas of scenic beauty and areas that are protected in part for their visual value.

**Visual character:** this addresses the viewer response to the landscape elements and the relationship between these elements that can be interpreted in terms of aesthetic characteristics such as pattern, scale, diversity, continuity and dominance.

**Visual contour:** the outer perimeter of the visual envelope determined from the site of the development. The two dimensional representation on plan of the horizon contour

**Visual contrast:** the degree to which the physical characteristics of the proposed development differ from that of the landscape elements and the visual character.

**Visual impact assessment:** a specialist study to determine the visual effects of a proposed development on the surrounding environment. The primary goal of this specialist study is to identify potential risk sources resulting from the project that may impact on the visual environment of the study area, and to assess their significance. These impacts include landscape impacts and visual impacts.

**Visual impact:** Changes to the visual character of available views resulting from the development that include: obstruction of existing views; removal of screening elements thereby exposing viewers to unsightly views; the introduction of new elements into the view shed experienced by visual receptors and intrusion of foreign elements into the view shed of landscape features thereby detracting from the visual amenity of the area.

**Visual magnitude:** Product of the vertical and horizontal angles of an object to describe quantitatively the visual dimension of an object (Iverson, 1985). The visual magnitude is best described in terms of visual arcs with a one minute arc usually considered as being the minimum resolution detectable by the human eye (equivalent to observing a 29 mm ball at a distance of one hundred metres).

**Visual quality:** an assessment of the aesthetic excellence of the visual resources of an area. This should not be confused with the value of these resources where an area of low visual quality may still be accorded a high value. Typical indicators used to assess visual quality are vividness, intactness and unity. For more descriptive assessments of visual quality, attributes such as variety, coherence, uniqueness, harmony, and pattern can be referred to.

**Zone of visual influence:** the extent of the area from which the most elevated structures of the proposed development could be seen and may be considered to be of interest.

## 1. INTRODUCTION

Naledzi Environmental Consultants (NEC) has been appointed by Eskom Holdings Limited to conduct an Environmental Impact Assessment (EIA) for the proposed 2 x 400kV Power Lines from Glockner Substation to Etna Substation. Glockner substation is found within the Midvaal Local Municipality of the Sedibeng District while Etna substation is within the Johannesburg City Council area of jurisdiction. Both Sedibeng District Municipality and the Johannesburg City Council fall under the Gauteng Province, South Africa. Naledzi Environmental Consultants served as independent environmental consultants in this project while Eskom Holdings Limited is referred to as the project proponent.

The scoping phase was completed with the submission of the Scoping Report, detailing the potential impacts and issues around the construction of the 2x400 kV transmission line. This marked the end of the first phase of the EIA process; the application procedure then required the project to proceed into the second phase namely, the EIA phase.

This Final Environmental Impact Report (FEIR) documents the entire EIA process and is hereby submitted to the Department of Environmental Affairs and Tourism (DEAT), as the competent decision making authority, for review and possible authorization. The FEIR has been prepared on the strengths of the information available to the investigation team at the time of the assessment, and in accordance with the principles of Integrated Environmental Management (IEM), inputs from specialists and the public participation process. Care has been taken to provide an objective document, which will ensure that DEAT will be in a position to make an informed decision.

### 1.1 SCOPE OF WORKS

In light of the above, Naledzi Environmental Consultants committed itself to implement the project as per the requirements of the new environmental impact assessment regulations. The following Scope of Work or Terms of Reference, as extracted from the regulations was applicable to the environmental impact assessment process and related reports:

*“If a competent authority accepts a scoping report and advises the EAP in terms of regulation 31 (1) (a) to proceed with the tasks contemplated in the plan of study for environmental impact assessment, the EAP must proceed with those tasks, including the public participation process for environmental impact assessment referred to in regulation 29 (1) (i) (iv) and prepare an environmental impact assessment report in respect of the proposed activity”*

The competent authority (Department of Environmental Affairs and Tourism) gave the EAPs a go ahead (**Appendix 1: Scoping Report Approval Letter**) with the tasks contemplated in the plan of study for environmental impact assessment, which formed part of the Final Scoping Report.

## **1.2 ASSUMPTIONS AND LIMITATIONS**

---

### **1.2.1 STAGE OF PROJECT AND AVAILABILITY OF INFORMATION**

It is important to note that this FEIR was compiled during the conceptual stages of the proposed development, with the primary aim of assisting Eskom to plan and possibly secure the servitude for the proposed 2x400kV transmission lines. The report has considered a number of alternative corridors (1km each) that were proposed. Site selection was based on a careful examination of the pros and cons of each corridor. The precise positions of the towers along the preferred corridor have however not been decided during the course of this study and thus, references to positions of these towers are only made.

### **1.2.2 CONFIDENTIALITY**

Naledzi Environmental Consultants has prepared this Final Environmental Impact Assessment Report (FEIAR) for the sole use of Eskom Transmission and the appointed development consultants/contractors to this project, in accordance with generally accepted consulting practices and for the intended purposes, as stated in the agreement under which this work was prepared. The report is also intended for review by the relevant competent authorities. Interested & Affected Parties are also privy to the review of the report to provide input to the EIA process. This report may not be relied upon by any other party without the explicit written agreement of Eskom Transmission and Naledzi Environmental Consultants. No other warranty, expressed or implied, is made as to the professional advice included in this report. The EIA was conducted in as transparent a manner as possible, with emphasis on making the EIA understandable enough for the affected communities to participate.

## **2. ENVIRONMENTAL ASSESSMENT PRACTITIONERS**

### **2.1 BACKGROUND**

The Environmental Regulations specifically calls for practitioners involved in Environmental Assessment Work to list their qualifications and expertise in the report. The Regulations also indicates that the role of the Environmental Consultant or Environmental Assessment Practitioner (EAP) is to conduct the environmental impact assessment process in an independent fashion. Independence was at the core of the EIA process.

An Environmental Assessment Practitioner appointed in terms of regulation 17(1) is required to –

- (a) be independent;
- (b) have expertise in conducting environmental impact assessments, including knowledge of the Act, the Regulations and any guidelines that have relevance to the proposed activity;
- (c) perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.

Naledzi Environmental Consultants on its own is an independent Environmental Consulting Company which performs environmental assessment objectively. The team outlined below abide by the company's best practices in the consulting industry.

### **2.2 THE STUDY TEAM**

A team of qualified and experienced consultants was assembled for this project. The following consultants are involved in this project:

<b>Name</b>	<b>Qualifications</b>	<b>Roles and Responsibility</b>
Mr. Musetsho K.D	B.EnvM (Hons)	Project Management
Mr. Mutshatshi T.N	B.EnvM (Hons), Msc (pending)	Maps Compilation
Ms. Mudau R	N.Dip Env.M	Public Participation
Mr. Nangammbi M.S	B.EnvSc	Public Participation

**Table 1:** Naledzi Environmental Consultant's Team

All these individuals are permanent employees of Naledzi Environmental Consultants. Other individuals from other companies were roped in to serve as specialists, their names and the organisations they represented are highlighted throughout the Environmental Impact Assessment Report and reference would be made to their findings and conclusions.

The Environmental Assessment Practitioner responsible for the overall management of the environmental assessment process is as reflected below.

<b>Environmental Consultants</b>	Naledzi Environmental Consultants	
<b>Contact Person</b>	Mr. K.D. Musetsho	
<b>Postal Address</b>	Suite #320 Postnet, P/Bag X9307 Polokwane, 0700	
<b>Tel, Fax and Cell</b>	Tel	+2715 296 3988
	Fax	+2715 296 4021
	Cell	+2773 165 7891
<b>E-mail addresses</b>	<a href="mailto:dmusetsho@naledzi.co.za">dmusetsho@naledzi.co.za</a>	
	<a href="mailto:etna-glockner@naledzi.co.za">etna-glockner@naledzi.co.za</a>	

**Table 2:** Environmental Impact Assessment Practitioner's Contact Details

### **3. NATURE OF THE DEVELOPMENT**

---

#### **3.1 BACKGROUND**

---

Electricity cannot be stored, it is therefore necessary to generate and deliver power 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 power stations to major substations around the country. At these substations voltage is reduced for distribution to smaller substations, from where electricity is distributed to industry, businesses, homes and farms throughout the country.

If Eskom is to honour its mandate and commitment to meet the increasing needs of end-users, it has to establish and expand its infrastructure of both transmission/distribution power lines and substations on an ongoing basis. As a result of an increase in load, it is necessary to reinforce the existing electrical infrastructure.

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 balance these with environmental constraints. In order to achieve this, Eskom continually re-assesses 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.

A need (described in details below) aroused for Eskom Transmission to augment the existing electricity infrastructure within the Vaal/West Rand area of the Gauteng Province. Eskom Transmission is to build a double circuit 400kV power line between the existing Etna Substation and Glockner Substation. There are possible environmental impacts that arise from the proposed development; hence this environmental impact assessment process had to be conducted.

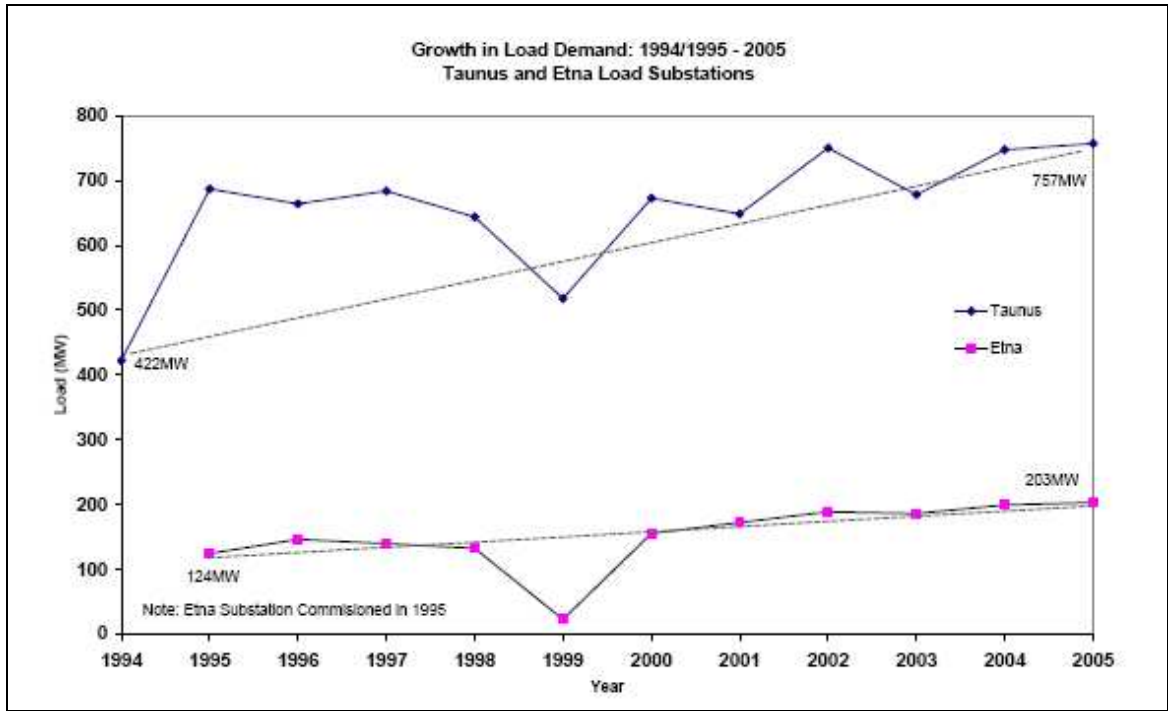
#### **3.2 THE NEED AND DESIRABILITY OF THE PROJECT**

---

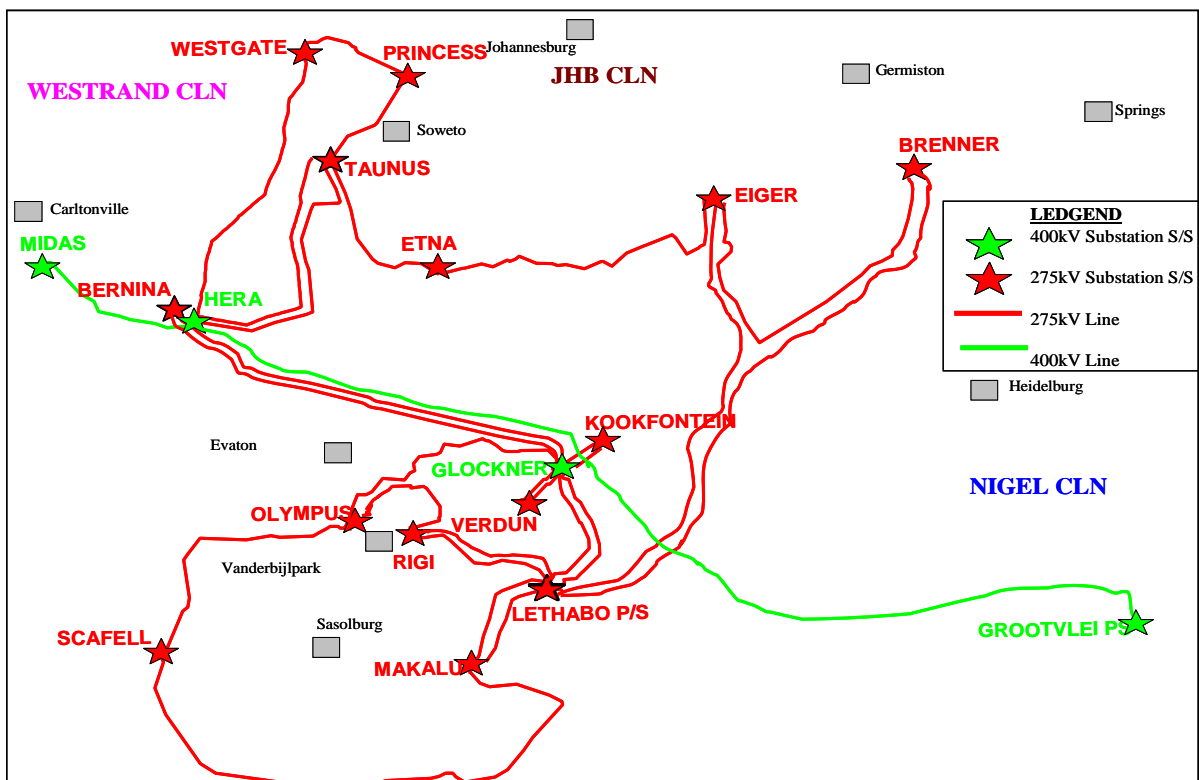
It is expected that the average growth in load demand in the Vaal and West Rand area will be in the order of 1.5% per annum from 2006 to 2026, i.e. over the 20-year Eskom Planning Period. It is also reported that since 1995, there has been a marked increase in load demand at Taunus Substation, which primarily supplies Soweto and its surrounding areas. This trend is shown in **Figure 1** below.

This load build-up, which reached a combined peak of almost 1000MW in 2005, has resulted in a significant increase in the amount of power flowing from Lethabo Power Station to Taunus and Etna Substations, via Eiger and Brenner Substations (**Figure 2**). Load flow studies indicated that the peak power flowing from Eiger Substation towards Etna and Taunus Substations is expected to be as high as 700MW during the winter period of 2006 (under system healthy conditions). The analysis showed, therefore, that it was sensible to consider alternative ways in which power from Lethabo Power Station could be more effectively delivered to these two substations.





**Figure 1:** Actual load demand for Taunus and Etna 1994-2005



**Figure 2:** Current Geographical Layout of the Vaal and West Rand CLN Networks

The increase in load demand in the Vaal, West Rand and Johannesburg Area, which is partly described above, has raised concerns that the loadings on the Lethabo –Eiger and Lethabo – Brenner 275kV lines are approaching the permissible thermal ratings for these lines. These two lines are critical since they transmit approximately 40% of the power generated at Lethabo Power Station. This figure is expected to increase in future; therefore, the future loadings on these two lines were a major concern.

The acquisition of the servitude for the construction of a double circuit 400kV power lines (2x400kV Power lines) would address the concerns raised above. At the same time, the line would provide network strengthening to support future load growth and prevent thermals limits being exceeded in the Johannesburg, Vaal and West Rand areas.

An Environmental Impact Assessment study was commissioned to establish if it would be feasible to build 2 x 400kV power lines from Glockner to Etna substations. It is envisaged that should it be feasible, the lines would be built to reduce the power flow through the existing Lethabo-Eiger and Lethabo-Brenner 275kV lines.

### **3.3 STRATEGIC ALTERNATIVES CONSIDERED**

Before a decision was made to commit to the environmental impact assessment on the proposed Glockner-Etna power line, alternatives were considered at a strategic level to address the situation. The following paragraphs outlines the options investigated.

#### **3.3.1 OPTION 1: DO NOTHING**

The very first option was to do nothing about the solution of the transfer constraint in the Vaal and West Rand area. This option was found not feasible for the following reasons:

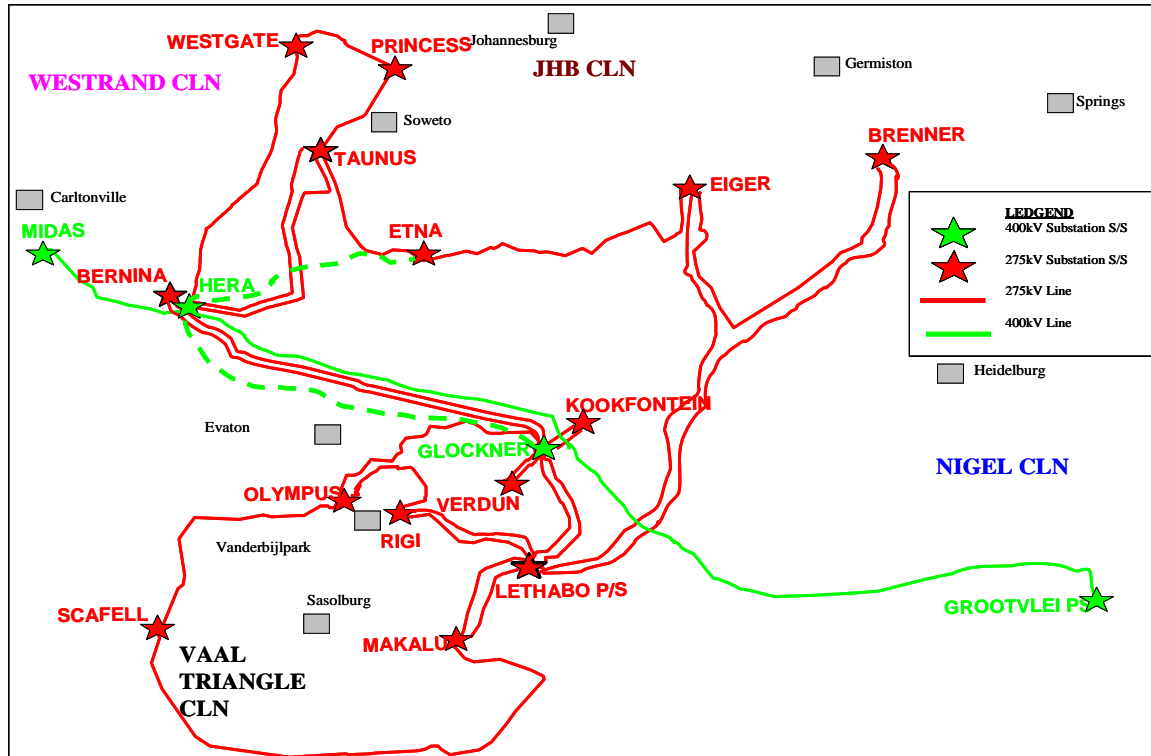
With the projected load growth, the line loadings of the Lethabo Eiger 275kV and Lethabo Brenner 275kV will increase to unacceptable levels resulting in:

- Contravention of statutory limits
- Possible voltage collapse on the Transmission network.
- Inability to meet natural and step load increases.

It was therefore necessary to investigate other possible options, hence the paragraphs below.

#### **3.3.2 OPTION 2: NEW 400kV CIRCUIT LINES BETWEEN ETNA-HERA AND GLOCKNER-HERA SUBSTATIONS**

The new line servitude will be approximately 59km long. The line servitude will be in proximity to the existing 275kV Glockner –Bernina and Bernina Etna line.



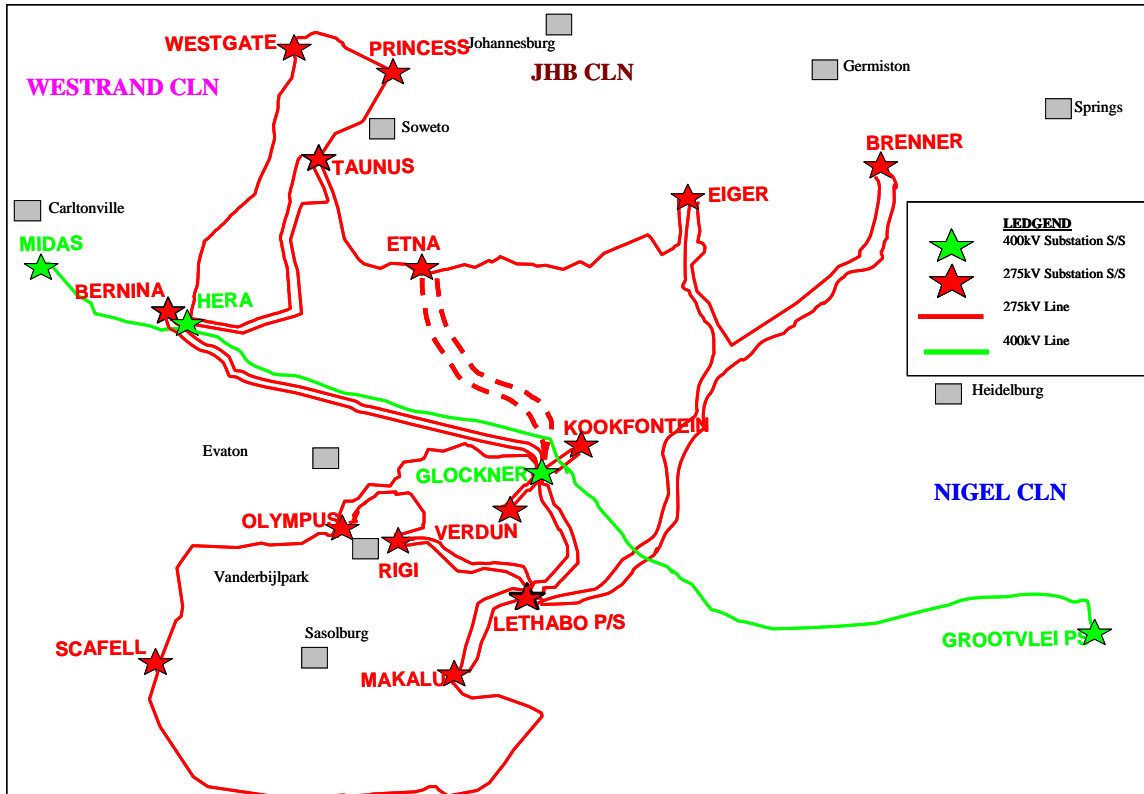
**Figure 3:** Proposed new 400kV circuit lines between Etna-Hera and Glockner-Hera substations

The following disadvantages were identified:

- CAPEX outlay is the highest.
- Johannesburg CLN and West Rand CLN interconnected.

**3.3.3 OPTION 3: BUILD A NEW 2x400kV LINE OPERATED AT 275kV DOUBLE CIRCUIT LINE BETWEEN GLOCKNER AND ETNA SUBSTATIONS**

The new line will be approximately 30km long. This line will basically follow the route due North of Glockner to Etna.



**Figure 4:** Proposed 275/400kV Double Circuit Line between Glockner and Etna

The following advantages were identified:

- The alternative has the most PV worth, i.e. it is the cheapest option to implement;
- The alternative remains the cheapest option over the 6% to 12% range of real discount rates that were considered

At the end, option three was found to be the most preferred one from a strategic point of view, hence the commencement of the environmental impact assessment to investigate further on the practicality of building the line, taking into consideration all the environmental issues. Should it be found feasible to build the lines, they would be operated at 275kV and then later, depending on the demand for more power, will be switched to operate at 400kV. Throughout the report, the project would be referred to as Glockner-Etna 2x400kV power lines.

### 3.4 THE ROUTE/CORRIDOR INVESTIGATION PROCESS

The scoping exercise undertaken for this project was aimed at gathering baseline environmental information, which will assist during the selection of an alignment or route or corridor with minimal environmental impacts. For the identification of an alternative with minimal environmental impacts, different role players had to play different roles. The following (not exhaustive) are some of the roles that the various stakeholders played.

#### 3.4.1 ROLE OF ENVIRONMENTAL PRACTITIONERS

The environmental practitioners were required to:

- ❖ Encourage the proponent to consider all feasible alternatives
- ❖ Provide opportunities for stakeholder input to the identification and evaluation of alternatives

- ❖ Document the process of identification and selection of alternatives
- ❖ Provide a comprehensive consideration of impacts of each alternatives
- ❖ Document the process of evaluation of alternatives

The public participation process carried out for the scoping process tried to achieve the above, by giving stakeholders a chance to have inputs into the whole process.

### **3.4.2 ROLE OF THE PROPONENT**

The proponent came into the picture by:

- ❖ Assisting in the identification of alternatives, particularly where these may be of technical nature
- ❖ Disclosing all information relevant to the identification and evaluation of the alternatives
- ❖ Being open to the consideration of all reasonable alternatives, and
- ❖ Being prepared for possible modifications to the project proposal before setting on a preferred option.

Please mention which route is preferable as this make the work of the consultant easy.

1. The impacts not recommended by the specialists could be mitigated e.g. Avi-fauna-bird diverters and flap

### **3.4.3 ROLE OF THE PUBLIC**

The role of the public was to:

- ❖ Assist in the identification of alternatives, particularly where local knowledge is required
- ❖ Be open to the consideration of all reasonable alternatives
- ❖ Recognize that there is rarely one favored alternative that suits all stakeholders and that alternatives were to be evaluated across a broad range of criteria, including environmental, social and economic aspects.

The combination of the three role players culminated into the identification of three possible corridors for the proposed 2x400kV power line from Glockner substation to Etna substation.

Alternative corridors/routes were discussed further in the EIR, subsequent to the specialist findings and input from the affected landowners along the proposed alternative routes. The preferred alternative was one that was found to minimize the environmental impact of the proposed development.

The preferred alignment was determined based on:

- ❖ The opinion of the public, ascertained through the public consultation process;
- ❖ Specialists' recommendations;
- ❖ Environmental constraints

At the stage of the scoping exercise, which was based on a preliminary identification of physical, biological and social constraints (captured through the public participation process) there was no indication of what the preferred corridor would be. It was however noted that the comprehensive impact assessment phase specifically assessed the likely impacts of the alternative routes of the line.

Only at the end of this phase, it started to emerge that most specialist had their own preferred route while the public also had their preferences. This notwithstanding, three alternative routes were identified. Specialist studies were carried out to determine the most preferred corridor from the three identified. The said corridors are explained in detail below. The aim was for the public and key stakeholders to further comment and make inputs into the specialist studies and their recommendations, in order to come up with the final most preferred route/corridor.

### **3.5 ALTERNATIVE CORRIDORS/ROUTES IDENTIFIED**

#### **3.5.1 ALTERNATIVE ROUTE 1**

From Glockner substation, the route takes the western direction parallel to the existing power lines, up to the west of Jacobskop, where it turns north from the existing lines. There is a vacant servitude where the route runs parallel to other existing power lines from Glockner to Jacobskop.

The route goes up past the Steelview Agricultural Holdings, Dreamland Agricultural Holdings, Annaton, Vlakfontein, Ironside Agricultural Holdings, Debonair Park, Kanana, Sweetwaters, Hartebeestfontein, Unaville Agricultural Holdings and then into Etna substation.

For ease of reference, the 1km corridor proposed traverses the following Farms:

- ❖ Aerovaal 637 IQ
- ❖ De Deur 539 IQ
- ❖ Driemoeg 537 IQ
- ❖ Doornkuil 369 IQ
- ❖ Braklaagte 370 IQ
- ❖ Fonteine 813 IQ
- ❖ Hartebeestfontein 312 IQ
- ❖ Vlakfontein 303 IQ

#### **3.5.2 ALTERNATIVE ROUTE 2**

The route starts the same way as route one up to just north of Ironside Agricultural Holdings where it proceed straight between Homestead Apple Orchards Agricultural Holdings and Althea Agricultural Holdings. The route then goes through Spioenkop, Cyferfontein up to Elandsfontein where it turns left/west through Sunshine Valley and Sunrise Farm up to Etna substation. There is a vacant servitude from Cyferfontein through Sunshine Valley and Sunrise Farm.

For ease of reference, the proposed 1km wide route traverses the following Farms:

- ❖ Aerovaal 637 IQ
- ❖ De Deur 539 IQ
- ❖ Driemoeg 537 IQ

- ❖ Doornkuil 369 IQ
- ❖ Cyferfontein 333 IQ
- ❖ Elandsfontein 334 IQ
- ❖ Vlakfontein 303 IQ

### **3.5.3 ALTERNATIVE ROUTE 3**

Starting from Glockner, the route takes the north direction parallel the existing power lines. It turns left at 27° 58' 56.05"e and 26° 35' 49.50"s and runs on the eastern side of Vereeniging Aerodome up to Road R551 where it turns left/west and goes through De Deur Estates, The Reeds, west of Walkers Fruit Farms Agricultural Holdings, Walkerville Manor and turns left/west at Hartsenbergfontein, goes straight to join route 2 at Elandsfontein and subsequently up to Etna substation.

For ease of reference, the proposed 1km route traverses the following Farms:

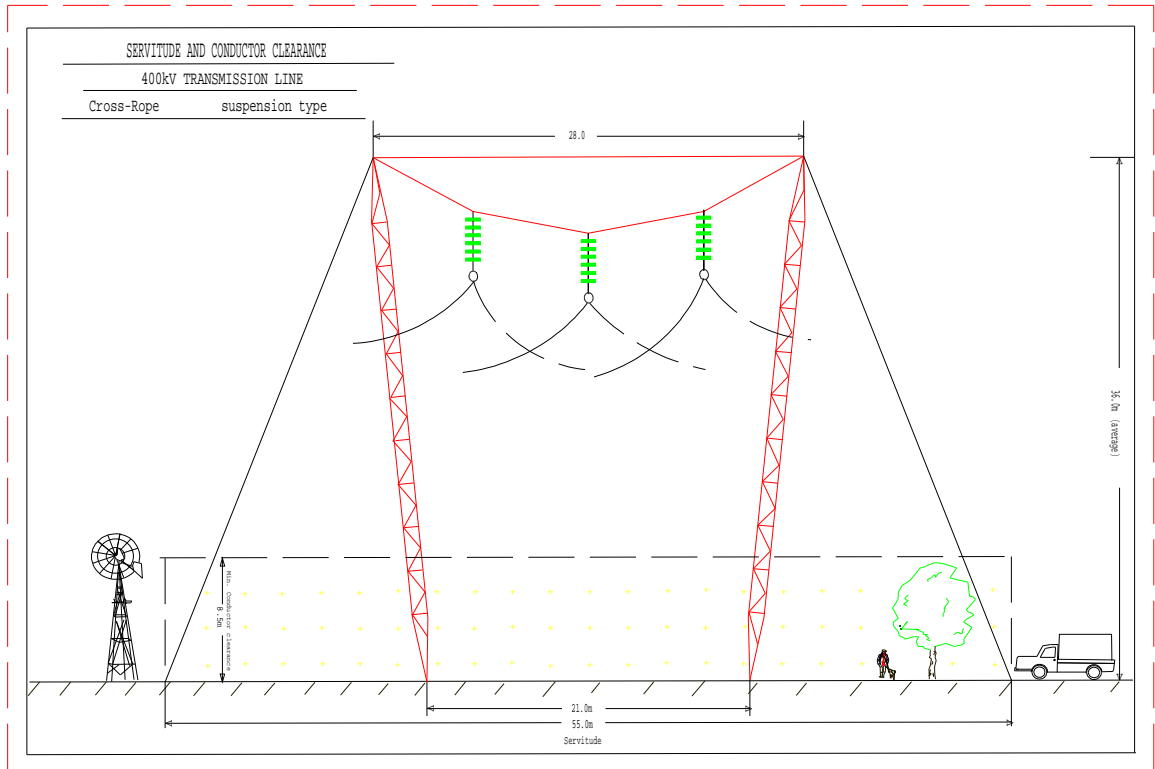
- ❖ Aerovaal 637 IQ
- ❖ De Deur 539 IQ
- ❖ Varkensfontein 373 IQ
- ❖ Faroasfontein 372 IQ
- ❖ Hartsenbergfontein 332 IQ
- ❖ Elandsfontein 334 IQ
- ❖ Vlakfontein 303 IQ

## **3.6 THE TECHNICAL DETAILS OF THE PROJECT**

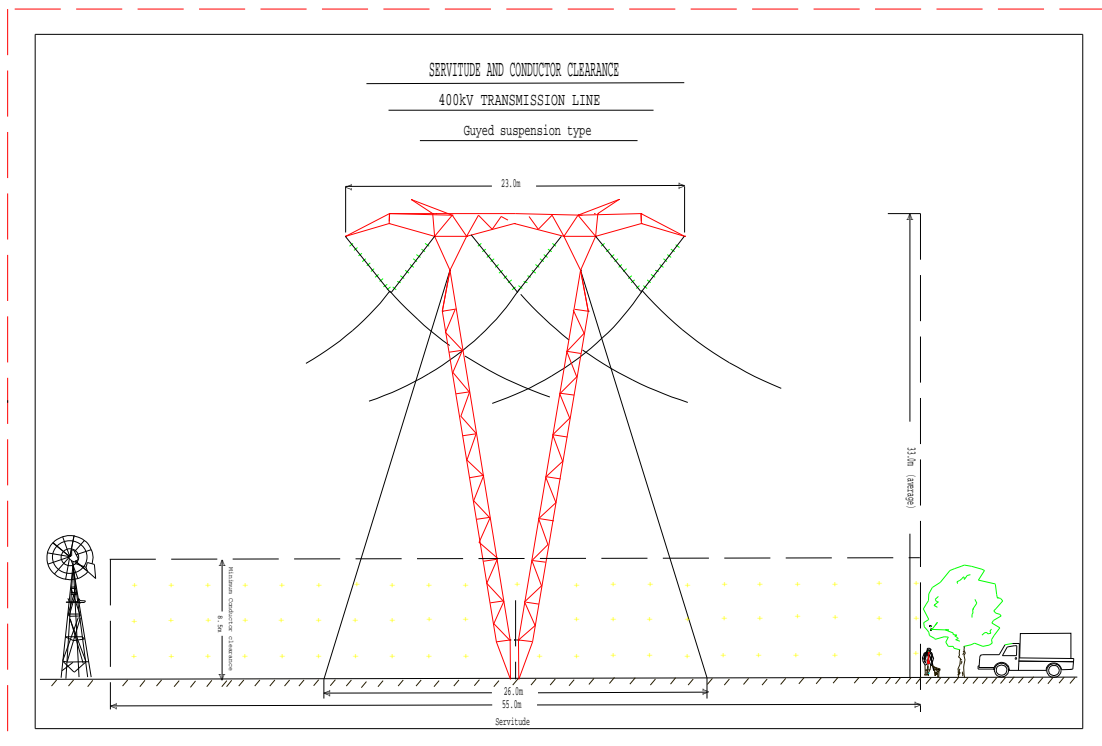
### **3.6.1 TYPES OF TOWERS/PYLONS**

The environmental impact assessment process being carried out is part and parcel of Eskom Holdings Limited's planning process, and as such, specific details regarding certain components of the proposed development could only be finalized once it is clear that the development has got a green light from the authorities. As a result, there is no final decision made yet as to the exact type of towers/pylons to be used in this project. That notwithstanding, the following are the common types of towers or pylons that may be used on this project:

- ❖ Cross rope suspension tower;
- ❖ Guyed suspension tower; and
- ❖ Self-supporting suspension tower.

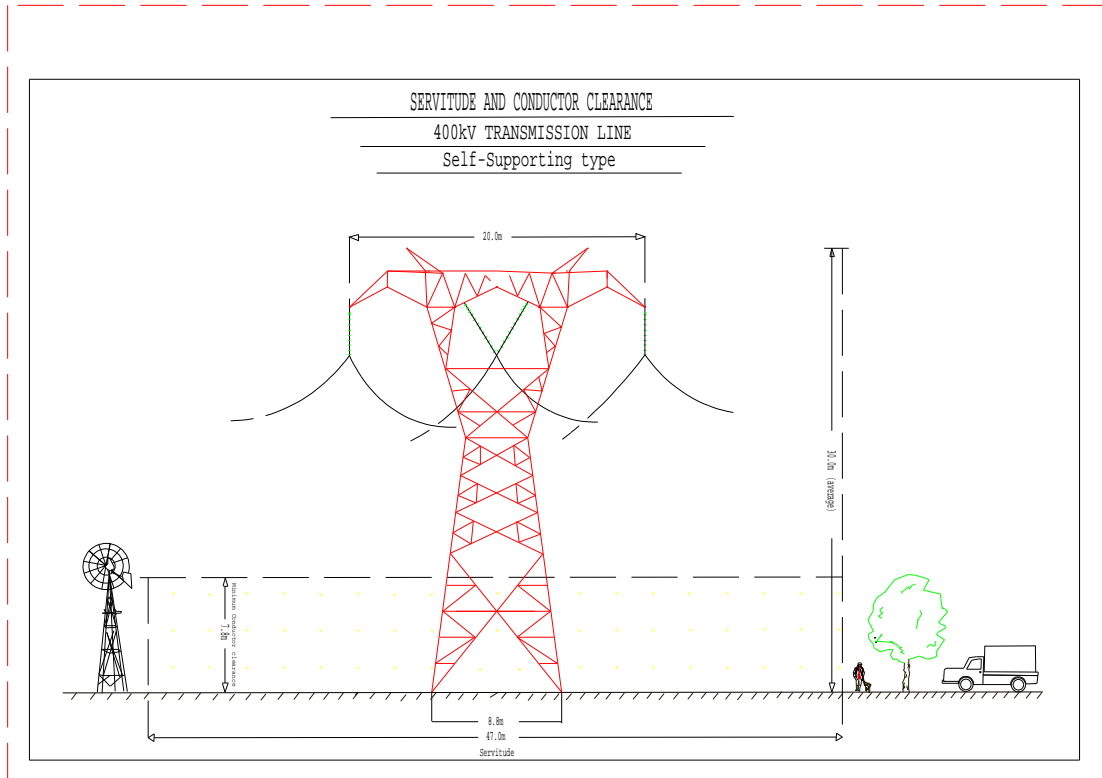


**Figure 5: Cross Rope Suspension Tower**



**Figure 6: Guyed Suspension Tower**





**Figure 7: Self-Supporting Tower**

It is important to highlight at this point that the final tower type chosen will depend on both technical and environmental constraints. Landowner requirements also play a pivotal role in the tower selection process. Where necessary a different tower type could be used if it enables Eskom to address a site-specific challenge.

**3.6.2 SERVITUDE REQUIRED FOR THE PROPOSED POWER LINES**

Throughout this report, any reference to a servitude should be interpreted as the piece of land demarcated for the proposed Transmission line, including areas required for routine maintenance that are carried out once the power line is in operation.

The servitude required for a single 400kV Transmission Power line would be 55m, while the separation distance between 400kV and any other line would be 55m. In cases where there are constraints related to space, the separation distance can be limited to 35m (towers opposite). On these bases, the proposed 2x400kV Power Lines would require a 110m servitude.

Power line servitudes are usually secured along existing servitudes such as roads and pipelines. In cases where the servitude is required next to a road reserve, a distance of 95m from the centre of road to edge of power line servitude is required.

### **3.6.3 PHASES OF THE DEVELOPMENT**

Establishment of power lines is a long process that starts with the identification of a need, power system planning, environmental impact assessment, route selection, negotiation, surveying, the actual construction, operation and maintenance and end with the decommissioning of the power lines. The whole process completes the life cycle of the power line. Other things being equal, the environmental impact assessment, although related to most of the listed aspects of the planning process, focuses more or identifies environmental issues related to the construction phase, operation and maintenance and the subsequent decommissioning.

#### **3.6.3.1 Construction phase**

This phase basically entails the establishment of construction camp sites, equipment yards and lay-down areas, access routes establishment, installation of gates (at points where power line intersects fence lines), clearance of servitude to facilitate access, construction of over head power lines (excavation of pits for tower foundations, casting of foundation for towers, assembly and erection of towers, stringing of pilot wire, stringing of conductors including winching and tensioning), movement of construction workforce, equipment and materials.

#### **3.6.3.2 Operation and Maintenance Phase**

The phase mainly involves the transmission/distribution of electricity/power from one substation to the other, including the use of electricity from the substation by beneficiaries. It also includes the inspections and maintenance of the power line infrastructure, all areas disturbed during construction, servitude/right of way vegetation pruning/cutting, ongoing monitoring and management of erosion and lastly eradication and control of invasive species if any.

Some of the activities that characterize this phase include replacements of hardware on the line such as insulators, improvement of earthing cables, maintenance of bird patches/platforms, aviation markers and bird flappers.

#### **3.6.3.3 Decommissioning Phase**

Decommissioning phase mainly entails the dismantling of the power lines. Environmental rehabilitation is carried out during this phase of the development. Breaking up and removal of foundations also characterize the decommissioning phase of the power line development. This includes creation of access routes to facilitate demolition and transport of waste materials, disposal of waste materials and monitoring of the success of rehabilitation measures.

## **4. DESCRIPTION OF THE AFFECTED ENVIRONMENT**

---

### **4.1 BACKGROUND (LOCATION)**

---

The study area is a stretch of land between the existing Etna Substation and the existing Glockner Substation. This piece of land traverses the City of Johannesburg and Sedibeng District Municipality's jurisdiction. The upper part of the study area (the area where Etna Substation is located) that falls under the City of Johannesburg comprises Lenasia, Ennerdale and Orange Farm, both falling under Region G of the City of Johannesburg. Other areas include Pinetown, Cyferfontein, Hartebeestfontein. The lower part falls within the Sedibeng District Municipality, and specifically within the Emfuleni and Midvaal Local Municipalities. Other specific areas include Dadaville, Rust ter Vaal and Debonair Park (**Figure 8: Locality Map**).

Etna substation is located (**26°23' 7.61"s and 27°52' 31.33"e**) some 26km southwest of Johannesburg. It is also approximately 15km from Lenasia and approximately 5km from Ennerdale, within the City of Johannesburg area of jurisdiction. Glockner substation on the other hand is located (**26°36' 17.28"s and 27°59' 12.78"e**) in the Rothdene area of the Midvaal Local Municipality.

### **4.2 BIOPHYSICAL ENVIRONMENT**

---

#### **4.2.1 CLIMATE**

The climate in the area under study is characteristic of the highveld. It has warm summers with showers and thunderstorms commonly occurring in the late afternoon with rainfalls that vary between 700mm and 800mm. The winters are cool and dry. The area (particularly Midvaal) is located in the southern portions of the Gauteng Province, where air pollution occurs. This is attributed to the fact that the area is situated south of the mining belt in Johannesburg, which results in dust being blown over the area from the mining activities. Further causes of air pollution are the industries situated in Johannesburg, the East Rand and within the Sedibeng District as a whole.

#### **4.2.2 TOPOGRAPHY AND MAJOR LAND FEATURES**

The topography of the area covering the southern tip of the City of Johannesburg through Emfuleni Local Municipality to the Midvaal Local Municipality is characterised by gentle slopes with the elevation above sea level varying from 800m to over 1500m at the top of the Suikersbosrand which is the highest point in Gauteng.

#### **4.2.3 FAUNA AND FLORA**

The study area falls within the Grassland Biome, which covers the high central plateau of South Africa. Most of the area is covered by Cymbogon Themeda Veld Type 48b, Northern Variation. Setaria grass species and Themeda and Eragrostis species dominate this veld type. Normally occurring trees and shrubs are limited to specialised niches, such as riverine fringes.

Certain areas along the Midvaal Local Municipal jurisdiction are covered by Babenveld type 61b, which is underlain by the Ventersdorp lava. This is a sour, unpalatable grassveld, which typically includes *Trachypogon*, *Tristachya*, *Setaria* and *Eragrostis* grass species.

The Grassland Biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZuluNatal and the Eastern Cape. Grasslands (also known locally as Grassveld) are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. Trees are absent, except in a few localized habitats. Geophytes are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees.

Urbanization is a major additional influence on the loss of natural areas - the Witwatersrand is centred in this biome. The Grassland Biome is considered to have an extremely high biodiversity, second only to the Fynbos Biome. Rare plants are often found in the grasslands, especially in the escarpment area. These rare species are often endangered, comprising mainly endemic geophytes or dicotyledonous herbaceous plants. Very few grasses are rare or endangered.

Although the area is broadly described as Grassland, it is also subdivided into two main veld types (Bankenveld towards Etna substation and *Cymbogon*-Themeda veld towards Glockner substation). The two veld types are known to harbour a diversity of faunal species, but unfortunately the development activities in the area, dominated by cultivation are responsible for the diminishing faunal species in the area. It is said that at the time when the area was still intact, the following number of faunal species were identified or could be identified; Mammals (205), Butterflies (157), Birds (505) and Reptiles (33).

These species are unfortunately found in conservation areas such as the Suikerbosrand Nature Reserve, and they are hardly identified in developed areas. Red data that are common in the area include those of birds (within the Suikerbosrand Nature Reserve, Bullfrog (particularly North West of Midvaal),

#### **4.2.4 CONSERVATION AREAS**

The area under study is characteristic of the Gauteng Urban environment, where most portions have already been developed and where there are no major mountains and forests such as the ones found in the Limpopo, Mpumalanga and Kwazulu Natal Provinces. One nature reserve (Johanna Jacobs Nature Reserve) was identified in the study area while there are small pockets of conservancies (especially around the Walkerville area).

#### **4.2.5 SOILS**

Deep, red (Hutton) and yellow (Clovelly) soils, mostly on Karoo Sequence sediments but also on shale (Witwatersrand Supergroup), andesitic lava (Ventersdorp Supergroup) and some other substrates, predominate.

## **4.2.6 GEOLOGY AND GEOMORPHOLOGY**

The area between Glockner substation and Etna substation is characterised by five different geological strata. For ease of reference, all of these are labelled as Vp, Vh, Vm, Pes and RVv.

### **4.2.6.1 Vp**

**Lithology:** Quartzite, shale, conglomerate, iron formation, breccia, diamictite, limestone, dolomite and where not shown separately as Vh, andesite; also includes Malmani dolomite.

**Formation:** Part of the Pretoria Group, Deutschland, Penge and Langrant Formations.

**Rock type:** Compact sedimentary strata

### **4.2.6.2 Vh**

**Lithology:** Andesite

**Formation:** Hekpoort Formation

**Rock type:** Mafic/basic lava

### **4.2.6.3 Vm**

**Lithology:** Dolomite, chert, subordinate quartzite, conglomerate, shale; diabase and syenite dykes and sills

**Formation:** Malmani Sungroup, Assen and Black Reef Formations (except where the latter is included with Godwan Formation).

**Rock type:** Dolomite, chert and subordinate limestone

### **4.2.6.4 Pes**

**Lithology:** Shale, sandstone,; intruded by dolerite dyke and sheets

**Formation:** Ecca Group

**Rock type:** Compact arenaceous and argillaceous strata

### **4.2.6.5 Rvv**

**Lithology:** Andesite, quartz porphyry, dacite, rhyolite, trachyte, tuff, agglomerate, volcanoclastics, conglomerate, sandstone, arkose, quartzite shale and chert

**Formation:** Ventersdorp SuperGroup' Klipriviersber, Zoetlief, Amalia, Hartswater and Sodium Groups' Hereford

**Rock type:** Assemblage of compact sedimentary and extrusive rocks

#### 4.2.7 HYDROLOGY AND DRAINAGE

The study area does not have major river ecosystems. Rietspruit and Varkensfonteinspruit are the main streams located within the study area. There are patches of other streams such as Fouriespruit, including several man made water bodies scattered all over the area. Due to the unavailability of surface water bodies, there is a lot of ground water sources (wind pumps) scattered across the area. Reservoirs are also common features in the area. The majority of the streams (if not all) are tributaries of the Vaal River which is found south of the study area. There are no well defined dams in the study area. There are patches of wetland ecosystems found along the identified streams, especially along the Rietspruit. Major wetlands are found to the north of the study area (along the Kliprivier).

#### 4.3 SOCIO-ECONOMIC ENVIRONMENT

##### 4.3.1 SOCIAL AND POPULATION CHARACTERISTICS

###### 4.3.1.1 Population figures

The total population figures under the jurisdiction of the three municipalities are as follows:

Municipality	Total Population <sup>1</sup>
City of Johannesburg Metropolitan Municipality	3 225 301
Midvaal Local Municipality	64 635
Emfuleni Local Municipality	658 412

**Table 3:** Population figures of municipalities in the area

As the greater part of the study area falls under the jurisdiction of the Midvaal Local Municipality, one could derive that the larger part of the study area is not that densely populated, especially in the areas characterized by the agricultural holdings.

The Midvaal IDP (March 2006 Revision) estimated the population in the area for 2006 at 88 999. Estimations made in the Emfuleni IDP (2007/2008) indicates the population in the municipal area for the year 2006 at approximately 726 298.

###### 4.3.1.2 Age groups and gender

41.7% of the population in the Midvaal Local Municipality is under the age of 25 and in the City of Johannesburg Municipality this age category constitutes 42.4% of the population in that area. In the Emfuleni Local Municipality these figures are even higher as 46.5 % are under the age of 25.

The above indicates a definite need for job creation and social services in the study area.

From information sourced the gender statistics in the three municipal areas are as outlined in **Table 4** below:

Municipality	Gender	
	Males	Females
City of Johannesburg Metropolitan Municipality	50%	50%
Midvaal Local Municipality	51%	49%
Emfuleni Local Municipality	65%	35%

<sup>1</sup> Census data: 2001

There is a normal ratio between males and females in the City of Johannesburg Metropolitan Municipality, as well as in the Midvaal Local Municipality.

#### 4.3.1.3 Population stability

The Midvaal Local Municipality area is characterised by an influx of people from other areas. This could impact on the stability of the population in the area which could make it more vulnerable to change. The same situation appears in the Emfuleni Local Municipal area, probably due to new housing developments which attract more people to the area.

#### 4.3.1.4 Education levels

From the statistical information gathered it is apparent that 7.2% of the total adult population in the City of Johannesburg Metropolitan Municipality report not having had any schooling. In the Emfuleni Local Municipality this figure is 9.5% and in the Midvaal Local Municipality it reaches 11.6%. The overall figures for education in the three municipal areas are as follows:

<b>City of Johannesburg Metropolitan Municipality</b>				
<b>Some primary</b>	<b>Complete primary</b>	<b>Some secondary</b>	<b>Std 10 / Gr 12</b>	<b>Higher</b>
10%	5%	35%	29%	14%
<b>Midvaal Local Municipality</b>				
<b>Some primary</b>	<b>Complete primary</b>	<b>Some secondary</b>	<b>Std 10 / Gr 12</b>	<b>Higher</b>
16%	5%	33%	25%	9%
<b>Emfuleni Local Municipality</b>				
<b>Some primary</b>	<b>Complete primary</b>	<b>Some secondary</b>	<b>Std 10 / Gr 12</b>	<b>Higher</b>
14%	6%	38%	24%	8%

**Table 5:** Education Statistics

From the above it is clear that the percentages of the total adult population who have completed school are low. The need for education and training in the study area therefore remains a key priority and should be attended to as a matter of urgency.

#### 4.3.1.5 Employment

In the City of Johannesburg Metropolitan Municipality 27.3% of the total adult population is unemployed. The unemployment rate in the Emfuleni Local Municipality reaches 29.5%, and in the Midvaal Local Municipality it is estimated at 15.8%. The Midvaal IDP (March 2006 Revision) estimates the unemployment in the area at 23%. However, the unemployment rate in Midvaal Local Municipality is still below the national average, which is according to the 2001 Census Data estimated at 24%.

Based on the household income levels of the people residing in the study area, a large part of the population is poor as they have very low income levels or no income. The City of Johannesburg Regional Spatial Development Framework for Region G (2007/2008) also emphasised the low levels of education and skills development in the area resulting in high unemployment rates and poverty levels in this region.

Unemployment rates for the Orange Farm area have been estimated as high as 60%. Of those employed, in both the Midvaal and Emfuleni Local Municipalities, the major industries supplying employment are the Community Services and Manufacturing sectors, followed by the Wholesale/Retail sector. The Community Services sector is also the major employment creator in the City of Johannesburg Metropolitan Municipality, closely followed by the Wholesale/Retail and Business Services sectors.

The need for employment in all three these municipal areas therefore remain high. The influx of more unemployed individuals into the study area results in further challenges in this regard.

#### 4.3.2 HOUSING AND BASIC SERVICES

There is approximately 20 760 households in the Midvaal Local Municipality area and the average household size is 3.6. In addition, it has been stated that 20% of the dwellings are of an informal nature. There is a housing backlog of approximately 14% (between 2 500 to 3 000 houses) in the Midvaal area. According to the Emfuleni IDP 81% of their residents live in formal housing structures.

The City of Johannesburg Regional Spatial Development Framework for Region G (2007/2008) indicates that the high number of informal settlements in the region implies a definite shortage of housing in the area.

In terms of basic services the following should be noted:

Access to services	Percentage of population		
	City of Johannesburg Metropolitan Municipality	Midvaal Local Municipality	Emfuleni Local Municipality
Electricity for lighting purposes	85%	63%	90%
Refuse removal once a week	91%	50%	47%
Flushed toilet sewer system	82%	49%	85%
Regional local water scheme	48%	33%	48%

**Table 6:** Basic Services Statistics

According to the Midvaal IDP (March 2006 Revision) there has been an improvement in all of the above services and that approximately 60% of households in the Midvaal area have access to clean water inside their dwellings, 70% are served by waterborne sewer and 74% receive electricity from either the local municipality, Eskom or other sources. In most cases the backlogs appear in the rural areas and informal settlements. The Emfuleni IDP (2007/2008) states that 46% of their residents receive refuse removal once a week. These figures differ from the previously stated 47%.



### 4.3.3 LAND USE AND PROPERTIES

On a broader scale, the area under study is used mostly for two major land use activities (agriculture and residential), with agricultural activities mostly found towards the eastern side and the residential activities towards the western side. The stretch of land where the three route alternatives were identified is characterised by a mixture of the two major land use activities, with agricultural activities as the dominant activities.

The stretch of land towards Rothdene (Glockner substation) is privately owned while the land towards Lenasia South (Etna substation) is government owned. The area in between the two above is characterised by the presence of Agricultural Holdings/Estates which are scattered almost everywhere. The following agricultural holdings/estates were identified in the area:

- ❖ Walkerville Agricultural Holdings
- ❖ Blignautsrus Agricultural Holdings
- ❖ Golf View Agricultural Holdings
- ❖ Althea Agricultural Holdings
- ❖ Homestead Apple Orchards Agricultural Holdings
- ❖ Walker Fruit Farms Agricultural Holdings
- ❖ Balmoral Estate
- ❖ De Deur Estate
- ❖ Ironside Agricultural Holdings
- ❖ Dreamland Agricultural Holdings
- ❖ Steelview Agricultural Holdings
- ❖ Ebenneserpark Agricultural Holdings
- ❖ Ophir Agricultural Holdings

Residential areas identified throughout the study area include:

- ❖ Lenasia South
- ❖ Ennerdale
- ❖ Sweetwaters
- ❖ Cyferfontein
- ❖ Zakariya Park
- ❖ Kanana
- ❖ Hartbeestfontein
- ❖ Rothdene
- ❖ Debonair Park
- ❖ Dadaville
- ❖ Rust ter Vaal
- ❖ Roshnee

It is also important to mention that there are informal settlements mushrooming throughout the study area, especially towards the Etna substation. The area between Rust-ter-Vaal and Waldrift has been suggested for residential development, and it is important to highlight that housing developments have already started in the vicinity of Rust-ter-Vaal. Other areas earmarked for further housing developments (amongst others) include Sweetwaters.

#### **4.3.4 AGRICULTURE**

As mentioned above, agriculture is one of the major land use activities in the area. The area, particularly towards the southern tip of the 30km stretch of land between Glockner and Enta substations is considered part of the Maize Triangle of South Africa. Bluegum species are also scattered throughout the study area, especially within the identified agricultural holdings. These are very tall trees which can grow up to an average height of 40m.

#### **4.3.5 EXISTING AND FUTURE INFRASTRUCTURE/DEVELOPMENTS**

Vereeniging Aerodome is located within the study area, near Dadaville. No any other landing strips or aircraft centres were identified throughout the study area. Mobile Telephone Network (MTN), Vodacom and Telkom telecommunication infrastructure is also scattered through out the area, just like in any other urban kind of environment. Mining and industrial activities were also identified in the area, especially towards Glockner substation.

On a broader scale, tourism development has been identified as having a huge potential in the area, particularly along the Midvaal area. A recently approved Tourism Master Plan for the Midvaal area has identified the Suikerbosrand Reserve and the Vaal Dam as the cornerstones of tourism development in the area. The stretch of land between Glockner and Etna substations lack tourist attraction areas, except for the Johanna Jacob Nature Reserve.

## **5. LEGAL CONSIDERATIONS**

A scoping of relevant legislation was undertaken in order to identify the relevant key legal issues related to the proposed construction of 2x400kV Power Lines from Glockner Substation to Etna Substation. Applicable environmental legislation, which must be taken into consideration by Eskom during the implementation of the proposed development are summarised below and a full description highlighted in project legal review report prepared by Cameroon Cross Inc on behalf of both Naledzi Environmental Consultants and Eskom Holdings.

### **5.1 THE CONSTITUTION ACT, 1996 (ACT NO. 108 OF 1996)**

The constitution states that:

“...everyone has the right to an environment that is not harmful to their health or well being; and to have the environment protected for the benefit of present and future generations”. The Act therefore imply that measures must be implemented that 1) prevent pollution and ecological degradation; 2) promote conservation; and 3) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development'.

### **5.2 ENVIRONMENT CONSERVATION ACT, 1989 (ACT NO 107 OF 1989)**

The purpose of the Environment Conservation Act is to provide the effective protection and controlled utilization of the environment. The coming into effect of the National Environment Management Act (NEMA) repealed some but not all of ECA provisions, namely the control of environmental pollution, the control of activities which may have a detrimental effect on the environment and the remediation of environmental damage. Development must be environmentally, socially and economically sustainable. In terms of section 20, the developer is required to obtain a permit from the Department of Water Affairs and Forestry in order to establish, provide or operate any waste disposal site within the boundaries of the proposed development. Where hazardous or domestic wastes are to be removed from the site by contractors, the developer needs to place a contractual obligation on the contractor to dispose of the waste at a licensed site and to ensure that this is properly done.

The Act therefore implies that the developer must develop in a sustainable fashion in which integrated environmental management is implemented i.e. taking cognizance of ecological, social and economic issues. No waste disposal is proposed, but any hazardous waste created during construction will have to be disposed off at a permitted Waste Disposal Site. The developer will be responsible for rehabilitating disturbed sites.

### **5.3 NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998)**

The act states that sustainable development requires the consideration of all relevant factors including:

- (i) that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimized and remedied;
- (ii) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions
- (iii) the participation of all interested and affected parties in environmental governance is promoted, and all people have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.

### **5.4 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT NO. 10 OF 2004)**

The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was developed.

The National Spatial Biodiversity Assessment (NSBA) classifies areas as worthy of protection based on their biophysical characteristics, which are ranked according to priority levels.

### **5.5 NATIONAL FOREST ACT, 1998 (ACT NO. 84 OF 1998)**

This Act provides for the management, utilisation and protection of forests through the enforcement of permitting requirements associated with the removal of protected tree species, as indicated in a list of protected trees (first promulgated in 1976 and has been updated since). Permits are administered by the Department of Water Affairs and Forestry (DWAF).

Provincial ordinances were developed to protect particular plant species within specific provinces. The protection of these species is enforced through permitting requirements associated with provincial lists of protected species. Permits are administered by the provincial departments responsible for environmental affairs.

### **5.6 NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)**

Section 22.2 of the Water Act states "A person who uses water (a) must use the water subject to any condition of the relevant authorization of that use; (b) is subject to any limitation, restriction or prohibition in terms of this Act or any other applicable law (c) in the case of the discharge or disposal of water or water containing waste contemplated in section 21(f),(g), (h) or (j) must comply with any applicable waste standards or management practices prescribed under section 26(I)(h) and (i), unless the conditions of the relevant authorization provide otherwise: (d) may not waste that water.

In terms of Section 22 of the National Water Act a water use must be authorized. In section 21 "water use" is defined to include: impeding or diverting the flow of water in a watercourse or altering the bed, banks, course or characteristics of a watercourse.

The Act implies that the developers are responsible for taking reasonable measures to prevent pollution of water resources that they owns, controls occupies or uses on the proposed study area in question. The developers are required to remedy situation where pollution of a water resource occurs following emergency incident and where it is responsible for the incident or owns or is in control of the substance involved. The developers must take all reasonable measures to minimize the impacts of the incident, undertake cleanup procedures, remedy the effects of the incident and take measures as directed by the catchment agency.

The water Act guides the management of water in South Africa as a common resource. The Act aims to regulate the use of water and activities which may impact on water resources through the categorization of 'listed water uses' encompassing water extraction, flow attenuation within catchments as well as the potential contamination of water resources, where DWAF is the administering body in this regard.

## **5.7 CONSERVATION OF AGRICULTURAL RESOURCES ACT**

Various regulations promulgated in terms of the Conservation of Agricultural Resources Act are also relevant. In terms of section 6 of the Act, the Minister may prescribe control measures with which all land users have to comply. The control measure may relate to the following:

- ❖ the regulating of the flow pattern of run-off water;
- ❖ the control of weeds and invader plants;
- ❖ the restoration or reclamation of eroded land or land which is otherwise disturbed or denuded.

These regulations therefore imply that;

- (i) Unless authorized thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow category 2 plants (weeds) to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Wetlands and streams exist in the area between Glockner Substation and Etna substation. These include Rietspruit, Varkensfonteinspruit and Fouriespruit.
- (ii) No land user shall allow category 3 plants (weeds) to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.
- (iii) Storm-water control must be implemented both during construction and operation.

## **5.8 NATIONAL HERITAGE RESOURCES ACT, 1999 (ACT NO. 25 OF 1999)**

The protection of archaeological and palaeontological sites and material is the responsibility of a provincial heritage resources authority and all archaeological objects, palaeontological material and meteorites are the property of the state. Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

38. (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorized as

(a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50 m in length;

(c) any development or other activity which will change the character of a site—

(i) exceeding 5 000 m<sup>2</sup> in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m<sup>2</sup> in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

(2) The responsible heritage resources authority must, within 14 days of receipt of a notification in terms of subsection (1)—

(a) if there is reason to believe that heritage resources will be affected by such development, notify the person who intends to undertake the development to submit an impact assessment report. Such report must be compiled at the cost of the person proposing the development, by a person or persons approved by the responsible heritage resources authority with relevant qualifications and experience and professional standing in heritage resources management;

(b) notify the person concerned that this section does not apply.

The Act implies that no person may alter or demolish any structure or part of a structure, which is older than 60 years or disturb any archaeological or palaeontological site or grave older than 60 years without a permit issued by the relevant provincial heritage resources authority. No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise.

**5.9 NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT, 2003 (ACT NO. 57 OF 2003)**

---

The purpose of this Act is to provide for the protection, conservation and management of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes.

## **6. AUHTORITY CONSULTATION AND PUBLIC PARTICIPATION**

### **6.1 APPLICATION TO THE AUTHORITIES**

The National Department of Environmental Affairs and Tourism was identified as the relevant competent authority for this project. An Application Form was submitted to DEAT on 26 October 2006. Subsequent to the submission of the application form, an acknowledgement letter (**Appendix 2**) with a Reference Number (12/12/20/867) was received on 31 October 2006. The letter called for the environmental assessment practitioners to submit the scoping report.

### **6.2 EIA COMMENCEMENT PRESS ADVERTISEMENTS**

Advertisements (**refer to Volume 2 of this report**) were placed in national, regional and local newspapers to notify people of the commencement of the environmental impact assessment process. The adverts were placed in the following newspapers:

<b>Name of the newspaper</b>	<b>Date of placement</b>
Sowetan	22 November 2006
Vaal Vision	24 November 2006
Vaal weekly	22 November 2006
Meyerton Star	21 November 2006
Lenasia Times	29 November 2006

**Table 7:** List of newspapers where the EIA commencement was announced

### **6.3 EIA COMMENCEMENT ON-SITE ADVERTISEMENTS**

On-site advertisements (**refer to Volume 2 of this report**) were placed at Glockner/Etna substations and throughout the study area at the same time when newspaper advertisements were released. A0 size on-site advertisements were used to enhance their visibility. A map clearly showing the study area was placed next to the EIA advertisement site notice. Both the newspaper and site advertisements called for Interested and Affected Parties (I&APs) to register their names, organizations as I&APs so that they could receive project information or invited to public meetings.

### **6.4 IDENTIFICATION OF KEY STAKEHOLDERS AND I&APS**

Immediately after both the newspaper and on-site advertisements, the project team started identifying individuals, organizations and/or their representatives who could potentially be interested and/or affected by the development. This included authorities in whose jurisdiction the project study area falls. A database (**refer to Volume 2 of this report**) of interested and affected parties, including key stakeholders was created and is being updated on regular bases.

### **6.5 FOCUS GROUP MEETINGS**

Focus group meetings were arranged with relevant government groups, especially the district, local and metro councils whose jurisdiction the project falls. The following municipalities were invited to these focus group meetings:



Municipality name	Focus Group Meeting Date
Midvaal Local Municipality	28 November 2006
Joburg City Council	13 February 2007
Sedibeng District Municipality	Invitations were not accepted

**Table 8:** Municipalities invited to Focus Group Meetings

## 6.6 KEY STAKEHOLDER WORKSHOP

A key stakeholder workshop was held on 30 January 2007 with identified key stakeholders. The following organizations, departments and individuals were invited to the Key Stakeholder Workshop:

- ❖ Midvaal Local Municipality
- ❖ Emfuleni Local Municipality
- ❖ Sedibeng District Municipality
- ❖ Gauteng Provincial Government
- ❖ Telkom
- ❖ Gauteng Conservancy Association
- ❖ Spoornet
- ❖ South African Heritage Resources Agency
- ❖ South African National Roads Agency
- ❖ Agricultural Research Council: Plant Protection
- ❖ Birdlife South Africa
- ❖ Earth Life
- ❖ National Department of Environmental Affairs and Tourism
- ❖ Department of Minerals and Energy
- ❖ Ingwe ya Lekoa Entertainment

## 6.7 PROJECT PUBLIC MEETINGS ADVERTISEMENTS

An invitation was published in newspapers (**Appendix 6**) calling for all interested and affected parties to attend public meetings. Advertisements appeared in the following newspapers:

Name of the newspaper	Advertisement date
Sowetan	16 January 2007
Daily Sun	16 January 2007
Beeld	16 January 2007

**Table 9:** Public meetings newspaper advertisements

On-site public meetings advertisements/posters (**refer to Volume 2 of this report**) were distributed throughout the study area at least two days before the public meetings. These posters/adverts informed the general public about the intended public meetings date, venue and time.

The combination of all the above approaches were aimed at notifying potential interested and affected parties, government departments and other organizations about the project and an opportunity for them to get involved. Background information documents were prepared in English (**refer to Volume 2 of this report**), Afrikaans (**refer to Volume 2 of this report**) and SeSotho (**refer to Volume 2 of this report**) and distributed to those who showed interest on the project and to those identified as potential I&APs including key stakeholders. Comment and registration form (**refer to Volume 2 of this report**), with spaces provided for comments were also distributed along with the BIDs. Personalized letter were also sent to those who requested to be registered as I&APs in the project. Issues were raised and discussed throughout the public participation process. A Comment and Issues Response Report (**refer to Volume 2 of this report**) was prepared. It should be noted that both I&APs identification and engagement are ongoing processes that would continue throughout the environmental impact assessment.

A draft scoping report (DSR) was prepared and made available to the public and key stakeholders through newspaper advertisements and placed in public places. Interested & Affected Parties, key stakeholders and authorities were invited to review the draft scoping report and comment. Issues raised were considered and the Comment and Issues Response Report was updated accordingly.

Draft Scoping Report availability was advertised in the following newspapers:

<b>Name of the newspaper</b>	<b>Advertisement date</b>
Sowetan	23 February 2007
Daily Sun	20 February 2007
Meyerton Ster	23 February 2007
Vaal Vision	20 February 2007

**Table 10:** Newspapers where DSR availability was advertised

Draft Scoping Reports were placed in the following areas”

<b>Place</b>	<b>Placement date</b>
Vereeniging Public Library	20 February 2007
Vanderbijlpark Public Library	20 February 2007
Midvaal Municipal Library	20 February 2007
Kookrus Clinic	20 February 2007
Wilberforce Community College Library	20 February 2007
Ennerdale Extension 9 Public Library	20 February 2007
Lenasia South Public Library	20 February 2007
Naledzi Environmental Consultants offices	20 February 2007
Eskom website (www.eskom.co.za/eia)	20 February 2007

**Table 11:** Public places where DSR were placed for review and comments

Information about the availability of the draft scoping report was also sent to Interested & Affected Parties and Stakeholders in the project database through e-mails and personalized letters.

## **6.8 PLACEMENT OF PROJECT INFORMATION ON ESKOM'S WEBSITE**

Public documents described above were also posted on the Eskom Holdings Limited website address. The aim was also to create different ways in which people could access project information.

## 7. GLOCKNER TO ETNA SPECIFIC ENVIRONMENTAL ASSESSMENT

In the Scoping Phase of the project, information was gathered, and together with specialist and technical input, used to identify potential impacts associated with the proposed project, and to highlight areas, which should be avoided in order to minimise these impacts. A public participation process was undertaken to identify issues and concerns of key stakeholders and Interested and Affected Parties (I&APs). The results are documented in the Final Scoping Report.

A number of potentially significant issues were highlighted and further investigated in the Impact Assessment phase in order to assess their significance, and to determine the need for the implementation of measures in order for the overall project to be environmentally sustainable. The following key issues were identified in the scoping phase:

- ❖ Visual impacts
- ❖ Soils, geology and agricultural impacts
- ❖ Archaeology and/or heritage resources impacts
- ❖ Ecology and ecological sensitivity impacts
- ❖ Social and economic impacts (including current and future developments)
- ❖ Birds (Avi-fauna) impacts

### 7.1 SUMMARY PF FINDINGS OF SPECIALIST STUDIES

Specialists were appointed to form part of the EIA project team. The team of specialists competent in the following areas has been included:

Organization	Name of Specialist	Specialist Study
Strategic Environmental Focus	Gerhard Griesel	Visual Impact Assessment
Africa Geo-Environmental Services	Kingsley Ayisi	Agricultural Impact Assessment
Archaeo-Infor Northern Province	Stephan Gaigher	Heritage Impact Assessment
University of Venda	Koos Steyn	Ecological Impact Assessment
Ingrid Snyman Development Cons	Ingrid Snyman	Social Impact Assessment
Endangered Wildlife Trust	Chris van Rooyen	Avi-faunal Impact Assessment

**Table 12:** List of Specialists involved in the project

## **7.1.1 VISUAL IMPACTS**

### **7.1.1.1 Potential Landscape Impacts**

Landscape impacts are alterations to the fabric, character, visual quality and/or visual value which will either positively or negatively affect the landscape character. During the construction and operational phases, the project components are expected to impact on the landscape character of the landscape types it traverses. The magnitude or severity of this intrusion is measured against the scale of the project, the permanence of the intrusion and the loss in visual quality, -value and/or VAC.

The following are consequential effects of the proposed 2x400kV transmission line project on the landscape character:

- ❖ Clearing of servitudes to accommodate new transmission lines;
- ❖ Construction of foundations and erection of transmission lines;
- ❖ Installation of overhead lines;
- ❖ Construction of camps, lay-down yards and other construction equipment;
- ❖ Construction of access roads to inaccessible points and;
- ❖ Construction of service roads

Activities listed above are expected to cause landscape impacts in the construction phase.

These activities will create surface disturbances which will result in the removal of vegetation and the exposure of the underlying soil. The extent of the disturbances will generally be determined from the footprint area.

Clearing of servitudes will be associated with undisturbed areas with only grass or low growing vegetation. Only in cases where dense vegetation occurs along the servitude path will vegetation be cleared to reduce the fire hazard. Taller and denser vegetation clumps mostly occur in drainage lines, in isolated patches on the hills and boundaries of properties in undeveloped areas. The presence of the project components in the landscape will have a localized reduction in the character of the landscape.

During construction, the area around the individual towers will be disturbed, cleared for foundation footings. The number of concrete footings will depend on the type of pylon.

Overhead lines/ cables are installed with a tension station. A helicopter and cranes are used to lift the pylon structures into place. This activity complexity will depend on the type of tower being erected and terrain.

The construction camps and lay-down yards are anticipated to disturb a much larger area. The size and location of the construction camps will play a major role in the degree of severity of the landscape impact. Due to a lack of programme and planning information, two options are considered namely; the location of construction camps in remote, virgin land, or in/adjacent existing settlements. The initial presence of a construction camp in a pristine landscape will cause a temporary and localised alteration to the landscape character.

A construction camp located in or adjacent to an existing town or settlement will be easily associated with the town and therefore the presence of the town, mitigates the impact. The mitigating result is most effective, the bigger the town or settlement is due to the direct relationship between size of a town and its ability to absorb physical changes.

Access roads to the towers are expected to be a two-track dirt road which will create the minimum disturbance. In other cases these roads will become service roads. The severity of landscape impact during the construction stage is expected to be *low* for alternatives 1 and 2 and *medium* for alternative 3. The impact will extend over the entire length of the different alignments and may vary in degrees of severity along the linear length as it traverses landscape types of varying (VAC) and sensitivity. Surface disturbances are also minimized through, for example, utilizing existing roads and already disturbed land. Severity of the landscape impact is already low, however to avoid more significant impacts at a local level sensitive placement of the construction camp sites, limited surface disturbance and prompt rehabilitation are recommended.

The severity of these components is determined by the size or footprint of their disturbance. In this case the construction camps and service roads will cause the greatest landscape impacts. The severity of all these components is considered for two scenarios, which are construction and operational phases. The cumulative impact of the project components and activities are rated *medium*.

Surface disturbances created during construction may remain for an extended period during the operational phase. These are seen as residual affects carried forward from the construction phase and can be completely or substantially mitigated if treated appropriately during the construction phase.

An additional impact will be caused as a result of the presence of the completed transmission line, i.e. that of the evenly spaced towers in the landscape. The industrial character and the near monumental vertical scale of the towers will easily blend with the prevailing conditions in the Midvaal Agricultural, Midvaal Residential and Midvaal Industrial as there already a significant number of structures in these landscape types. Due to vegetation along road sides, structures and buildings, some form of screening will be provided to reduce inter-visibility between landscape units. The VAC for the Midvaal Agricultural, Midvaal Residential and Midvaal Industrial is rated *medium*, while the Highveld Midvaal Grassveld is rated *low* (**refer to Volume 3 of this report**).

The Highveld Midvaal Grassland has a low VAC and therefore will not readily absorb the project components without compromising the character of this landscape type. The relative remoteness, the associated openness and value of; the Pedeberg Koppie in the north-east of the study area, Ohinimuri Golf course at north of the R82 and R558 intersection, Walkerville rural retreat in the Spioenkop koppie located west of Ohinimuri Golf course are considered as landscape amenities that contribute to the study area's character. The quality of this landscape will be negatively affected by the presence of a transmission line of this scale and extent.

### 7.1.1.2 Potential Visual Impacts

Severity of visual impact refers to the magnitude of change to specific visual receptor's views and/or experience of the landscape. Severity of visual impact is influenced by the following factors:

The **viewer's exposure** to the project:

- ❖ Distance of observers from the proposed project;
- ❖ The visibility of the proposed project (ZVI);
- ❖ Number of affected viewers; and
- ❖ Duration of views to development experienced by affected viewers.
- ❖ Degree of **visual intrusion** created by the project.

During the construction and operational phases, certain project components or activities will intrude on specific visual receptor's views, ultimately resulting in a visual impact.

The following consequential effects of the proposed 400kV transmission line will impact on the visual character:

- ❖ Presence of construction camps and equipment in the construction period to viewers;
- ❖ Presence of new permanent structure of the transmission line in the operational phase to viewers;
- ❖ The direct impacts of the project upon views of the landscape through intrusion or obstruction;
- ❖ The overall impact on visual amenity, due to the degradation of a visual amenity; and
- ❖ The reaction of viewers who may be affected.

Empirical research indicates that the visibility of a transmission tower and hence the severity of visual impact, decreases as the distance between the observer and the tower increases.

The landscape type, through which the transmission line crosses, can mitigate the severity of visual impact through topographical or vegetative screening. Bishop *et al* (1988) noticed that in some cases the tower may dominate the view for example, silhouetted against the skyline, or in some cases be absorbed in the landscape. A complex landscape setting with a diverse land cover and topographical variation has the ability to decrease the severity of visual impact more than a mundane landscape (Bishop *et al*, 1985).

The Zone of Visual Influence (ZVI) is determined through a Geographical Information System (GIS). The result reflects a shaded pattern which identifies the areas that are expected to experience views of the proposed alignments. The ZVI is limited to 10 km from the proposed alignments.

A visibility analysis has been completed for each of the three alternative alignments. According to Bishop *et al* (1988), visual receptors within 1 km from the alignment are most likely to experience the highest degree of visual intrusion, hence contributing to the severity of the visual impact. This is considered as the zone of highest visibility after which the degree of visual intrusion decreases rapidly at distances further away.

The visibility analysis considers the worst-case scenario, using line-of-sight based on topography alone. This assists the process of identifying possible affected viewers and the extent of the affected environment. The following consequential effects of the proposed 400kV transmission line will impact on the visual character:

- ❖ Presence of construction camps and equipment in the construction period to viewers;
- ❖ Presence of new permanent structure of the transmission line in the operational phase to viewers;
- ❖ The direct impacts of the project upon views of the landscape through intrusion or obstruction;
- ❖ The overall impact on visual amenity, due to the degradation of a visual amenity; and
- ❖ The reaction of viewers who may be affected.

At the end of the day, the sensitivity of visual recipients depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions.

The presence of construction equipment and activities during the construction phase will cause a visual intrusion on residents living in the study area. All residents will be affected by the introduction of the transmission lines as indicated from the visibility maps.

During the construction phase, unsightly views may be created by the presence of the construction camp and the lay-down yards. The uncertainty pertaining to the number, location and size of the construction camps, relates to a *medium* level of confidence in the assessment of the visual impact. The duration of the potential visual impact will be temporary which will result in a *medium* severity of visual impacts on residents.

According to Bishop *et al* (1988), visual receptors within 1 km from the alignment are most likely to experience the highest degree of visual intrusion, hence contributing to the severity of the visual impact. This is considered as the zone of highest visibility after which the degree of visual intrusion decreases rapidly at distances further away.

Alternative 3 crosses through Mayerton Park, De Deur and Sebokeng residential areas. These residents will have a severe impact due to their proximity to the project components associated with construction. For alternative 3 a *medium* severity of visual intrusion is expected even after mitigation due to proximity to this route.

The operational phase will be characterised with the permanent structures within the landscape that will intrude on their views. The residents to the west side of the R82 will experience a *low* degree of visual intrusion due to increased distance between residents and proposed alternatives. Such areas include Sebokeng, Evaton and Orange farm residents. Severity of the visual impact is considered to be *medium* for all residents.



Although there is no information relating to tourist attraction spots in this area, the nearest tourist attraction is the Suikerbosrand Nature Reserve. Most visitors to this area would make use of the R557 to visit the Suikerbosrand Nature Reserve. Alternative 3 crosses over the R557 and only at this point will a *medium* visual impact be experienced by tourists in this phase.

Due to their limited exposure to the project activities associated with construction, mitigation can be implemented successfully. The potential visual impact on tourists during the construction phase of the project can be mitigated with relative ease to a *low* severity.

The construction camps may however cause a higher visual intrusion on tourists. Their exposure to possible unsightly views of the construction camps and the associated activity will however be minimal and localised due to the fact that they are travelling along the route and not visiting this particular area.

The positioning of construction camps near roads can be motivated from an accessibility point of view. The presence of the construction camp and lay-down yards may create unsightly views. Motorists' visual exposure is brief and the severity of visual impact is therefore *low* with effective mitigation the severity will have *no significance*.

Cumulative impact is anticipated at the point where other existing lines already cross the R59 from the Glockner substation in the south. The severity of visual impact at this point will be further increased by the additional alignment; this applies to all alternatives as they all cross at this point before branching off taking different routes.

In conclusion, the following observations were made:

**Residents:**

Residents within 5 kilometres buffer around the transmission line will be exposed to the highest visual impact severity. The severity to these residents will be difficult to mitigate effectively due to the nature and scale of transmission lines. Most of the construction will occur along the proposed alternative routes. Landscape impacts will negatively influence the visual value of the landscape on a localised scale. Residents are going to be visually impacted on during construction and operational phase. More severity in the operational phase is anticipated due to the permanency of the transmission lines. Residents are regarded as very sensitive receptors compared to tourist and motorists.

**Tourists:**

Due to the fact that there are no recorded tourist attraction spots in the study area, tourists are limited to travelling tourist instead of visiting tourists. Only main routes leading to a particular tourist attraction area will be considered, in this case the R557 is a possible route to the Suikerbosrand Nature Reserve.

Travelling tourists could be considered less sensitive. Tourists will be exposed to a *medium* visual severity. The assessment only refers to alternative 3; this is the only alignment that crosses the R557.

## **Motorists:**

Only major routes are considered as there are many other numerous smaller roads to consider in the area. Main routes will accommodate a higher number of motorist receptors. These are the least sensitive receptors. Their views are limited to what they see along the road. Severity of the impact to motorists is rated *low*. The construction and operational phase are anticipated to have the same severity.

### **7.1.2 SOILS, GEOLOGY AND AGRICULTURE**

By definition, based on Part 1 of the Regulation of Conservation of Agricultural Resources Act 43 of 1983, the land occurring at the project site can be classified as moderate to high potential for agriculture due to the following reasons:

#### **7.1.2.1 Moderate potential**

Eight out of ten spots assessed for soil depth were found to be below 800 mm, which is the minimum depth required for a land to be considered prime at the project site. The depth was limited by either rock or hard clay.

There are localised pockets of undesirable soil forms such as Rock outcrop, Mispah and Glenrosa, making it difficult to get a large stretch of land with desirable soil form and depth.

The abundance of *Themida triandria* will support good livestock grazing but the size of the available area could be a hindrance to an economically viable production. Low pH and sub-optimal concentrations of some minerals and organic matter was also a determining factor.

#### **7.1.2.2 High potential**

A large proportion of the farms throughout the study area contain Hutton soil forms in addition to localised pockets of Clovelly an Avalon are considered to be prime soil forms for the area. The average topsoil clay content range from 10 to 32 %, which qualifies to be prime. The project site is expected to receive moderate rainfall and is classed as 3, which is considered to be conducive for rain fed agriculture.

There is no distinct difference in the potential of land occurring under the three proposed routes. However route 1 appears to traverse an area with less old croplands and relatively levelled terrain which might be suitable for arable crop production. It could therefore be considered as relatively better with respect to negative impact on prime agricultural land. The construction of the power line along route 1 should however consider the necessary environmental mitigation measures outlined in the environmental management plan.

### **7.1.3 ARCHAEOLOGICAL AND/OR CULTURAL RESOURCES**

The heritage resources and historical features of the study area have been succinctly described above. It must be reiterated that as the study area is a predominantly agricultural and residential area, past and present activities would have an impact on any cultural and historical resources in the area.

Impact analysis of the cultural resources that could be threatened by the transmission line is based on the present understanding of the construction and operation of a transmission line. Each heritage site is unique and should be treated separately. The significance of a heritage site and its artifacts is determined by its historical, social, aesthetic, technological and scientific value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

Sites regarded as having low significance are viewed as being recorded in full after identification and would require no further mitigation. Impact of the development would therefore be assessed to be low. Sites with a medium to high significance would therefore require mitigation. Mitigation, in most cases the excavation of a site, is in essence destructive and therefore the impact can be viewed as permanent and as such of high significance. It has to be mentioned that no areas of archaeological and or heritage importance were identified across the study area, especially along the proposed three corridors.

#### **7.1.4 ECOLOGY AND ECOLOGICAL SENSITIVITY**

The study area is located within the Grassland Biome of South Africa. The Grassland Biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. Urbanization is a major additional influence on the loss of natural areas - the Witwatersrand is centred in this biome. The Grassland Biome is considered to have an extremely high biodiversity, second only to the Fynbos Biome. Rare plants are often found in the grasslands, especially in the escarpment area.

These rare species are often endangered, comprising mainly endemic geophytes or dicotyledonous herbaceous plants. Very few grasses are rare or endangered. (Van Rooyen & Bredenkamp, 1996). A total of 15 vegetation types is recognised in the grassland biome by van Rooyen & Bredenkamp (1996) with the study area situated mostly in what is described as the Moist Cool Highveld Grassland vegetation type. Mucina, Rutherford & Powrie (2005) in comparison recognised a total of 82 vegetation types. The study area in this case is situated in what is described as the Soweto Highveld Grassland.

Mucina, Rutherford & Powrie (2005) recognised the Soweto Highveld Grassland of which a total of 33.66 % of this vegetation type is found in the Gauteng province. At a regional level, 31.44% of the Gauteng Province forms part of this vegetation type. A total of 50.17% of the vegetation type that is found in the province is transformed with only 1.56% under formal conservation. Conservation of this vegetation type is poor. Cultivation, urbanisation and development has lead to the ploughing up of most of this vegetation type. The remnant patches of natural vegetation are intensively grazed and are consequently often degraded.

Although according to the classification by Mucina, Rutherford & Powrie (2005) the study area falls in the Soweto Highveld Grassland, this vegetation type in the study area can be further divided into plant communities. Different plant communities were recognized comprising of the grassland areas, ridges, wetlands and riverine vegetation each with its associated species driven by specific ecological factors like soil type, elevation and moisture regime.

The distribution of terrestrial invertebrates is largely dependent on the ridges, wetlands and the small pristine patch in the study site. The Gauteng Conservation Authority listed as near threatened or vulnerable a total of 37 priority invertebrate species for the province. These consist mostly of butterflies, baboon spiders and trapdoor spiders (Forsyth, 2004). Terblanche (2006) did a study in the Soweto Highveld Grassland vegetation type, within which the study site falls, on invertebrates in the vicinity of the study site on the farm Elandsfontein 412 IR. A total of 25 butterfly species is likely to occur in the area according to literature, but only nine of these species were recorded during this study. None of the six Red Data listed butterfly species was found in the area. Butterfly species like *Chrysoritis aureus* (Heidelberg Copper) and *Aloeides dentatis dentatis* (Roodepoort Copper) occur on very limited sites of a few hectares and need specific habitat.

No large game or predators, or any signs of them, were observed in the study area during field surveys. Ten wild mammals that are Red Data Listed occur in Gauteng. These species include Lion, Leopard, Cheetah, Brown Hyena, White Rhino etc that do not occur in the study area. No indication of other smaller, Red Data Listed species was found i.e. Schreiber's long-fingered bat, Short-eared trident bat and Springhare (2003 IUCN Red list of threatened animals).

Amphibians are an important and often neglected component of terrestrial vertebrate faunas and are important components of wetland systems. They are well represented in Gauteng with 30 of the 115 species present. No endemic species occur in the study area and only one of the species, the Giant Bullfrog *Pyxicephalus adspersus*, is of conservation concern. This species is listed as Near Threatened. The distribution of *P.adspersus* corresponds with the study area, and it could occur in the seasonal shallow grassy pans, vleis and dams in the study area (Du Preez, & Cook, 2004). The Gauteng Province is home to 87 reptile species. No endemic species occur in the study area and none are of conservation concern.

Access roads may disturb or destroy sensitive plant species or habitats and animals like Bullfrogs or their habitat. The rehabilitation of access roads may cause more damage if not done correctly. Pylon construction may have the same impacts as access roads and debris or other waste created during the construction process may have further impacts on the environment if not managed correctly. A detailed description of the ecological and habitat related impacts appears on the Ecological Sensitivity Analysis carried out specifically for the proposed development (**refer to Volume 3 of this report**).

## **7.1.5 SOCIAL AND ECONOMIC ASPECTS**

### **7.1.5.1 Population impacts (population change)**

Population change refers to any changes in the size and density of the local population as a result of the proposed project. The building of a transmission line is not expected to create a high number of temporary or permanent jobs during the construction and operational phases given the specialist nature of the construction of a transmission line. No immediate changes are thus anticipated during the construction or operational phases in terms of the overall demographic profile of the population. This would therefore not result in an increase in the size and density of the population, even if outsiders were to be sourced for these jobs. This variable is thus rated as neutral for all three Alternative route alignments.

### **7.1.5.2 Introduction of people dissimilar in demographic profile**

At this stage there is no information readily available to determine the age, race, gender or ethnic composition of the outside workers during the construction and operational phases, as well as the number of construction workers and contractors that could be hired from within the communities situated along the three proposed alternative routes. Given the scope of the project such as the specialised nature of the construction activities, the relative short and intermittent construction period, and the frequency of maintenance, it is anticipated that the construction of the transmission line would not introduce large numbers of “outsiders” into the area and would therefore not impact on the social status and networks of the communities along the alternative routes.

It should, however, be noted that the likelihood of this variable manifesting depends on the following:

- ❖ The number of local labour that could be used, specifically during the construction phase of the project;
- ❖ Whether there would be a large influx of jobseekers to the areas and if illegal immigrants would form part of the process;
- ❖ Whether a construction camp(s) would be erected and the location thereof.

### **7.1.5.3 Inflow and outflow of workers**

This variable refers to the inflow of temporary workers during the construction phase of the project as well as potential social conflict between locals and outsiders mainly due to:

- ❖ Possible perceptions that outsiders are favoured above locals for employment opportunities;
- ❖ Social tension between immigrants and locals with regards to the availability of services and infrastructure;
- ❖ Misconduct of workers housed in temporary accommodation facilities and construction camp mismanagement.

Whilst the expected inflow and outflow of workers cannot be quantified at this point, this variable is expected to manifest predominantly during the construction phase. It is also anticipated that the employment of workers from outside the project area would give rise to discontentment and possibly anger amongst local residents especially in the study area characterised by high unemployment levels.

Given the scope of the project, the number of external job-seekers coming into the area would most probably be small or possibly non-existent even though such outsiders are likely to seek accommodation in surrounding settlements. The presence of construction camps to accommodate the workers could also result in social conflict and associated environmental impacts. The likelihood of this impact negatively impacting on the local residents and environment would depend on whether a construction camp would be erected, the location thereof, as well as on the standard of construction camp maintenance.

Maintenance of the servitudes would have to be undertaken, for the life of the line, resulting in an inflow and outflow of workers, although it is not anticipated that there would be any change in the population or social conflict during the operational phases of the proposed project.

#### **7.1.5.4 Residential proximity and relocation**

Power line alignments that pass through residential areas and in close proximity to dwellings are intrusive. Alternatives that pass through areas of medium social or cultural attachment (sensitive areas) are considered to be moderately intrusive, unless there is an existing intrusion that is similar. Route alternatives proposed to be in parallel to existing power lines and other infrastructure such as roads and railway lines are reduced to a low impact due to the existing intrusion. Sections of Alternative 1, 2 and 3 where the routes run parallel to roads (R551 and R82), next to existing power lines or within vacant servitudes are thus preferred, due to the lessened impact.

At this stage no known relocation of residents are expected to take place. One should, however, note that the City of Johannesburg Regional Spatial Development Framework for Region G (2007/2008) indicates that in certain areas there are dwellings located underneath existing power lines. Should the route alignment thus be adjacent these lines, relocation of these individuals might be necessary. In areas where land has genealogical, cultural and economic meaning, relocation becomes more difficult. Loss of land to transmission lines could therefore threaten the social networks and livelihood of the affected area. Eskom, however, aims to avoid built up areas thereby limiting negative impacts to a minimum.

All three routes proposed therefore generally avoid or pass built up residential areas or dense settlements. However, once the final route alignment and tower positions have been decided, some residences (farm dwellings and subsidiary dwellings where labourers are staying) or informal housing structures could be negatively affected.

With regards to residential proximity and/or relocation the following areas are thus of concern:

- ❖ Walkers Fruit Farm Agricultural Holdings (Alternative 2 and 3)
- ❖ De Deur Estates (Alternative 1, 2 and 3)
- ❖ Walkerville Manor (Alternative 2 and 3)
- ❖ Homestead Apple Orchards (Alternative 1)
- ❖ Dreamland Agricultural Holdings (Alternative 1)
- ❖ Unaville Agricultural Holdings (Alternative 1)
- ❖ Weilers Farm (Alternative 1)
- ❖ Informal settlement to the east of the Etna Substation on the farm Vlakfontein (Vlakfontein Extensions) (Alternative 2 and 3)

During the construction phase of the project construction activities could have negative intrusion impacts (dust and noise pollution) on dwellings and settlements, depending on the proximity of these to the actual construction site(s).

In terms of residential proximity and relocation, the anticipated impacts during the construction and operational phase of the proposed project are rated similar (based on the information available at this stage) as the intensity of these impacts would depend on the final route alignment and tower positions.

#### **7.1.5.5 Community and institutional impacts**

##### **Formation of attitudes against the project**

Although attitude formation is not an impact per se, it serves an important indication of community sentiments toward the project. It could provide important information regarding the feelings and potential actions of I&APs that could become evident during the construction and operational phases of the proposed project and even the negotiation phases.

From the results of the public participation process and particularly the comments received from I&APs, there is, at this stage, no attitude formation or social mobilisation against the proposed development.

Attitude formation could however manifest in future due to the perceived impact of transmission lines on the property values, construction related intrusion impacts associated with the proximity of the proposed line to dwellings or settlements, I&APs perception with regard to safety and health risks, as well as expectations created with regards to employment opportunities. Comments have also been received regarding poor and interrupted electricity supply in the study area.

I&APs, that are not familiar with the functioning of the electricity network and chain of supply could be under the incorrect impression that the proposed project would lead to the upgrading of the power supply to the area which in turn could result in direct economic benefits to the communities in the study area. If accurate facts are not communicated to these I&APs, they could be left under the impression that they would receive direct benefits in terms of electricity supply from the proposed project.

Experience has also shown that in cases where property owners experience problems with the conduct of maintenance workers (e.g. where owners are not notified when personnel would be entering the property, damage to fences, problems with locking of gates, stock theft and so forth) it could lead to possible individual cases of social mobilisation against Eskom and its employees.

##### **Employment opportunities**

In terms of employment opportunities, the following aspects should be considered:

- ❖ The number of jobs that would be created during the construction and operational phase of the project;
- ❖ The extent to which the local skills match the requirements of the project proponent (economic inequity); and
- ❖ The extent to which certain groups such as the unemployed, disadvantaged and minority groups (e.g. women, youth) could be employed (employment equity).

Typical of a project of this nature, where highly specialised personnel are required for the construction of transmission lines, no long term employment opportunities would be created for the local labour force. Temporary job opportunities for unskilled or low-skilled labour could occur during the construction phase, although limited.

Maintenance and operation of the proposed transmission line is not expected to result in employment opportunities for the locals as the maintenance of these lines is usually undertaken by Eskom employees. This is unfortunate, as the area is characterised by increasingly high unemployment levels.

As far as employment-related impacts are concerned, it is also important to consider that jobs are a scarce commodity in the study area and could create competition among the local jobless resulting in social conflict.

In terms of creating local employment, this impact is therefore rated as “negative” as it is not expected that it would lead to sustainable job creation. The rating “potentially positive” is introduced as there might be limited short term job opportunities for low-skilled or unskilled local labourers. This rating is also based on the fact that numerous individuals in the study area are unemployed and even limited employment opportunities should be seen as positive.

### **Economic benefits**

It is not expected that the project would have any major direct or indirect economic benefits to the communities through which the line would be traversing, as job creation of a project of this nature is limited and temporary. The increased income levels of those locals that would be able to secure jobs would also not have a lasting economic impact on local families and/or the community.

If the proposed project is implemented, the growing electricity requirements in the greater Vaal/West Rand area would be met and indirect benefits could accrue to the bigger area due to new economic benefits and opportunities. The local tax base of the local Municipalities in these areas could thus be increased as a result of the economic development in the area.

The Gauteng Province would, therefore, ultimately benefit from the proposed project although it is not anticipated that there would be any industrial diversification (e.g. utilisation of local equipment and supplies) during the construction or operational phases of the proposed project.

### **Disruption in daily living and movement patterns**

The construction phase of the proposed project is expected to impact on the daily living and movement patterns of residents in the following manner:

- ❖ Construction vehicle movement on the local roads such as the R82, R551, R553, R557 and roads intersecting the agricultural holdings, could affect daily movement patterns, irrespective of the alternative route alignment chosen. This is especially a source of concern in areas where the local roads are already congested during peak traffic hours, as well as in those areas with high pedestrian volumes (e.g. near schools and in the vicinity of commercial and transport nodes).
- ❖ Unwanted social activities (e.g. unruliness, drunkenness, unsustainable sexual relationships with the locals and unwanted after hours socialising) of construction workers living in construction camps could impact on the living patterns of residents, especially if these were located near existing settlements and farm or smallholding dwellings.



During the operational phase the following impacts on the daily living and movement patterns are anticipated:

- ❖ Unauthorised entry of maintenance personnel on private properties; and
- ❖ Possible misconduct of maintenance personnel (e.g. stock theft, inadequate bush clearings).
- ❖ Possible impact on operations at the Vereeniging Aerodrome due to the location of the proposed power line.

### **Impacts on infrastructure, services and farming activities**

During the construction phase, construction camps with related infrastructure and facilities would have to be set-up and the construction of access roads to specific sites could lead to erosion. Eskom, however, keeps the construction of access roads to a minimum and rather use the existing infrastructure, as the construction and maintenance of these roads is very costly and creates another potential for erosion.

Furthermore, national, secondary and local roads would have to be crossed with the stringing of the line. This impact will, however, be of a short duration. The servitude areas will alter the access to the affected sections of land and restrict certain uses such as the erection of buildings/dwellings in the servitude. Once the transmission line has been established, however, it is not expected to impact on the farming activities of the property owners residing on the smallholdings throughout the study area, as normal farming activities such as crop production and grazing can take place within the servitude.

Services would also not be interrupted. It should, however, be noted that the size of the property plays an important role in this regard as activities on smaller properties cannot be focused away from the power lines. If the power lines would thus be situated along the boundaries it could have a lessened impact on the properties and activities undertaken on the properties. It is anticipated that the proposed power line could negatively impact on the operations at the Vereeniging Aerodrome due to the location of the proposed power line.

### **Township developments**

As mentioned previously, the study area traverses the jurisdiction of three local municipalities namely the Midvaal Local Municipality, the Emfuleni Local Municipality and the City of Johannesburg Metropolitan Municipality. Various comments regarding township developments in these areas have been made during the public participation process undertaken for this study.

Indications are that new townships are planned in the following areas that are located within or close to the study area:

- ❖ North Evaton: Emfuleni Local Municipality (2000 stands)
- ❖ Evaton Small Farms: Emfuleni Local Municipality (500 stands on privately owned land)
- ❖ Kanana: Emfuleni Local Municipality (800 stands – currently in progress)
- ❖ Evaton Estates: Emfuleni Local Municipality (600 houses – currently in progress)

- ❖ Lakeside Estate Ext 1: Midvaal Local Municipality (Portion 103 – a portion of Portion 97 - of the farm Wildebeesfontein 536 IQ – in close proximity to De Deur – 1 245 erven)
- ❖ Sweetwaters

The City of Johannesburg’s Regional Spatial Development Framework 2007/2008 for Region G indicates that the following areas were identified as key focus areas for development (not necessarily housing development) with the aim of attracting private and public investment:

- ❖ Stretford Station District Node.
- ❖ Lenasia South District Node.
- ❖ Lenasia District Node.
- ❖ Agricultural Development.
- ❖ Informal Settlements.
- ❖ Greater Orange Farm Consolidation Development Programme.
- ❖ Ennerdale District Node.

Township developments pose severe challenges for the establishment of any type of linear infrastructure, and not only for transmission lines. From the information available at the time of compiling the report, it is not expected that any of the alternative routes investigated would negatively impact on the above mentioned township developments. However, these developments should be noted and care should thus be taken with the alignment of the proposed routes and discussions with the relevant councils should be undertaken to determine the extent of these developments.

From the above limited information gathered, it is anticipated that the above could thus be more of an issue of concern along Alternative 1 and the “northern” sections of Alternative 2 and 3 where the proposed line would enter/exit the Etna Substation.

#### **7.1.5.6 Perceptions regarding public health and safety**

##### **Health**

The social impact regarding health refers to the perception of risks associated with the proposed project.

During the construction phase of the proposed project an influx of outsiders to an area is usually associated with increased health risks due to the spread of sexually transmitted diseases. As the construction activities of a linear type of project, such as transmission lines, are not concentrated in one area for an extended time, it is anticipated that there would not be recurrent contact between the locals and outsiders. This aspect could limit the spread of sexually transmitted diseases.

Public concerns have been raised with regard to the exposure to Electromagnetic Fields (EMFs). The World Health Organisation (WHO) launched various research initiatives in this regard. At this stage some of the conclusions drawn are: “Electric field levels underneath power lines can be as high as 10 kV/m. However, the fields (both electric and magnetic) drop off with distance from the lines. At 50m to 100m distance the fields are normally at levels that are found in areas away from high voltage power lines. In addition, house walls substantially reduce the electric field levels from those found at similar locations outside the house.”

One could thus conclude that the 95 m servitude area (for one 400 kV transmission line) limits exposure to EMFs. In addition, it should be noted that Eskom does not allow anyone to live within the servitude. A study on EMFs was also commissioned and the results are reflected presented to DEAT in a form of a letter from Eskom Holdings (**refer to Volume 2 of this report**).

Concerns with regards to the outbreak of fires during the construction and operational phase of the proposed project were raised. The emergency services of the local municipalities are not that effective at the moment due to shortages of staff and equipment. The rural character of area and the density of informal settlements, also hamper or delay the response times and effectiveness of fire fighting efforts.

### **Safety and security**

Concerns have been raised with regards to the safety and security of property owners and communities. This relate to the perceived loss of security during the construction phase of the proposed project due to the influx of an outsider workforce to the area. Although the numbers of these “outsiders” will be limited, the fears of property owners with regards to an increase in crime should not be disregarded. Additional safety risks include the increased risk of veld fires and the movement of heavy vehicles or machinery through the study area during the construction phase.

Should the power line be in close proximity to dense settlements, the general safety risks associated with construction sites would be applicable.

During the operational phase of the proposed project unauthorised entry of maintenance personnel on private properties should be avoided as this could pose some security risks for both the owners and the personnel. Due to the high crime rates in the area, these issues should be sensitively dealt with.

Power lines are also associated with an increased fire risk due to sparking, which could negatively impact on cultivated land, threaten the safety of people and animals and pose a risk to infrastructure and dwellings.

### **7.1.6 BIRDS (AVI-FAUNA) AND THEIR HABITATS**

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are the electrocution of birds (and other animals) and birds colliding with power lines. Other problems are: electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure; and disturbance and habitat destruction during the construction and maintenance activities associated with electrical infrastructure.

**Electrocution** of birds on overhead lines is an emotional issue as well as an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa (APLIC 1994; van Rooyen and Ledger 1999). However, in the context of overhead lines above 132kV, electrocutions are not of major concern.

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Due to the large size of the clearances on most overhead lines above 132kV, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components. In fact, transmission lines have proven to be beneficial to many birds, including species such as Bald Ibis, Martial Eagles, Tawny Eagles, African White-backed Vultures, and even occasionally Verreaux's Eagles by providing safe nesting and roosting sites in areas where suitable natural alternatives are scarce (van Rooyen 2004).

Electrocutions are not envisaged as an impact by the proposed lines primarily because of the obvious size of the clearances between the live and earthed components and secondly, the unlikely occurrences of any of these species within the study area.

As mentioned previously, **Collisions** are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004) and refers to the scenario where a bird collides with the conductors or earth wires of overhead power lines. Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited maneuverability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines.

Unfortunately, many of the collision sensitive species are considered threatened (Red Data status) in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. A good example of this is the two flamingo species that occur in southern Africa, which have experienced hardly any successful breeding attempts at Etosha Pan in Namibia for several decades. These species have not evolved to cope with high adult mortality, with the result that consistently high adult mortalities over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are nondiscriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term. Using computer modelling, the South African Crane Working Group estimated that an annual mortality rate of 150 adult Blue Cranes could reduce the eastern population of Blue Cranes (approx. 2000 individuals in Mpumalanga and Kwa-Zulu-Natal) by 90% by the end of the 21st century (McCann *et al*, 2002). At that stage the population would be functionally extinct.

From the statements quoted above, it is clear that power lines are a major cause of avian mortality among power line sensitive species, especially Red Data species. Furthermore, the cumulative effects of power lines and other sources of unnatural mortality might only manifest itself decades later, when it might be too late to reverse the trend. It is therefore imperative to reduce any form of unnatural mortality in these species, regardless of how insignificant it might seem at the present moment in time.

Collisions are envisaged as an impact in the study area. The most sensitive area will be where the lines run adjacent to and cross the numerous dams identified through the Bird Impact Assessment Study (**refer to Volume 3 of this report**). The dams may be frequented by vagrant individuals of Flamingos and Black, White and Yellow-billed Storks, using the area as a 'stop-over' when flying between localities. Agricultural lands are also sensitive from a collision point of view as these areas are much sought after by storks. The areas where the alignment will cross or run parallel to the large concentration of irrigated lands to the south will obviously pose a higher risk in terms of collisions.

During the construction phase and maintenance of power lines and substations, some **habitat destruction** and alteration inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the leveling of substation yards. 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 of the servitude, through the modification of habitat. Similarly, the above mentioned construction and maintenance activities impact on birds through disturbance, particularly during the bird's breeding activities.

**Impact of the birds on the proposed power line:** it is important to mention that birds could have an impact on the line, primarily through streamers produced by large raptors and herons roosting at night above the phases on strain towers. They will not be able to roost on the suspension towers (assuming that the cross-rope suspension structure will be used), but it could be a problem on the strain towers.

The bird impact assessment report assess, in detail, the anticipated impacts of this line on both the Red Data and non Red Data species, according to the criteria shown in the report. Those impacts that were rated as MEDIUM or higher magnitude and significance are listed here, with the recommended mitigation measures highlighted later in the report.

**Collision with earth wire/conductor:**

- ❖ Black, White and Yellow-billed Storks and Flamingos at or near the dams.
- ❖ White and Abdim's Storks at or near grassland patches and cultivated land
- ❖ Secretary bird in open grassland patches.
- ❖ Various non Red Data species in the vicinity of water sources.

**Electrocution:**

- ❖ The threat of electrocution is unlikely, owing to the obvious size of the clearances between the live and earthed components.

### **Disturbance & habitat destruction:**

- ❖ Although these impacts were not rated as MEDIUM for any of the species, they should always be considered, as resident bird species and will almost invariably be affected to some extent by a project such as this one.

### **Streamer related faults on the strain towers:**

- ❖ Streamers produced by large raptors and herons could potentially induce electrical faulting along the power line. The reporting rate for herons within this study area is relatively large, therefore increasing the likelihood of streamer faulting along the proposed 2x400kV.

## **7.2 IMPACT ASSESSMENT, RANKING AND RATING**

Key issues identified during the scoping phase informed the structure of the specialist studies. Each issue consists of components that on their own or in combination with each other give rise to potential impacts, either positive or negative and from the project onto the environment or from the environment onto the project. This chapter assesses these potential impacts for each of the three possible corridors considered, identifies recommended mitigation and provides an indication of the significance of the impacts after mitigation. A description of the assessment criteria was highlighted in the Plan of Study for EIA. The following criterion was used to evaluate significance:

### **EXTENT**

Magnitude of the impact, which is classified as:

**Local:** the impacted area is only at the site- the actual extent of the activity

**Regional:** the impacted area extends to the surrounding, the immediate and the neighbouring properties

**National:** the impact can be considered to be of national importance

### **DURATION**

This measures the lifetime of the impact

**Short term:** the impact will be for 0-3 years, or only last for the period of construction

**Medium term:** three to ten years

**Long term:** longer than 10 years or the impact will continue for the entire operational lifetime of the project

**Permanent:** this applies to the impact that will remain after the operational lifetime of the project

### **INTENSITY**

This is the degree to which the project affects or changes the environment, and is classified as follows:

**Low:** the change is slight and often not noticeable, and the natural functioning of the environment is not affected

**Medium:** the environment is remarkably altered, but still functions in a modified way

**High:** Functioning of the affected environment is disturbed and can cease

## **PROBABILITY**

This is the likelihood or the chances that the impact will occur, and is classified as:

**Low:** during the normal operation of the project, no impacts are expected

**Medium:** the impact is likely to occur if extra care is not taken to mitigate them

**High:** the environment will be affected irrespectively, in some cases, such impact can be reduced

## **CONFIDENCE**

This is the level of knowledge/information that the environmental assessment practitioner or specialist had in his/her judgement

**Low:** the judgement is based on intuition and not on knowledge or information

**Medium:** common sense and general knowledge informs the decision

**High:** Scientific and or proven information has been used to give such a judgement

Based on the above criteria, the **SIGNIFICANCE** of issues will be determined. This is the importance of the impact in terms of physical extent and time scale.

**Low:** the impact are less important, but my require some mitigation action

**Medium:** the impacts are important and require attention; mitigation is required to reduce the negative impacts

**High:** the impacts are of great importance and mitigation is critical

## 7.2.1 VISUAL CHARACTER OF THE AREA

### 7.2.1.1 Impacts on the landscape

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative- Impacting on the landscape types due to the presence of foreign elements and alteration to sensitive landscape types over alignment's length	Low	Permanent if not mitigated	Medium	Probable	Low	Low	Medium
Alternative 2		Low		Medium	Probable	Low	Low	Medium
Alternative 3		Medium		Medium	Probable	Medium	Medium	Medium
Operational Phase								
Alternative 1	Negative- impacting on the visual quality of the landscape due to the intrusion of or by transmission line	Regional	Permanent	Medium	Definite	Medium	Low	Medium
Alternative 2				Medium	Definite	Medium	Low	Medium
Alternative 3				Medium	Definite	Medium	Medium	Medium

**Table 13:** Impact Rating Table; Landscape



**7.2.1.2 Visual Impacts on Residents**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative-Construction camps and lay-down yards may cause unsightly views	Local	Temporary	Medium	Probable	Low	Low	Medium
Alternative 2				Medium	Probable	Low	Low	Medium
Alternative 3				Medium	Probable	Medium	Medium	Medium
Operational Phase								
Alternative 1	Negative-impacting on the visual quality of the landscape due to the intrusion of or by transmission line	Regional	Permanent	Medium	Highly probable	Medium	Low	Medium
Alternative 2				Medium	Highly probable	Medium	Low	Medium
Alternative 3				Medium	Highly probable	Medium	Medium	Medium

**Table 14:** Impact Rating Table; Visual Impacts on Residents

**7.2.1.3 Visual Impacts on Tourists**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative- Intruding on the existing views of the landscape	At a number of point locations	Short period	Medium	Probable	Low	Low	Medium
Alternative 2				Medium	Probable	Low	Low	Medium
Alternative 3				Medium	Probable	Low	Low	Medium
Operational Phase								
Alternative 1	Negative- impacting on the visual quality of the landscape due to the intrusion of or by transmission line	Local	Short period	Medium	Probable	Low	Low	Medium
Alternative 2				Medium	Probable	Low	Low	Medium
Alternative 3				Medium	Probable	Low	Low	Medium

**Table 15:** Impact Rating Table; Visual Impacts on Tourists

**7.2.1.4 Visual Impacts Motorists**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative- Intruding on the existing views of the landscape	At a number of point locations	Short period	Low	Probable	Low	Very-Low	Medium
Alternative 2				Low	Probable	Low	Very-Low	Medium
Alternative 3				Low	Probable	Low	Very-Low	Medium
Operational Phase								
Alternative 1	Negative- impacting on the visual quality of the landscape due to the intrusion of or by transmission line	Local	Short period	Low	Probable	Low	No significance	Medium
Alternative 2				Low	Probable	Low	No significance	Medium
Alternative 3				Low	Probable	Low	No significance	Medium

**Table 16:** Impact Rating Table; Visual Impacts on Motorists

**7.2.2 SOILS, GEOLOGY AND AGRICULTURE**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative-Physical reduction of available arable land, introduction of foreign material on land	Local	Short period	Medium	Highly probable	Low	Low	Medium
Alternative 2				Medium	Highly probable	Low	Low	Medium
Alternative 3				Medium	Highly probable	Medium	Medium	Medium
Operational Phase								
Alternative 1	Negative-Though not conclusively proven, the micro climate created in the immediate vicinity of the power line can reduce the growth and development of tree crop	Local	Long term	Medium	Probable	Low	Low	Medium
Alternative 2				Medium	Probable	Low	Low	Medium
Alternative 3				Medium	Probable	Low	Medium	Medium

**Table 17:** Impact Rating Table; Soils, Geology and Agriculture

**7.2.3 ARCHAEOLOGICAL AND/OR CULTURAL RESOURCES**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Constructing the towers of the transmission line at a site having historical and cultural significance, along any one of the four corridors	Local	Short	Medium	Probable	High	Medium	High
Alternative 2				Medium	Probable	High	Medium	High
Alternative 3				Low	Probable	High	Medium	High
Operational Phase								
Alternative 1	Damage and looting of cultural heritage sites, resulting in loss of heritage.	Local	Short	High	Improbable	Medium	Low	High
Alternative 2				Medium	Improbable	Medium	Low	High
Alternative 3				Medium	Improbable	Medium	Low	High

**Table 18:** Impact Rating Table; Heritage and Archaeological Resources

## 7.2.4 ECOLOGY AND ECOLOGICAL SENSITIVITY

### 7.2.4.1 Impacts on vegetation

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative-impacting on the vegetation due to the physical damage as a result of construction and erection activities	Local	Short period	Medium	Probable	Medium	Low	Medium
Alternative 2				Medium	Probable	Medium	Low	Medium
Alternative 3				Medium	Probable	Medium	Low	Medium
Operational Phase								
Alternative 1	Negative-impacting on the vegetation due to existence of servitude and other service or temporary roads, the presence of pylon foundations and foot blocks	Local	Long term	Low	Probable	Medium	Low	Medium
Alternative 2				Low	Probable	Medium	Low	Medium
Alternative 3				Low	Probable	Medium	Low	Medium

**Table 19:** Impact Rating Table; Ecology and Sensitivity

**7.2.4.2 Impacts on ridges**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative- Impacting on ridges due to the physical damage as a result of construction and erection activities	Local	Short period	Low	Improbable	Low	Low	Medium
Alternative 2				Medium	Probable	Medium	Low	Medium
Alternative 3				Medium	Probable	Medium	Low	Medium
Operational Phase								
Alternative 1	Negative- impacting on ridges due to the existence of servitude and other services or temporary roads, the presence of pylon foundations and foot blocks	Local	Long term	Low	Improbable	Low	Low	Medium
Alternative 2				Medium	Probable	Medium	Low	Medium
Alternative 3				Medium	Probable	Medium	Low	Medium

**Table 20:** Impact Rating Table; Ridges

**7.2.4.3 Impacts on wetlands and water courses**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative- Impacting on wetlands due to the physical damage as a result of construction and erection activities	Local	Short period	Low	Improbable	Low	Low	Medium
Alternative 2				Medium	Probable	Medium	Low	Medium
Alternative 3				Low	Improbable	Low	Low	Medium
Operational Phase								
Alternative 1	Negative- impacting on wetlands due to existence of servitude and other service or temporary roads, the presence of pylon foundations and foot blocks	Local	Long term	Low	Improbable	Low	Low	Medium
Alternative 2				Medium	Probable	Medium	Low	Medium
Alternative 3				Low	Improbable	Low	Low	Medium

**Table 21:** Impact Rating Table; Wetlands and Water Courses



**7.2.4.4 Impacts on Rivers and Riparian Habitat**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative- Impacting on rivers and riparian habitats due to the physical damage as a result of construction and erection activities	Local	Short period	Low	Improbable	Low	Low	Medium
Alternative 2				Medium	Probable	Medium	Low	Medium
Alternative 3				Low	Improbable	Low	Low	Medium
Operational Phase								
Alternative 1	Negative- impacting on rivers and riparian habitats due to existence of servitude and other service or temporary roads, the presence of pylon foundations and foot blocks	Local	Permanent	Low	Improbable	Low	Low	Medium
Alternative 2				Medium	Probable	Medium	Low	Medium
Alternative 3				Low	Improbable	Low	Low	Medium

**Table 22:** Impact Rating Table; Rivers and riparian habitats

**7.2.4.5 Impacts on Pristine Patches of Grassland Habitats**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative- Impacting on pristine patches of grassland habitats due to the physical damage as a result of construction and erection activities	Local	Short period	Low	Improbable	Low	Low	Medium
Alternative 2				Low	Improbable	Low	Low	Medium
Alternative 3				Low	Improbable	Low	Low	Medium
Operational Phase								
Alternative 1	Negative- impacting on pristine patches of grassland habitat due to existence of servitude and other service or temporary roads, the presence of pylon foundations and foot blocks	Local	Long term	Low	Improbable	Low	Low	Medium
Alternative 2				Low	Improbable	Low	Low	Medium
Alternative 3				Low	Improbable	Low	Low	Medium

**Table 23:** Impact Rating Table; Pristine Patches of Grassland Habitats

**7.2.4.6 Impacts on Faunal Species**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative- Impacting on fauna due to the physical damage as a result of construction and erection activities	Local	Short period	Medium	Probable	Medium	Low	Medium
Alternative 2				Medium	Probable	Medium	Low	Medium
Alternative 3				Medium	Probable	Medium	Low	Medium
Operational Phase								
Alternative 1	Negative- impacting on fauna due to existence of servitude and other service or temporary roads, the presence of pylon foundations and foot blocks	Local, but could be regional and national for some bird species	Long term	Medium	Probable	Medium	Low	Medium
Alternative 2				Medium	Probable	Medium	Low	Medium
Alternative 3				Medium	Probable	Medium	Low	Medium

**Table 24:** Impact Rating Table; Faunal Species

**7.2.5 SOCIAL AND ECONOMIC ASPECTS**

**7.2.5.1 Population Change**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Neutral impact on the size and density of the population	Local	Short term	Low	Improbable	Very low	Very low	High
Alternative 2								
Alternative 3								
Operational Phase								
Alternative 1	Neutral impact on the size and density of the population	Local	Long term	Low	Improbable	Very low	Very low	High
Alternative 2								
Alternative 3								

**Table 25:** Impact Rating Table; Population Change

**7.2.5.2 Introduction of people dissimilar in demographic profile**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Possible negative- impact on the social status of the communities along the routes	Local	Short term	Medium	Probable	Very low	Very low	Medium
Alternative 2								
Alternative 3								
Operational Phase								
Alternative 1	Possible negative- impact on the social status of the communities along the routes	Local	Long term	Low	Probable	Very low	Very low	High
Alternative 2								
Alternative 3								

**Table 26:** Impact Rating Table; Introduction of new people

**7.2.5.3 Inflow and outflow of workers**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative impact due to the inflow of outsiders to the area and possible erection of construction camps	Local	Short term	Medium	Probable	Very low	Very low	Medium
Alternative 2								
Alternative 3								
Operational Phase								
Alternative 1	Neutral status due to limited impact of inflow of workers during maintenance of the power line	Local	Short term (due to intermittent nature of maintenance)	Low	Improbable	Very low	Very low	High
Alternative 2								
Alternative 3								

**Table 27:** Impact Rating Table; Inflow and Outflow of Workers

**7.2.5.4 Residential proximity and/or relocation**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative impact dwellings, settlements and possible relocation	Local	Short term	Medium	Probable	Very low	Very low	High
Alternative 2								
Alternative 3								
Operational Phase								
Alternative 1	Negative impact dwellings, settlements and possible relocation	Local	Permanent	Medium	Probable (Relocation) Highly probable (residential proximity)	High	Medium	Medium
Alternative 2								
Alternative 3								

**Table 28:** Impact Rating Table; Residential Proximity and/or relocation

**7.2.5.5 Township Developments**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Negative impact on proposed township developments	Local	Short term	Low	Improbable	Very low	Very low	High
Alternative 2		Local		Low	Improbable	Very low	Very low	High
Alternative 3		Local		Low	Improbable	Very low	Very low	High
Operational Phase								
Alternative 1	Negative impact on proposed township developments	Local	Long term	High	Probable	High	Low	Medium
Alternative 2		Local		Medium	Probable	Medium	Low	Medium
Alternative 3		Local		Medium	Probable	Medium	Low	Medium

**Table 29:** Impact Rating Table; Township Developments



## 7.2.6 BIRDS (AVI-FAUNA) AND THEIR HABITATS

### 7.2.6.1 Habitat Destruction

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Habitat destruction (negative impact) Resident bird species will almost invariably be affected to some extent by a project such as this one	Local	Short term	Medium	Probable-particularly for Grass Owls, Greater and Lesser flamingos, White and Abdin's Stork	Low	Low	High
Alternative 2		Local	Short term	Medium		Low	Low	High
Alternative 3		Local	Short term	Medium		Low	Low	High
Operational Phase								
Alternative 1	Electrocutions (Negative Impact). Electrocutions are not envisaged as an impact due to the large size of clearance between live and earthrd components	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alternative 2		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alternative 3		N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 30:** Impact Rating Table; Bird Habitat Destruction

### 7.2.6.2 Habitat Disturbance

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	<b>Habitat disturbance</b> (negative impact) Resident bird species will almost invariably be affected to some extent by a project such as this one	Local	Medium term	Medium	Probable-particularly for Grass Owls, Greater and Lesser flamingos, White and Abdin's Stork	Low	Low	High
Alternative 2		Local	Medium term	Medium		Low	Low	High
Alternative 3		Local	Medium term	Medium		Low	Low	High
Operational Phase								
Alternative 1	<b>Electrocutions</b> (Negative Impact). Electrocutions are not envisaged as an impact due to the large size of clearance between live and earthrd components	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alternative 2		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alternative 3		N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 31:** Impact Rating Table; Bird Habitat Disturbance

### 7.2.6.3 Habitat Destruction

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction Phase								
Alternative 1	Habitat destruction (negative impact) Resident bird species will almost invariably be affected to some extent by a project such as this one	Local	Short term	Medium	Probable-particularly for Grass Owls, Greater and Lesser flamingos, White and Abdin's Stork	Low	Low	High
Alternative 2		Local	Short term	Medium		Low	Low	High
Alternative 3		Local	Short term	Medium		Low	Low	High
Operational Phase								
Alternative 1	<b>Electrocutions</b> (Negative Impact). Electrocutions are not envisaged as an impact due to the large size of clearance between live and earthrd components	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alternative 2		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alternative 3		N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 32:** Impact Rating Table; Bird Habitat Destruction A

**7.2.6.4 Collisions and Disturbance Impacts during Operational Phase**

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Operational Phase Collisions								
Alternative 1	<b>Collision</b> (negative impact) Collisions are envisaged as an impact by the proposed lines especially where the power lines cross dams, grassland areas and cultivated lands	Local	Permanent	Medium	Improbable	Medium	Low	High
Alternative 2		Local	Permanent	Medium	Improbable	Medium	Low	High
Alternative 3		Local	Permanent	Medium	Improbable	Medium	Low	High
Operational Phase Disturbance								
Alternative 1	<b>Disturbance</b> (Negative Impact). Resident bird species will almost invariably be affected through disturbance as a result of maintenance activities taking place along the power line	Local	Medium term	Medium	Probable-particularly for Grass Owls, Greater and Lesser flamingos, White and Abdin's Stork	Low	Low	High
Alternative 2		Local	Medium term	Medium		Low	Low	High
Alternative 3		Local	Medium term	Medium		Low	Low	High

**Table 33:** Impact Rating Table; Collisions and impacts during operation

## **8. IMPACTS MITIGATION MEASURES**

### **8.1 VISUAL IMPACTS**

The aim of mitigation is to reduce or alleviate the intrusive contrast between the proposed project components and activities, and the receiving landscape to a point where it is acceptable to visual and landscape receptors.

#### **8.1.1 GENERAL**

Proceed with construction of the transmission line during the off peak tourism season. Where areas are going to be disturbed through the destruction of vegetation, for example the establishment of the construction camp, the vegetation occurring in the area to be disturbed must be salvaged and kept in a controlled environment such as a nursery, for future re-planting in the disturbed areas as a measure of rehabilitation.

#### **8.1.2 TRANSMISSION TOWERS**

Avoid crossing over or through ridges, rivers, pans or any natural features that have visual value. The preferred type of tower is the compact cross-rope or the cross-rope suspension tower. These two tower types are the most visually permeable and create an extremely low degree of visual obstruction. Avoid changing the alignment's direction too often in order to minimize the use of the self-supporting strain tower. This tower type is the most visually intrusive as the steel lattice structure is more dense than the other two tower types, hence creating more visual obstruction.

Where practically possible, provide a minimum of 1 km buffer area between the transmission line and sensitive visual receptors such as residential areas and tourism facilities and rehabilitate disturbed areas around pylons as soon as practically possible after construction. This should be done to restrict extended periods of exposed soil.

#### **8.1.3 ACCESS ROADS**

Make use of existing access roads where possible. Where new access roads are required, the disturbance area should be kept as small as possible. A two-track dirt road will be the most preferred option. Locate access alternatives so as to limit modification to the topography and to avoid the removal of established vegetation. Avoid crossing over or through ridges, rivers, pans or any natural features that have visual value. Maintain no or minimum cleared road verges. Access alternatives should be located on the perimeter of disturbed areas such as cultivated/fallow lands as not to fragment intact vegetated areas; and if it is necessary to clear vegetation for a road, avoid doing so in a continuous straight line. Alternatively, curve the road in order to reduce the visible extent of the cleared corridor.

#### **8.1.4 CLEARED SERVITUDES**

Locate the alignment and the associated cleared servitude so as to avoid the removal of established vegetation; and avoid a continuous linear path of cleared vegetation that would strongly contrast with the surrounding landscape character. Feather the edges of the cleared corridor to avoid a clearly defined line through the landscape.

### **8.1.5 CONSTRUCTION CAMPS**

If practically possible, locate construction camps in areas that are already disturbed or where it isn't necessary to remove established vegetation for example, areas with less dense vegetation. Utilize existing screening features such as dense vegetation stands or topographical features to place the construction camps and lay-down yards out of the view of sensitivity visual receptors. Keep the construction sites and camps neat, clean and organized in order to portray a tidy appearance; and screen the construction camp and lay-down yards by enclosing the entire area with a dark green or black shade cloth of no less than 2 m height.

## **8.2 AGRICULTURAL POTENTIAL, SOILS AND GEOLOGY**

The study area looks homogenous from an agricultural potential point of view, and as such, impacts on alternative route 1, 2 and 3 would almost be the same. The only slight difference would be the fact that alternative 3 cuts across an area predominantly used for agricultural activities while alternatives 1 and 2 are in an area fairly developed for residential purposes. The main recommendation would be that the farm and/or property owners be consulted during the negotiation process so that they can have inputs into the value of their properties before decisions are made.

## **8.3 ARCHAEOLOGY AND HERITAGE RESOURCES**

The Heritage Impact Assessment Study (**refer to Volume 3 of this report**) did not find any objects or materials of either heritage or archaeological importance throughout the study area. As a result, there were no recommendations given. That notwithstanding, some of the archaeological and heritage resources are usually buried beneath the ground, and as such, could only be discovered during construction and maintenance activities.

## **8.4 ECOLOGY AND ECOLOGICAL SENSITIVITY**

Different categories of sensitive areas have been pointed out in the ecological sensitivity assessment report. Route options should be considered to avoid these areas where possible. Provision should be made to shift the locality of some pylon positions on the final planned route to avoid any significant impact on any of these sensitive areas, especially along water courses. Considering the proposed alternatives, route alternative no 1 will have the least coincidence with sensitive biological features as indicated by this report and is therefore the recommended option. Since the major direct impact on the environment is likely to be the construction of access roads for, and the construction of pylons, care should be exercised to plan the route so that existing roads may be used as far as possible.

## **8.5 SOCIAL AND ECONOMIC ENVIRONMENT**

### **8.5.1 POPULATION CHANGE**

No mitigation measures are proposed due to the neutral status of the impact.

### **8.5.2 INTRODUCTION OF PEOPLE DISSIMILAR IN DEMOGRAPHIC PROFILE**

The main mitigating strategy would be to limit an influx of people dissimilar in demographics to that of the local populations through maximising the local workforce component as far as possible. If construction camps are introduced, ensure effective construction camp management and implement a system to avoid misconduct of workers living at the construction camp.

### **8.5.3 INFLOW AND OUTFLOW OF WORKERS**

The construction process would have to be carefully managed with emphasis on the following:

- ❖ all construction activities would have to be restricted to working areas (if possible, the construction camp should not be located in close vicinity to residential areas or settlements);
- ❖ construction workers would be expected to wear name tags and clothing to ensure that they can be readily identified as belonging to the construction workforce;
- ❖ meetings would have to be arranged with affected residents and community policing structures to clarify the contractor's plans, procedures, schedules and possible difficulties and risks.

It is further suggested that Eskom should, where practicable, make the appointment of local labour a key requirement in its tender documentation. In so doing, the successful contractors would be obliged to, as far as possible, use local labour during the construction phase.

### **8.5.4 RESIDENTIAL PROXIMITY AND/OR RELOCATION**

Mitigation measures proposed are:

- ❖ Routes should preferably run parallel to existing infrastructure. With regards to Alternative 2 and 3 it is therefore suggested that the route alignment is as close to the R551 and R82 and other infrastructure (such as existing lines) as possible to avoid further intrusion into residential areas as mentioned above.
- ❖ If any relocation would be necessary, proper land valuations should be undertaken and fair compensation should be negotiated with the affected property owners.
- ❖ Eskom to negotiate with local and provincial authorities regarding any possible relocation of individuals and the relocation destination to ensure the minimum social disruption and housing of people closer to opportunities and services.
  
- ❖ Eskom should ensure that the period of uncertainty regarding possible relocations should be kept as short as possible. Lengthy cumbersome procedures should thus be avoided, although such a process should be undertaken in a sensitive and transparent manner.

### **8.5.5 FORMATION OF ATTITUDES AGAINST THE PROJECT**

The following mitigation measures are proposed:

- ❖ Construction activities should not negatively impact on any farming activities. If damages occur (e.g. if crops are damaged / animals are harmed), compensation should be provided to the affected farm owners at market related prices.
- ❖ In the case of general maintenance, Eskom workers or contractors should inform property owners well in advance when they would access the property and for what reasons. Should they not manage to get in touch with the property owner, they should report to the property owner or farm manager when entering the property if this person is staying on site.
- ❖ Community representatives should also be notified well in advance of maintenance schedules to enable the representatives to relay the information to the wider community.
- ❖ In the case of emergencies, maintenance and emergency personnel from Eskom should as far as possible aim to contact the affected property owners or community representatives to inform them of the emergency.

### **8.5.6 EMPLOYMENT OPPORTUNITIES**

The following mitigation measures are proposed:

- ❖ Eskom should, where practicable, make the appointment of local labour a key requirement in its tender documentation. In so doing, the successful contractors would be obliged to, as far as possible, use local labour during the construction phase.
- ❖ Eskom or the contractors should source skills required for the construction phase of the project from the local communities as far as possible.
- ❖ The skills required should be communicated to the local community leaders and community based organisations.
- ❖ Local recruitment agencies should be contacted to obtain a list of potential jobseekers.
- ❖ An equitable process should be ensured whereby minority groups and previously disadvantaged individuals are taken into account.
- ❖ Skills training should be undertaken aimed at developing portable skills among the local labourers.

### **8.5.7 DISRUPTION IN DAILY LIVING AND MOVEMENT PATTERNS**

Mitigation measures to be implemented are:



- ❖ Eskom should not create new access routes during construction activity but should utilise existing paths and roads for the movement of material.
- ❖ The location of the construction camps should be placed in areas that would result in the minimum impact on the local residents. Aspects that need to be considered are availability of water and sanitation facilities, shops and recreational facilities. The movement of pedestrians across the main roads to access these facilities must be avoided.
- ❖ If possible, construction vehicle movement should be limited. Main roads should only be used during off-peak traffic hours. Vehicular movement should be directed away from areas with a high level of pedestrian movement, notably during peak hour periods.
- ❖ Eskom contractors should communicate their work schedules to property owners and the public at large via large, reflective signs posted along routes that would be affected by construction activity.
- ❖ Eskom should enter into detailed discussions with the Vereeniging Aerodrome with regards to the exact alignment of the line to limit any negative impacts on the facilities operations.

#### **8.5.8 INFRASTRUCTURE, SERVICES AND FARMING ACTIVITIES**

Mitigation measures include:

- ❖ It is recommended that the alignment of the final route be undertaken in consultation with the affected property owners and local authorities to ensure that the impact on infrastructure and services are limited.
- ❖ Should a power line negatively impact on any farming activities resulting in negative economic impacts for the property owner, Eskom should take this into account when compensation amounts are calculated.
- ❖ Bodies responsible for the infrastructure along the routes should be communicated with such as Telkom, MTN, Vodacom, Department of Public Works, Department of Transport and so forth.
- ❖ Eskom should enter into detailed discussions with representatives of the Vereeniging Aerodrome facility to determine the negative impacts on their operations due to the location of the proposed power line. The final route alignment in that section of the study area should thus be finalised in consultation with representatives of this facility.

#### **8.5.9 TOWNSHIP DEVELOPMENTS**

Mitigation measures in this regard could include the following:

- ❖ Once the project has been approved, and during the negotiation phase, Eskom should discuss the final route alignment and tower positions with representatives of the town planning departments of the Midvaal Local Municipality, the Emfuleni Local Municipality and the City of Johannesburg Metropolitan Municipality in order to either avoid these new townships or to allow for a servitude to be included in the planning processes before township establishment.
- ❖ Eskom should take note of the RDP planning processes and houses that will be built in the next financial years.
- ❖ If technically and economically feasible, route alignment from the Etna Substation could follow the existing line from Etna Substation to the Eiger Substation for a section of the route (approximately to where the line crosses the road from Weilers Farm to the Elandsfontein area).

#### **8.5.10 PERCEPTIONS REGARDING HEALTH AND SAFETY**

Mitigation measures proposed are:

- ❖ The proposed routes should not, where possible, be located within close vicinity to sensitive establishments such as schools, playgrounds and old age homes, or through high-density settlements.
- ❖ Eskom should protect public health by complying to international guidelines and national safety standards for electromagnetic fields.
- ❖ During the construction phase of the proposed project, HIV/Aids awareness campaigns should be highlighted among the communities along the routes, but should be more focused on the contract/construction workers.
- ❖ Eskom should ensure that fire hazards are non-existent by adopting high safety standards.
- ❖ In cases where the transmission line crosses residential areas, or is located within the urban edge, the lives and safety of the residents (especially children) should be protected, during the construction phase.
- ❖ Local labour should be employed during the construction phase where possible.
- ❖ The location of construction camps should be dealt with in consultation with the local community representatives and local municipalities.
- ❖ Unauthorised practices taking place at construction camps or illegal activities undertaken by contract workers should immediately be reported. A monitoring system should be developed in consultation with the contract workers and affected parties.

- ❖ Construction schedules should be communicated to the affected property owners and communities.
- ❖ The proposed routes should not, where possible, be located within close vicinity to sensitive establishments such as schools, playgrounds, old age homes and so forth.
- ❖ Eskom should ensure that fire hazards are non-existent by adopting high safety standards.
- ❖ Construction vehicles should be equipped with adequate fire fighting equipment and no open fires should be allowed on the construction site.
- ❖ In terms of attenuating fire-related risks and impacts, it would be vital to develop a fire/emergency management plan in conjunction with the various local municipalities prior to construction.
- ❖ General safety measures in terms of construction work should be implemented and relevant regulations be adhered to (Occupational Health and Safety Act).
- ❖ Eskom workers should inform property owners and representatives of the various communities of their general maintenance tasks prior to undertaking them.

## **8.6 BIRDS IMPACTS MITIGATION MEASURES**

The following are recommended in order to mitigate as far as possible for the impacts related to birds:

### **8.6.1 COLLISION WITH EARTH WIRE:**

The earth wire of those sections of line that are in close proximity to the dams, the grassland patches and the irrigated land to the south (near Glockner substation) should be marked with a suitable marking device.

### **8.6.2 DISTURBANCE AND HABITAT DESTRUCTION:**

All construction and maintenance activities should be carried out according to generally accepted environmental best practices. In particular, care should be taken in the vicinity of the river crossings, and existing roads must be used as far as possible for access during construction.

### **8.6.3 STREAMER RELATED FAULTS ON THE STRAIN TOWERS:**

It is suggested that bird guards are fitted to strain towers above the phases as a precautionary measure.

Please note that site specific recommendations will be provided prior to construction during the EMP phase of this project.

## **9. IMPACT STATEMENT**

---

The assessment of potential impacts was carried out above. The mitigation measures were also suggested. The three alternative corridors (1km wide each) identified would have environmental (bio-physical, social and economic) impacts that are unique to each alternative route or corridor. At the same time, the construction of the 2x400kV power line would bring about a lot of relief on the current load build ups in the area. This will go a long way in addressing the power dips/shortages that are being experienced in the area, including enabling new business activities that rely on the supply of electricity.

Between the three identified corridors, a number of impacts were identified and are summarized as follows:

- ❖ Impacts on wetlands
- ❖ Impacts on critical habitats
- ❖ Impacts on grasslands and ridges
- ❖ Impacts on current and future development activities such as townships

- ❖ Impacts on agricultural activities
- ❖ Impacts on the visual character of the landscape

Such being the case, there are differences in the manner in which these impacts would be felt along the proposed three corridors as reflected during the impact assessment and ranking of each identified impact. Management measures recommended for each impact would mitigate the impacts differently from each alternative corridor. It is the believe and understanding of the Environmental Impact Assessment Team that after taking all these into consideration, alternative corridor 1 might have minimal environmental impacts, hence it is recommended (without influencing DEAT from considering other corridors) for possible authorization. The table below summarizes the findings of the specialist studies carried out.

SPECIALIST	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Visual Impacts	✓	✗	✗
Avi-Fauna	✓	✗	✗
Agricultural Pote	✓	✓	✓
Ecological Impac	✓	✗	✗
Heritage Impacts	✓	✓	✓
Social Impacts	✗	✓	✓

✓ = Recommended

✗ = Not Recommended

## 10. CONCLUSIONS AND RECOMMENDATIONS

The EIA team believes that the EIA for the proposed 2x400kV double circuit power line between Glockner and Etna Substations fulfils the process requirements of current environmental legislation. Issues and associated impacts have been investigated by a team of qualified specialists who have reported on their findings without reservations. Extensive efforts have been made to identify and involve all potentially affected parties in the public participation process. The public has been afforded opportunities to participate in the EIA. The recommendations set out in the findings section of the EIA are therefore presented for project implementation and the EIR is hereby presented to the relevant authorities for decision making.

## 11. REFERENCES

### 11.1 VISUAL

Bureau of Land Management (1986), Handbook H-8431-1, Visual Resource Contrast Rating. U.S. Department of the Interior BLM

<http://www.blm.gov/nstc/VRM/vrmsys.html>

Government Office of the South West - England (2006), Using landscape sensitivity for renewable energy, Revision 2010–Empowering the region [Online]

[http://www.oursouthwest.com/revision2010/lca\\_methodology\\_windbiomass.doc](http://www.oursouthwest.com/revision2010/lca_methodology_windbiomass.doc)

[Accessed 8 November 2006]

Landscape Institute and the Institute of Environmental Assessment and Management (2002), Guidelines for Landscape and Visual Impact Assessment (GLVIA), Second Edition, E & FN Spon Press.

Oberholzer, B. (2005). Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 R. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning, Cape Town.

Swanwick, C. Department of Landscape, University of Sheffield and Land Use Consultants. (2002). Landscape Character Assessment: Guidance for England and Scotland. The Countryside Agency / Scottish Natural Heritage

Van Riet, W., Claassens, P., Van Rensburg, J., Van Viegen, T., Du Plessis, L. (1997), *Environmental Potential Atlas for South Africa*. The Department of Environmental Affairs and Tourism in conjunction with The Geographic Information Systems Laboratory CC and the University of Pretoria. J.L. van Schaik.

Van Rooyen, M.W. 2002. Management of the old field vegetation in the Namaqua National Park, South Africa: conflicting demands of conservation and tourism. Published paper from *The Geographical Journal*, Vol. 168, No.3, September 2002, pp. 211-223.

U.S.D.O.T., Federal Highway Administration, Office of Environmental Policy. (March 1981), Visual Impact Assessment for Highway Projects, U. S. Department of Transportation Washington D. C

Urban Land Institute (1980), Visual Resource Management 0510-1: Environmental Comment (May 1980). Washington D.C.

Silvia Collasius. Socio-Economic Analysis report (2001) prepared for the Midvaal Local Municipality, IDP Revision March 2006, and Development & Planning Department.

## 11.2 AGRICULTURE, SOILS AND GEOLOGY

Acocks, J.P.H (1975) Veld types of South Africa; Botanical Research Institute of South Africa

Agricultural Research Council (2002) Areas in which high potential agricultural land may occur, superimposed on moisture availability zones. Map Scale: 2 500 000. Project No. 041\_2000/bw/Mois.gra.

Bredenkamp, G.J. & Brown, L.R (2001) Vegetation – A reliable ecological basis for environmental planning. Urban Greenfile Nov-Dec 2001: 38-39

Barrie-Low, A and Rebelo G (1996) Vegetation of South Africa, Lesotho and Swaziland, Department of Environmental Affairs and Tourism, Pretoria

Brady, N. C (1974) The nature and properties of soils; 8th Edition; MacMillan Publishing Co., Inc. New York.

COMBUD (2005) Enterprise Budgets. Sub-directorate: Economic and Statistics, Economics, Marketing and Transformation, Limpopo Department of Agriculture.

Frnzmeir, D.P., E. *et al* (1969) Properties of some soils in the cuberland plateau as related to slope aspect and position. Soil Sci. Soc. Am. Proc. 33:755-761.

Huschke, R.E (1959) Glossary of Meteorology, American Meteorological Society, Boston, Second printing

Jiang, P., and K.D. Thelen (2004) Effect of soil topographic properties on crop yield in north-central corn-soybean cropping system. Agron. J. 96:252-258.

Laker, M.C (2005) South Africa's soil resources and sustainable development [http://www.environment.gov.za/nssd\\_2005/Web/NSSD%20Process%20Documents%20and%20Reports/REVIEW\\_Soil\\_and\\_Sustainability\\_Oct\\_05.pdf](http://www.environment.gov.za/nssd_2005/Web/NSSD%20Process%20Documents%20and%20Reports/REVIEW_Soil_and_Sustainability_Oct_05.pdf).

McIntosh, D. H (1972) Meteorological Glossary, Her Majesty's Stationery Office, Met. O. 842, A.P. 897, 319 p

Mucina L, Rutherford M.C. & Powrie L.W. (eds) (2005). Vegetation Map of South Africa, Lesotho and Swaziland, 1:1000000 scale sheet maps.

Peveill, K.I., I.A. Sparrow, and D.J. Reutter (1999) Soil Analysis, an Interpretation Manual. CSIR Publication, Collingwood, Victoria. Australia

Schoeman, J.L. National Department of Agriculture (2002) Criteria for prime or unique agricultural land in South Africa. Report Number GW/A/2002/21.  
Soil classification working group (1991) Soil classification, A Taxonomic System for South Africa, Soil and Irrigation Research Institute, Department of Agricultural Development, Pretoria

Stone, J.R et al (1985) Effect of erosion and landscape position on the productivity of piedmont soils. Soil Sci. Am. J. 49:987-991.

### 11.3 ARCHAEOLOGY AND HERITAGE

---

Aldenderfer, Mark S., and Carolyn A. Hale-Pierce (1984) The Small-Scale Archaeological Survey Revisited, *American Archeology* 4(1):4-5

Butler, William (1984) Cultural Resource Management: The No-Collection Strategy in Archaeology, *American Antiquity* 44(4):795-799

Deacon, J. (1996) *Archaeology for Planners, Developers and Local Authorities*, National Monuments Council Publication no. PO21E.

Deacon, J. (1997) Report: Workshop on Standards for the Desk study of Significance and Research Priorities for Contract Archaeology. In: Newsletter No. 49, Sept.1998. South African Association of Archaeology

Dincause D. F et al (1984) A Retrospective Desk study of Archaeological Survey Contracts in Massachusetts, 1970-1979, Massachusetts Historical Commission, Survey and Planning Grant 1980, 3 volumes.

Dunnell Robert C and William S. Dancey (1983) The Siteless Survey: A Regional Scale Data Collection Strategy. In: *Advances in Archaeological Method and Theory* 6:267-287. M.B. Schiffer, ed

Evers, T.M (1983) Oori or Moloko? The origins of the Sotho/Tswana on the evidence of the Iron Age of the Transvaal, *S. African Journal of Science*. 79(7): 261-264.

Hall, M (1987) *The changing past: Farmers, kings and traders in Southern Africa, 200-1860*. Cape Town: David Phillip.

Hall, S.L (1981) Iron Age sequence and settlement in the Rooiberg, Thabazimbi area. Unpublished MA thesis, University of the Witwatersrand

Huffman T.N (1989) "Zimbabwe ruins and Venda prehistory" *The Digging Stick* 6(3), 11

King Thomas F (1978) *The Archaeological Survey: Its Methods and Uses*, Interagency Archaeological Services, Department of the Interior, Washington, D.C.

Lightfoot Kent G (1989) A Defense of Shovel Test Sampling: A Reply to Shott. *American Antiquity* 54(2):413-416.

Maggs T.M O'C (1976a) *Iron Age communities of the southern Highveld*, Pietermaritzburg: Natal Museum.

McManamon, F.P (1984) *Discovering Sites Unseen*. In *Advances in Archaeological Method and Theory* 8:223-292, edited by M.B. Schiffer, Academic Press, New York.



## **11.4 ECOLOGY AND ECOLOGICAL SENSITIVITY**

---

Acocks, J. P. H. (1988). Veld types of South Africa. Memoirs of the Botanical Survey of South Africa No.57. Government Printer, Pretoria.

Bredenkamp, G., Granger, J.E. & van Rooyen, N. (1996.) Moist Sandy Highveld Grassland. In: Low, A.B. & Robelo, A.G. (eds) Vegetation of South Africa, Lesotho and Swaziland. Department of Environmental Affairs and Tourism, Pretoria

Brownlie, S. 2005. Guideline for involving biodiversity specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 C. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

Du Preez, L.H. and Cook, C.L. (2004) Conservation status and threats. Pp. 300-303 in L.R. Minter, M.Burger, Harrison. J.A., Braack, H.H. Bishop, P.J. & Kloepfer, D. eds. Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series#9. Smithsonian Institution, Washington, DC.

Mucina L. and Rutherford M.C. (eds). (2007) National Vegetation Maps of South Africa.

O'Connor TG & Bredenkamp GJ 1997. Grassland. In: Cowling RM, Richardson DM & Pierce SM (eds). Vegetation of South Africa. Cambridge University Press, Cambridge

Palgrave, K.C. (1984) Trees of Southern Africa, 2nd ed. Struik Publications, Cape Town

### **OTHER SOURCES**

Ekurhuleni SoER, 2003

National Biodiversity Implementation Plan

Grasslands Project Progress Report, August 2006

Gauteng Conservation Plan version 2

South Africa's National Biodiversity and Action Plan

National Grassland Biodiversity Programme

Tshwane Integrated Environmental Policy

Urban Development and Biodiversity in Gauteng: Workshop Proceedings

## **11.5 SOCIAL AND ECONOMIC**

---

The following websites were consulted:

<http://www.demarcation.org.za>

<http://www.emfuleni.gov.za>

<http://www.en.wikipedia.org>

<http://www.joburg.org.za>

<http://www.midvaal.gov.za>

<http://www.saps.gov.za>

<http://www.statssa.gov.za>

<http://www.walkervillesa.co.za>

<http://www.who.int>

The following documents were consulted:

City of Johannesburg Regional Spatial Development Framework for Region G (2007/2008)

Emfuleni IDP: 2007/2008

Naledzi Environmental Consultants: Final Scoping Report for the construction of a proposed new 2 x 400 kV power line from Glockner Substation to Etna Substation. March 2007

Naledzi Environmental Consultants: Background Information Document. November 2006

Midvaal IDP: Revision March 2006

Interviews with the following key I&APs were undertaken

- Mr. Ivan Parks – Thorntree Conservancy
- Mr. Harold Liederer – Walkerville Fruit Farms
- Ms. Bianca Siafia – Ward Committee Ward 7
- Mr. Rob Jones - Councillor

## **11.6 BIRDS**

---

Avian Power Line Interaction Committee (APLIC)-(1994) Mitigating Bird Collisions with Power Lines: The State of the Art in 1994. Edison Electric Institute. Washington D.C

BARNES, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V & BROWN, C.J. (eds). 1997. The atlas of southern African birds. Volume 1 & 2. BirdLife South Africa, Johannesburg.

McCANN, K.I., MORRISON, K., BEYERS, A., MILLER, P. & FRIEDMAN, Y. (eds). 2002. Population and Habitat Viability Assessment for the Blue Crane (*Anthropoides paradiseus*). Final Workshop Report. IUCN/SSC Conservation Breeding Specialist Group.

VAN ROOYEN, C.S. 2004. The Management of Wildlife Interactions with overhead lines. In *The fundamentals and practice of Overhead Line Maintenance (132kV and above)*, pp217-245. Eskom Technology, Services International, Johannesburg.

VAN ROOYEN, C.S. and LEDGER, J.A. 1999. "Birds and utility structures: Developments in southern Africa" in Ferrer, M. & G.F.M. Janns. (eds.) *Birds and Power lines*. Quercus: Madrid, Spain, pp 205-230

## **APPENDICES (1 & 2)**