EXECUTIVE SUMMARY

Introduction

Arcus GIBB (Pty) Ltd (Arcus GIBB) has been appointed by Eskom Holdings Limited Distribution Division (Eskom) as the Independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) for the construction of the proposed Westgate Tarlton Kromdraai 132 kV Powerline, Kromdraai Substation and associated infrastructure. This project is the result of Eskom expanding its Distribution Network countrywide to meet current and future electricity demands.

The environmental process followed for this Environmental Impact Assessment (EIA) is in compliance with Section 24 of the National Environmental Management Act, 1998 (NEMA) and the NEMA EIA Regulations of 2006.

This Environmental Impact Report documents the conclusions of the EIA process, including a recommendation on the preferred corridor alternative for the proposed powerline.

Project Background and Need for the Project

The project is located in Western Gauteng within the Mogale City and Randfontein Local Municipalities of the West Rand District Municipality (WRDM).

The existing 11 kilovolt (kV) lines in this area are currently experiencing high loads as a result of the rapid growth rate of development in the area and the associated increase in the demand for electricity. To meet this demand Eskom proposes to strengthen the network by constructing a 132 kV distribution powerline between the Westgate and Tarlton Substations and from the Tarlton Substation to the proposed new Kromdraai Substation, which shall also be constructed should authorisation be granted.

The total length of the power line will be approximately 50 km, depending on the final alignment of the corridor, with a width of 52 meters for double lines. The proposed Kromdraai Substation will require an area of 0.64 ha (80 m x 80 m).

The Environmental Impact Assessment Process

The proposed construction of the distribution powerline and substation is a listed activity in terms of the NEMA EIA regulations (Government Notice Numbers R. 385, 386 and 387 of 2006) and in terms of the NEMA. The activities associated with the proposed development include listed activities identified in the Government Notices R 386 and R 387 of 2006 pertaining to Basic Assessment and Scoping and EIA activities respectively. The activities associated with the proposed development are indicated below.

Number and date of the relevant Government Notice:	Description of each listed activity:
R. 386 of 2006 Activity:1 (m)	The construction of facilities or infrastructure, including associated structures or infrastructure, for any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including – (i) canals; (ii) channels; (iii) bridges; (iv) dams; and (v) weirs.
R. 386 of 2006 Activity: 4	The dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5 cubic metres from a river, tidal lagoon, tidal river, lake, in-stream dam, floodplain or wetland
R. 386 of 2006 Activity 15	The construction of a road that is wider than 4 meters or that has a reserve wider than 6 meters, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 meters long.
R.387 of 2006 Activity 1 (l)	The construction of facilities or infrastructure, including associated structures or infrastructure, for "the transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more.

The Department of Environmental Affairs and Tourism (DEAT) is responsible for all applications made by parastatals and thus, DEAT is the relevant authority for this project whilst the Gauteng Department of Agriculture, Conservation and Environment (GDACE) are the commenting authority. The Environmental Impact Assessment (EIA) has been conducted, to present the authorities with reliable and objective information for decision-making. The EIA process as prescribed by the new EIA regulations consists of a Scoping phase (preliminary investigations) and EIA phase (detailed investigations), together with a concurrent public participation process (PPP). The EIA process commenced in July 2007.

Overview of Scoping Phase

The Environmental Scoping Study identified the potential environmental (biophysical and social) impacts associated with the proposed project. A number of issues for consideration were identified by the environmental team and/or raised by IAPs during the consultation process. The Scoping Report was made available for public comment from 11 February 2008 until 11 March 2008. A Public Meeting held on 04 March 2008 indicated significant opposition by various landowners to the proposed project alternatives and the project itself, resulting in Eskom having to re-evaluate the alternatives. This led to revision of the Scoping Report and the Revised Draft Scoping Report (RDSR) was made available for public comment from 28 November 2008 to 02 February 2009. The Final Scoping Report was submitted to DEAT (Relevant Authority) on 23 February 2009 and was approved on 16 April 2009.

A number of technical specialists were appointed to undertake assessments in their relevant fields for the proposed development. The studies undertaken included ecology, heritage, geotechnical suitability, agricultural potential, visual impact and avifauna.

Public Participation Process (PPP)

Arcus GIBB conducted the public participation for this EIA. The process was aimed at involving as many interested and affected parties (IAPs) as possible. All comments

received during the PPP have been incorporated into the Environmental Impact Report and have been utilised in identifying project alternatives and mitigation measures.

The PPP included consultation with the South African Heritage Resources Agency (SAHRA), Department of Water Affairs and Forestry (DWAF), Department of Minerals and Energy (DME), District and Local Municipalities and the Gauteng Department of Agriculture, Conservation and Environment (GDACE).

IAPs were informed about the process via the distribution of background information documents, placement of site notices, and placement of advertisements in the local newspapers. An IAP database for the project has been created and maintained for the duration of the project. IAP comments have been incorporated in an Issues and Response Report (IIR) in the Scoping and Environmental Impact Reports.

Description of the Study Area

Biophysical Environment

A significant portion of the study area experiences a dry, sunny climate with temperatures during summer ranging between 20°C and 30°C[1]. Winter temperatures are low with Gauteng experiencing a daily mean temperature of 9.8°C in July. The annual average rainfall is 600 mm to 800 mm, which is mostly concentrated between October and March. The prevailing wind direction in the study area is north westerly in winter and south-easterly in summer.

The ground slope is gentle (< 5°) over much of the study area with the lowest point in the north, 1450 meters above see level (masl) and the highest point in the south with a maximum of 1720 masl[2]. The specific study area is underlain by sedimentary rocks of Randian and Vaalian age belonging to the Karoo, Transvaal and Witwatersrand Supergroups. Transported aeolian sand occurs throughout the study area with the exception of areas of shallow or outcropping bedrock. This soil type is considered to be potentially collapsible and subject to creep movements, however it is neither expansive nor dispersive.

There are two main wetland areas within the study area, one located in the south near the Westgate substation and the other in the north near the proposed Kromdraai substation and southwards from there. Just outside the western portion of the study area, is the primary drainage area of the Limpopo River in the North West Province. Wetlands, pans and dolomitic eyes fed by underground water resources are characteristic of this part of the study area. Major rivers within the portion of the study area falling within the Mogale City Local Municipality (MCLM) include the Crocodile, Magalies and Bloubank Rivers. An east-west watershed dominates the larger part of the MCLM, which drains via the Crocodile River and forms part of the Limpopo catchment. Water bodies within the MCLM cover an area of ± 280 ha.[3]

Groundwater is expected to be generally deep (>15m), except in the low-lying areas occupied by drainage paths

The proposed study area falls within two main vegetation types, namely Carletonville Dolomite Grassland and Soweto Highveld Grassland.

[1] Strategic Environmental Focus, 2003, Mogale City State of Environment Report
[2] Moore Spence Jones, 2008,Geotechnical Study for the proposed Westgate Tarlton Kromdraai Powerline EIA
[3] Strategic Environmental Focus, 2003, Mogale City State of Environment Report

No red data mammals have been confirmed for the proposed study area. However, Geoffroy's horseshoe bat (*Rhinolophus clivosus*), Peak-saddle Horseshoe bat (*Rhinolophus blasii*), Temminck's hairy bat (*Myotis tricolor*), White-tailed rat (*Mystromys albicaudatus*) and the South African Hedgehog (*Atelerix frontalis*) occurred here historically (museum records). Other vertebrate red list species with a distribution and habitat preference that co-incides with the proposed study area are the Striped Harlequin Snake and Giant Bullfrog.

The Cradle of Humankind World Heritage Site (COHWHS) is the most important cultural resource in the study area. The area contains a rich diversity of Stone Age relics and hominid fossils considered between 1.5 and 3 million years old contained in dolomite caves. It is the world's richest hominid site[4].

Socio- Economic Environment

According to Statistics South Africa, the 2007 Community Survey shows that the population in the West Rand District Municipality has grown from 533 675 in 2001 to 539 038 in 2007. In terms of health, though good health service infrastructure exists, there is still a high prevalence of Tuberculosis (TB) in the region. Coliform bacterial levels in water are over allowed limits and there is occurrence of Bilharzia in surface water[5].

Within the MCLM, approximately 40 % of the population have had no schooling at all, with the majority of the population having attained only secondary level education[6]. This is probably responsible for the high unemployment rate and poverty in the study area. Unemployment has been increasing since the 1990's. Job losses have been significant in the mining and agriculture sectors. In addition to this, changes in investment and exports have direct effects on growth and employment, the WRDM has experienced weak investment, thus limiting the ability to create jobs.[7]

The local economy of the broader region that falls within the MCLM contributes significantly to the ± 14 % that the MCLM contributes to the Gauteng Province GDP. The agricultural sector, which is driven by part-time farmers involved in the secondary and tertiary industries, provides the largest employment opportunities for the area with other industries such as insurance, real estate, wholesale, retail, catering and accommodation, transport, storage and communication.

According to the 2001 Census data, approximately 68 % of the population in the MCLM has access to electricity for cooking and heating. The remainder of the population makes use of primarily paraffin, then coal, wood and gas. The primarily rural nature of the broader region has resulted in relatively limited development of electricity distribution infrastructure.

Consideration of Alternatives

The following alternative corridors have been considered for the proposed 132kV distribution powerline:

[4] http://www.places.co.za/html/sterkfontein_caves.html
[5] Strategic Environmental Focus, 2003, Mogale City State of Environment Report
[6] http://www.demarcation.co.za/info
[7] West Rand District Municipality, 2007, Growth and Development Strategy

- **Corridor 1 - Red:** begins at the existing Westgate Substation, travels westwards to Randfontein Estates, then meanders north-west, ending at the existing Tarlton substation.
- **Corridor 2 - Purple:** is an alternative alignment for a portion of corridor 1.
- **Corridor 3 - Light blue:** is a crossover alternative between corridors 1 and 2.
- **Corridor 4 - Orange:** is between the existing Tarlton substation to the proposed Kromdraai substation that begins by first travelling northwards and then meandering east- to north-east to the site of the proposed Kromdraai substation.
- **Corridor 5 - Pink:** is an alternative alignment for a portion of corridor 4 further northwards.
- **Corridor 6 - Blue**: is a linkage between corridor 1 and 4.
- **Corridor 7 - Green** is primarily a combination of existing alignments with an added section through the Krugersdorp Nature Reserve.
- **Corridor 8 – Dark blue** uses some sections of other alignments, but includes a section south of Tarlton substation and another section south of the proposed Kromdraai substation to the north of the Krugersdorp Nature Reserve.

Alternative substation locations, the no-go alternative and technology alternatives were considered unfeasible.

Key Findings of the EIA Phase

The impact analysis highlighted all impacts as being of a low significance with the exception of the destruction or permanent loss of individuals of Red List species. This is an impact of low probability, since no such species were found within the proposed corridor of the powerline, although there is a likelihood for them to occur in the general area. This impact was rated as having a high significance, with the change in the visual quality at the proposed new Kromdraai substation having a medium significance.

The recommended corridors are as follows:

Westgate substation to the Tarlton substation is **Corridor 1 – Red.**
Tarlton Substation to the proposed new Kromdraai Substation is **Corridor 5 – Pink.**

These corridors were chosen for the following reasons:

- Alignment with existing powerlines; and
- Avoidance of sensitive areas of ecological, historical and social significance.

Both corridors have geo-technical constraints that can be mitigated through detailed investigations during the placement of pylons. In terms of the new proposed Kromdraai substation site the major impact is the visual appearance of the substation in an area considered to have a scenic value.

Thus, the construction of the proposed Westgate Tarlton Kromdraai 132kV distribution powerline, Kromdraai substation and associated infrastructure with suggested mitigation measures is recommended within corridors 1 and 5 and portion 35 of Sterkfontein 173 IQ for the proposed Kromdraai substation.

Conclusion

Identified impacts and associated mitigation measures for the construction and operation of the proposed development must be implemented via an Environmental

Management Plan (EMP) during the construction phase of the proposed development.

The findings of the EIA for the construction of the proposed Westgate Tarlton Kromdraai 132kV powerline and Kromdraai substation show that there are no environmental fatal flaws that should prevent the proposed project from proceeding.

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED WESTGATE TARLTON KROMDRAAI 132 kV POWERLINE, KROMDRAAI SUBSTATION AND ASSOCIATED INFRASTRUCTURE

DRAFT ENVIRONMENTAL IMPACT REPORT

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

BID	Background Information Document
CJMM	City of Johannesburg Metropolitan Municipality
COHWHS	Cradle of Humankind World Heritage Site
DEAT	Department of Environmental Affairs and Tourism
DMA	District Management Area
DSR	Draft Scoping Report
DWAF	Department of Water Affairs and Forestry
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act, 1989 (Act No. 73 of 1989)
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
FSR	Final Scoping Report
GDACE	Gauteng Department of Agriculture, Conservation and Environment
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GNR	Government Notice Regulation
Ha	Hectare
HV	High voltage
IAPs	Interested and Affected Parties
IDP	Integrated Development Plan
IRR	Issues and Response Report
IUCN	International Union for the Conservation of Nature and Natural Resources
Km	Kilometre
kV	Kilovolt
MCLM	Mogale City Local Municipality
MC SOER	Mogale City State of the Environment Report
Mm	Millimeters
MPNE	Magaliesberg Protected Natural Environment
MV	Mega volts
MW	Mega watts
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NW SOER	North West State of the Environment Report
PPP	Public Participation Process
RDSR	Revised Draft Scoping Report
RLM	Randfontein Local Municipality
SAHRA	South African Heritage Resources Agency
SOER	State of the Environment Report
TR	Terms of Reference
WRDM	West Rand District Municipality

GLOSSARY OF TERMS

Aesthetic	The science or philosophy concerned with the quality of sensory experience
Alignment	Refers to the actual physical placement of the proposed power line within the approved power line corridor
Applicant	Any person who applies for an authorisation to undertake a listed activity or to cause such activity to be undertaken in terms of the relevant environmental legislation
Biodiversity	Biodiversity is 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
Conservation	The management of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystem function and integrity
Clearance	Refers to the vertical and horizontal distance from any electrical power transmission conductor and other objects
Corridor	Refers to the area within which the power line will be constructed (aligned)
Cultural Resources	Refers to all non-physical and physical human-made occurrences, as well as natural occurrences that are associated with human activity. These include all sites, structures and artefacts of importance, either individually or in groups, in the history, architecture and archaeology of human (cultural) development.
Ecology	The study of the inter relationships between organisms and their environments
Ecosystem services	Activities that help to maintain an ecosystem but are not directly part of energy flows and nutrient cycles. Examples include pollination, dispersal, population regulation, provision of clean water and the maintenance of liveable climates (carbon sequestration)
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
Endemic	Occurring in a particular region, and nowhere else
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 EIA is 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 impacts and the significance of these

	impacts
Environmental Management Plan	A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts and limiting or preventing negative environmental impacts are implemented during the life-cycle of a project. This EMP focuses primarily on the construction phase and maintenance phase of the proposed project.
Footprint Area	The surface area to be used for the construction of the proposed pylons and the substation, which does not include the total study area
Habitat	Type of environment in which a plant or animal lives
Hillslope units	Configuration of the landform consisting of crest, scarp, midslope, footslope and valley bottom
Indigenous	Any species of plant, shrub or tree that occurs naturally in a region
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas
Landscape characterisation/ character	This covers the gathering of information during the desktop study and field survey work relating to the existing elements, features, and extent of the landscape (character). It includes the analysis and evaluation of the above and the supporting illustration and documentary evidence
Magnitude of Impact	Magnitude of impact means the combination of the intensity, duration and extent of an impact occurring.
Power line	Refers to an overhead line of varying voltage erected for the conduction of electricity
Rare species	Species, which have naturally small populations, and species, which have been reduced to small (often unstable) populations by man's activities
Red Data	A list of species, fauna and flora that require environmental protection based on the IUCN definitions
Sense of place	That distinctive quality that makes a particular place memorable to the visitor, which can be interpreted in terms of the visual character of the landscape. A more emotive sense of place is that of local identity and attachment for a place "*which begins as undifferentiated space* [and] *becomes place as we get to know it better and endow it with value*" (Tuan 1977)
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
Servitude	Refers to transmission rights granted to Eskom over the immovable property of another and registered or to be registered against the title deed of the land in question and usually involves the payment of compensation
Separation distance	Refers to the horizontal distance between the centre lines when measured perpendicularly between any two power lines running parallel to each other.
Significant Impact	An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties, on the context and intensity of its effects, provide reasonable grounds for mitigating measures to be included in the environmental management report.
Soil	A mixture of organic and inorganic substances, the composition and structure of the latter is derived from the parent rock material. Soil also contains bacteria, fungi, viruses and micro-arthropods, nematodes and worms
Heterogeneity	Variations in the landscape

Species diversity	A measure of the number and relative abundance of species (see biodiversity)
Species richness	The number of species in an area or habitat
Study area	Refers to the entire study area encompassing all the alternative alignments and substation locations as indicated on the study area map
Subsoil	Subsoil means those layers of soil and weathered rock immediately beneath the topsoil that overlay the hard rock formation
Substation	A distribution point within the local and national electricity network at which electrical current is increased/decreased and re-routed along different power lines as well as distributed to local and municipal networks
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs (Brundtland Commission, 1987)
Threatened species	Species, which have naturally small populations, and those, which have been reduced to small (often unstable) populations by man's activities
Topsoil	Topsoil means the layer of soil covering the earth and which provides a suitable environment for the germination of seed, allows the penetration of water, is a source of micro-organisms, plant nutrients and in some cases seed, and of a depth of 0.5 m or any other depth as may be determined by the Director: Mineral Development for each mining area
Tree and Building Restrictions	Refer to the horizontal distance measured perpendicularly from the centre line (on either side) within which no trees and buildings may encroach
Vertic	Soils high in expanding clay that form large cracks on drying; self-mixing
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 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 receptors	Includes viewer groups such as the local community, residents, workers, the broader public and visitors to the area, as well as public or community areas from which the development is visible. The existing visual amenity enjoyed by the viewers can be considered a visual receptor such that changes to the visual amenity would affect the viewers
Vulnerable	A taxon is 'Vulnerable' when it is not 'Critically Endangered' or 'Endangered' but is facing a high risk of extinction in the wild in the medium-term future

1 INTRODUCTION

1.1 Project Background

Eskom Holdings Limited Distribution Division (Eskom) is responsible for the distribution of electricity from substations at municipal level. In recognition of this mandate, Eskom is significantly expanding its Distribution Network countrywide to meet current and future electricity demands.

Eskom has identified that the Tarlton area, situated in the western portion of Gauteng (**Figure 1**), requires additional electricity capacity in order to meet both current and future needs within this area. The proposed study area falls within the Mogale City and Randfontein Local Municipalities, which in turn fall within West Rand District Municipality. The existing 11 kilovolt (kV) lines in this area are currently experiencing high loads as a result of the rapid growth rate of development in the area and the associated increase in the demand for electricity. To meet this demand Eskom proposes to strengthen the network by constructing a 132 kV distribution power line between the Westgate and Tarlton Substations and from the Tarlton Substation to the proposed new Kromdraai Substation, which will be constructed if authorisation is granted.

Figure 1: Map depicting the project location (blue box) in relation to the Gauteng Province (www.routes.co.za/gp/magaliesburg/index.html)

Arcus GIBB (Pty) Ltd (Arcus GIBB) has been appointed by Eskom as the Independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) for the construction of the proposed Westgate Tarlton Kromdraai 132 kV Powerline, Kromdraai Substation and associated infrastructure. Refer to **Appendix A** for the declaration of independence.

Under Section 24 (2) (a) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) the Minister of Environmental Affairs and Tourism may identify activities that may not commence without environmental authorisation from the competent authority. These activities were promulgated in two separate Government Notices in the Government Gazette on 21 April 2006, together with a third Government Notice on regulations for the administration of EIAs. These regulations came into effect on 1 July 2006 and replaced the previous EIA regulations promulgated in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989). The activities associated with the proposed development include some of the listed activities identified in the Government Notice pertaining to *Scoping and EIA* activities. The main activity is as follows:

The construction of facilities or infrastructure, including associated structures or infrastructure, for the transmission and distribution of above ground electricity with a capacity of 120kV or more"

The Department of Environmental Affairs and Tourism (DEAT) is responsible for all applications made by parastatals and thus, DEAT is the relevant authority for this project whilst the Gauteng Department of Agriculture, Conservation and Environment (GDACE) are the commenting authority. The Environmental Impact Assessment (EIA) has been conducted, to present the authorities with reliable and objective information for decision-making. The EIA process as prescribed by the new EIA regulations consists of a Scoping phase (preliminary investigations) and EIA phase (detailed investigations), together with a concurrent public participation process (PPP). The stakeholder engagement and PPP is an interactive procedure, and continues throughout the EIA process.

The EIA process commenced in July 2007. The Scoping phase, which was concluded in February 2009, focussed on a general environmental assessment of the study area, and included the identification of relevant, sensitive biophysical and socio-economic aspects and areas. The main purpose was to identify related environmental issues that will require further detailed investigation during the EIA phase. In order to allow input by stakeholders into the process, as required by legislation, significant consultation took place during the Scoping phase.

A number of detailed specialist assessments have been conducted based on the outcome of the Scoping phase. The main objectives of these studies were to determine the significance of the potential impacts that the proposed development may have on the biophysical and socio-economic environment.

The outcome of the EIA phase studies has been documented in this Draft Environmental Impact Report (DEIR), which has been submitted to the relevant authorities for review and IAPs for comment. All comments received will be documented and responded to, and will be included in an Issues and Response Report. The information contained in the EIR, together with the Environmental Scoping Report (ESR), will inform DEAT in their Record of Decision (ROD) for the proposed powerline and substation.

1.2 Purpose and Structure of the EIR

DEAT approved the Final Environmental Scoping Report and the Plan of Study for EIA on 15 April 2009. Refer to **Appendix B** for comments received from DEAT.

The specific objectives of the Scoping Phase were as follows:

- Inform a broad range of IAPs about the proposed project and the EIA process to be followed;
- Provide ample opportunity to all parties to exchange information and express their views, concerns and suggestions;
- Obtain contributions of IAPs and ensure that key issues, concerns, queries and suggestions raised are fully documented and carried forward in the EIA process;
- Identify the significant environmental issues that are to be addressed in the EIR; and
- Focus the remaining phases of the EIA on the viable project alternatives and relevant issues.

An overview of the Scoping Phase is provided in **Chapter 3**:

The main purpose of the EIR is to determine a final route which will be feasible for the development of the power line as well as to provide recommendations and mitigation measures that would ensure the least impact on the environment in the event that the proposed powerline and substation is constructed. The report provides a systematic and consolidated record of the results, conclusions and recommendations of the specialist studies **(Chapter 8)**.

The key tasks to be undertaken during the EIA phase include:

- Reviewing the comments received from DEAT regarding the Final Scoping Report and Plan of Study for EIA;
- Appointment of relevant specialists to undertake specialist investigations into cultural and heritage resources, ecology, visual impact, geology, avi-fauna and agricultural potential.
- Review and integration of the specialist reports by the Environmental Assessment Practitioner (EAP);
- Integration of the findings of the assessment of impacts and alternatives and potential mitigation measures for the project;
- Notification to all registered IAPs and relevant stakeholders of the availability of the Draft EIR for review and comment;
- Incorporation of IAPs comments into the Final EIR and submission to DEAT for decision-making; and
- Notification to all registered IAPs of DEAT's decision when it is issued.

The EIA phase serves to investigate and address the significant issues highlighted in the Scoping phase. Thus the objectives of the EIA phase are to:

- Continue to consult with and inform all relevant stakeholders and Interested and Affected Parties (IAPs);
- Compare the various project alternatives;
- Investigate salient environmental issues and their related impacts through specialist studies;
- Assess the identified impacts and recommend appropriate mitigation measures for the construction phase;
- Provide an opinion as to whether the proposed activity should be authorised or not; and
- Make an environmental impact statement with respect to a summary of the key findings and a comparative assessment of the positive and negative implications of the proposed activity and its alternatives.

Figure 2 provides a schematic representation of the EIA process.

Based on the outcome of the Scoping phase, the following specialist investigations were conducted as part of the EIA phase:

- Visual/ Aesthetics;
- Cultural and Heritage Resources;
- Ecology (Fauna & Flora);
- Avi-fauna;
- Geotechnical suitability; and
- Agricultural Potential.

The specialist studies informed the final conclusion and recommendations of the EIA Report, specifically through proposing mitigation and/or management measures to reduce the significance of impacts, which cannot be avoided.

This EIR has accordingly been structured to provide the following:

- A review of the EIA process to date;
- An overview of the baseline environment in the study area;
- A summary of the specialist assessments;
- A detailed assessment of potential environmental impacts and the significance thereof;
- A discussion of project alternatives;
- Recommendations pertaining to the proposed project based on the above; and
- A statement to conclude the EIA phase.

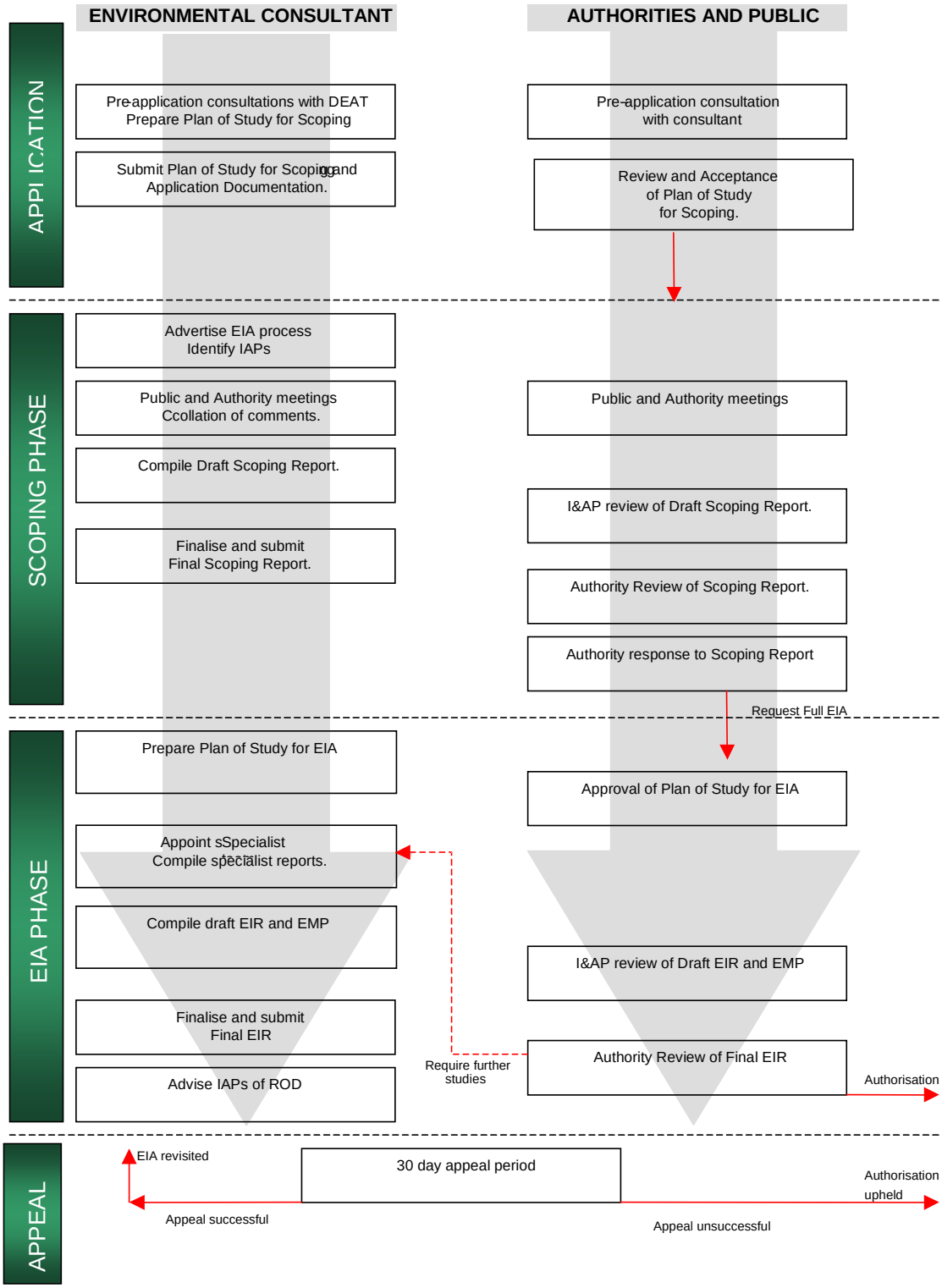


Figure 2: EIA Process as prescribed by the NEMA EIA Regulations

1.3 The Legal Framework

The following Acts are relevant to the proposed construction of the proposed 132kV distribution powerline and substation:

- The Constitution of the Republic of South Africa (Act No. 108 of 1996);
- The National Environmental Management Act (Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act 2004 (Act No. 10, 2004);
- National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)
- The Conservation of Agricultural Resources Act (Act No. 43 of 1983);
- National Forests Act, 1998 (Act No. 84 of 1998);
- The National Heritage Resources Act (Act No. 25 of 1999);
- The Municipal Systems Act, 2000 (Act No. 32 of 2000);
- The National Water Act (Act No. 36 of 1998); and
- Expropriation Act (Act No. 63 of 1975);

Other relevant legislation, guidelines, plans and policies considered in the preparation of this report include:

- Environmental Impact Assessment Regulations (July 2006);
- White Paper on the Energy Policy of the Republic of South Africa (December 1998);
- Protected species – Provincial Ordinances;
- Integrated Environmental Management;
- West Rand District Municipality Integrated Development Plan (IDP 2008/09);
- Mogale City Local Municipality Integrated Development Plan (IDP 2008/09);
- Mogale City Local Municipality State of the Environment Report (MCLM SoER, 2003);
- West Rand District Municipality Growth and Development Strategy (WRDM GDS, 2007)
- Gauteng Conservation Plan (Version 2);
- GDACE's Ridge Guidelines;
- GDACE's Red Data Plant Policy for Environmental Impact Evaluations;
- GDACE Requirements for Biodiversity Assessments
- DEAT Guidelines
    - DEAT Guideline 3: General guide to EIA Regulations;

- DEAT Guideline 5: Assessment of Alternatives and Impacts;
- DEAT Public Participation Guidelines as published in Government Gazette No. 28854, 19 May 2006;
- DEAT's detailed Guide to Implementation of the Environmental Impact Assessment Regulations: 2006;

- Eskom Distribution Guideline: Building Line Restrictions, Servitude Widths, Line Separations and Clearances from Powerlines (April, 2004); and
- Eskom Distribution Guideline: Public Participation Meetings (March 2005).

All relevant acts, guidelines, policies and plans listed above are described in more detail below.

1.3.1 The Constitution of the Republic of South Africa (Act No. 108 of 1996)

The Constitution of the Republic of South Africa is the supreme law of South Africa and is the statute against which all other law (both statutory instruments and the common law) must be measured. To the extent that other laws conflict with the Constitution, they are as a general rule invalid, subject to the provisions of the limitations clause. The Bill of Rights forms the cornerstone upon which the constitutional dispensation in South Africa is built. It applies to all law, and binds the legislature, the executive, the judiciary and all organs of state. A provision of the Bill of Rights binds a natural or a juristic person if, and to the extent that, it is applicable, taking into account the nature of the right and the nature of any duty imposed by the right. Of particular importance in relation to Eskom's initiatives with regard to its planned construction of a distribution powerline and substation, are those sections contained in the Bill of Rights which deal with the environmental rights, as follows:

Everyone has the right –

(a) to an environment which is not harmful to their health or well-being;
(b) to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures that:
  (i) prevent pollution and ecological degradation;
  (ii) promote conservation; and
  (iii) *secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*

1.3.2 National Environmental Management Act, 1998 (Act No.107 of 1998) and NEMA EIA regulations of 2006

The overarching environmental legislation for the management of the environment in South Africa is the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA). Its preamble states that sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of environmental decisions to ensure that development serves present and future generations. NEMA was amended in 2004 (Act No. 8 of 2004) and a proposed second amendment bill was published for comment on the 4th of May 2007.

Chapter 5 of NEMA makes provisions for regulations to be formulated and published. In April 2006, new EIA Regulations were promulgated and became effective from the 1st of July 2006. The purpose of these Regulations is "*to regulate procedures and criteria as stated in Chapter 5 of the National Environmental Management Act for the*

submission, processing, consideration and decision of applications for environmental authorisation of activities and for matters pertaining thereto."

The principles of the Act, which are of particular relevance to this project, include the following:

- Environmental management must place people and their needs at the forefront of its concern;
- Development must be socially, environmentally and economically sustainable;
- Environmental management must by integrated, acknowledging that all elements of the environment are linked and interrelated;
- Environmental justice must by pursued;
- Equitable access to environmental resources to meet basic human needs and ensure human well-being must be pursued;
- Responsibility for the environmental health and safety consequences of a project or activity exists throughout its life cycle;
- The participation of all IAPs in environmental governance must be promoted;
- Decisions must take into account the interests, needs and values of all IAPs;
- The social, economic and environmental impacts of activities, must be considered assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment;
- Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law;
- The environment is held in a public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage;
- The cost of remedying pollution, environmental degradation and consequent adverse health effects must be paid for by those responsible for harming the environment; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems required specific attention in management and planning procedures, particularly when subjected to significant human resource usage and development pressure.

Section 24 (F) of the National Environmental Management Amendment Act, 2004 (Act No. 8 of 2004 "NEMA Amendment Act") prohibits a listed activity from commencing prior to the authorisation thereof by the competent authority. A listed activity is defined in Government Notice R. 385 (NEMA Regulations 2006) as follows:

> "(a) *an activity identified in Government Notice No. R.386 and No. R. 387 of 2006 as a listed activity or (b) in any other notice published by the Minister or MEC in terms of section 24D of the Act as a listed activity or specified activity."*

These activities are listed as a result of their potential to have a significant detrimental impact on the environment. Developments listed in terms of GNR 386 require a Basic Assessment while developments listed in terms of GNR 387 require a Scoping and EIA process in order to assess the potential impacts of the proposed project on the receiving environment.

According to GN R 385 of 2006, any activities listed in GN R 386 and 387 of 2006 must apply for authorisation for the relevant activities in accordance with the requirements of GN R 387 of 2006, i.e. an EIA. The listed activities in terms of GN R 386 and GN R 387 of 2006 that are relevant to this project are outlined below.

Listed activities in terms of GN R 386 of 2006

Activities relevant to this project as identified in Government Notice R. 386 are as follows:

1(1)m - " The construction of facilities or infrastructure, including associated structures or infrastructure, for any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including –

- *canals;*
- *channels;*
- *bridges;*
- *dams; and*
- *weirs.*

4 - "The dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5 cubic metres from a river, tidal lagoon, tidal river, lake, in-stream dam, floodplain or wetland."

15 - ""The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long."

Listed activities in terms of GN R 387 of 2006

The main listed activity for this project is identified as activity number 1 in Government Notice R. 387 as follows:

1 (l) "The construction of facilities or infrastructure, including associated structures or infrastructure, for "the transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more".

1.3.3 DEAT Guidelines for implementation of the NEMA EIA Regulations of 2006

DEAT's Guideline 3: General guide to EIA regulations, 2005

The purpose of this guideline is to provide the competent authority with adequate information to make decisions to ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorised, and that activities which are authorised are undertaken in such a manner that the environmental impacts are managed to acceptable levels.

The guidelines are also intended to ensure that:

- The minimum information that is necessary for decision-making is provided;
- Adequate information is provided to IAPs to enable them to participate effectively;
- Issues, ideas and concerns raised by IAPs are properly considered; and
- Issues, impacts and alternatives are considered and assessed in a structured and objective manner.

DEAT's Guideline 5: Assessment of Alternatives and Impacts, 2006

This document provides a basic guideline to the assessment of alternatives and impacts which are key components of an EIA process. The purpose of the document is to create a common understanding amongst the different role-players of what is required in the assessment of alternatives and impacts.

DEAT Public Participation Guidelines as published in Government Gazette No. 28854, 19 May 2006

This guideline serves as general user's guideline which provides guidance on the benefits of public participation, the minimum legal requirements for public participation processes, the generic steps of a public participation process, guidelines for planning a public participation process and a description of the roles and responsibilities of the various role-players.

1.3.4 National Environmental Management: Biodiversity Act 2004 (Act No. 10, 2004)

The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the 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.

National Spatial Biodiversity Assessment

The National Spatial Biodiversity Assessment (NSBA): 2004 (2005) classifies areas as worthy of protection based on its biophysical characteristics, which are ranked according to priority levels. The approach used for biodiversity planning is systematic and entails the following three key principles:

- The need to conserve a representative sample of biodiversity pattern, such as species and habitats (the principle of representation);
- The need to conserve the ecological and evolutionary processes that allow biodiversity to persist over time (the principle of persistence); and
- The need to set quantitative biodiversity targets that quantifies the degree of conservation required for each biodiversity feature in order to maintain functioning landscapes and seascapes.

An important feature of the above-mentioned principles is the concentration on the conservation of the ecosystems as opposed to that of individual species. If the ecosystem is conserved, the individual species will also be conserved.

1.3.5 National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)

The objectives of this Act within the framework of the NEMA include the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes in order to:

- Protect areas with significant natural features or biodiversity;
- Protect areas in need of long-term protection for the provision of environmental goods and services; and

- Provide for sustainable flow of natural products and services to meet the needs of a local community; involvement of private landowners.

The Act provides for the involvement of parties other than organs of State in the declaration and management of protected areas.

1.3.6 The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)

The purpose of the Act is to provide for control over the utilization of the natural agricultural resources in order to promote the conservation of soil, efficient use of water resources and protection of ecosystems whilst combating the infestation of weeds and invader plants.

Furthermore the clearing of listed invasive alien vegetation is the legal duty of all landowners, in terms of the CARA (as amended). In this respect, management of alien vegetation should theoretically take place even without the development of the proposed power line. Nevertheless, it will be Eskom's duty to maintain the servitude and prevent the infestation of alien and invasive plant species within the power line servitude and on the site for the proposed Kromdraai Substation.

1.3.7 National Forests Act, 1998 (Act No. 84 of 1998)

Specific trees are protected in terms of Section 21 of the National Forest Act, 1998 (Act No. 84 of 1998). According to Section 15 of the above-mentioned Act, protected trees cannot be cut, destroyed, damaged or removed without a permit granted by the Minister of the Department of Water Affairs and Forestry (DWAF). The Ecological Assessment that was undertaken highlights the presence or absence of protected trees in relation to the proposed corridor alignments.

1.3.8 The National Heritage Resources Act, 1999 (Act No. 25 of 1999)

The National Heritage Resources Act (NHRA) legislates the necessity for a cultural and Heritage Impact Assessment (HIA) in areas earmarked for development, which exceed 0.5 ha or linear developments exceeding 300 metres in length. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA). The Act makes provision for a HIA to be undertaken as part of the EIA process.

The item in question for this application is as follows:

38(1) (a) *the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length*.

1.3.9 The Municipal Systems Act, 2000 (Act No. 32 of 2000)

The MSA specifies that municipalities must draw up an IDP as a single, inclusive and strategic development plan that must be aligned with other municipalities and other spheres of government.

Section 26 of the MSA specifies that certain requirements must be adhered to in the drafting of an IDP, including that an IDP must reflect-

- The vision for the long term development of the municipality with special emphasis on the municipality's most critical development and internal transformation needs;
- The council's development strategies which must be aligned with any national or provincial sectoral plans and planning requirements binding on the municipality in terms of legislation; and
- Applicable disaster management plans.

The Municipal Planning and Performance Management Regulations (promulgated in terms of the MSA) set out further requirements for an IDP which include making provisions for:

- Development initiatives including infrastructure, physical, social and institutional development; and
- *all known projects, plans and programmes* to be implemented within the municipality by any organ of state.

1.3.10 The National Water Act, 1998 (Act No. 36 of 1998)

The National 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 categorisation 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.

In terms of the proposed development, Section 21 of the National Water Act defines the listed activities for the use of water as follows:

21 (c) *impeding or directing the flow of water in a water course*
21 (i) *altering the bed, banks, course or characteristics of a watercourse*

The towers for the proposed powerline may be placed on the banks of drainage lines. In addition to this water may be sourced from rivers during construction, this is a section 21 (a) water use. Thus a Water Use Authorisation (WUA) is required from the Department of Water Affairs and Forestry (DWAF) for both activities in terms of Section 21 (c) and (i) of the National Water Act, 1998.

1.3.11 Expropriation Act, 1975 (Act No. 63 of 1975)

This Act serves to provide for the expropriation of land and other property for public and certain other purposes and to provide for matters connected therewith. Eskom can use this Act as a last resort to acquire land for a powerline servitude once all other avenues fail.

1.3.12 White Paper on the Energy Policy of the Republic of South Africa (December 1998)

The White Paper on the Energy Policy of the Republic of South Africa (The Energy Policy) was published by the Department of Minerals and Energy (DME) in December 1998.

The Energy Policy governs development within the energy sector in South Africa, and has five policy objectives which are as follows:

- Increased access to affordable energy services;
- Improved energy governance;
- Stimulating economic development;
- Managing energy related environmental and health impacts; and
- Securing supply through diversity.

1.3.13 Protected species – Provincial Ordinances

Provincial ordinances have been 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 Environmental Departments. The Gauteng Department of Agriculture, Conservation and Environment (GDACE) are the responsible authority for the area in which this project is proposed. GDACE's Red Data Plant Policy for Environmental Impact Evaluations and GDACE's Requirements for Biodiversity Assessments are examples of such ordinances. The Ecological Assessment that has been undertaken assesses the likely presence of such species in the areas potentially affected by the development of the power line, substation and associated infrastructure.

1.3.14 Integrated Environmental Management

Integrated Environmental Management forms part of the *White Paper on Environmental Management Policy in South Africa* and has been written into NEMA and is thus formally and legally recognised. It is a philosophy that is concerned with finding the right balance between development and the impacts thereof on the environment. It provides a framework of established guidelines to ensure that environmental considerations are taken into account at every stage of the life of a project.

1.3.15 West Rand District Municipality Integrated Development Plan (IDP 2008/09)

The WRDM IDP (2004), through its Spatial Development Framework (SDF), identified broad development zones in the district. The district includes a total of five administrative areas, three of which fall outside the study area. The MCLM and the District Management Area (DMA) fall within the study area.

The development zones affecting the broader region include the following (WRDM IDP 2004):

- **Urban Growth Zone:** These are areas where major urban development is expected to occur, including residential densification and infill as well as manufacturing and industrial growth. The communities in the broader region that are earmarked for urban development include Rietvallei and Muldersdrift.
- **Peripheral Interfaces:** Defined as areas between rural areas and urban areas, land use is to be restricted to agriculture, tourism and sports facilities.
- **Prime Opportunity Zone:** These areas have a diverse resource base in which recreation, tourism, conservation and agriculture are expected to benefit.

The WRDM IDP (2008/2009) has identified service delivery and infrastructure development as the first priority issue where access to electricity for example should be provided by 2012.

1.3.16 Mogale City Local Municipality Integrated Development Plan (IDP 2008/09)

The MCLM IDP (2004) identified Muldersdrift, Rietvallei, Magaliesburg, Tarlton and Hekpoort as priority areas from a socio-economic perspective as a result of the following challenges identified within these communities:

- Poverty and unemployment;
- Low levels of literacy;
- Landlessness and homelessness;
- Infrastructure development problems associated with both rural and peri-urban areas; and
- HIV/AIDS pandemic.

The municipality's Local Economic Development (LED) strategy has targeted tourism, small, medium and micro enterprises (SMMEs) and higher income residential housing as the three key areas of opportunity for accelerated economic growth.

According to the MCLM IDP (2008/2009) environmental sustainability is one of Mogale City's strategic objectives and is thus a key performance area. However there are many challenges that still face the city, these include:

- Sustainable Development in relation to electricity bulk services capacity and integrity;
- Sterilization of high agricultural land due to inappropriate land-uses; and
- Interpretation, implementation and enforcement of new and altered legislation

1.3.17 Mogale City Local Municipality State of the Environment Report (MCLM SoER, 2003)

The Mogale City State of the Environment (MC SOER) serves as an attempt to create an awareness of the environmental challenges facing MCLM and how the causes for environment change can be addressed in an ecologically sensitive, economically viable and socially beneficial way.

The main objectives of the SOER were to:

- Increase awareness and understanding of environmental trends and conditions and their causes and consequences among all stakeholders;
- Provide a foundation for improved decision making at all levels, from the individual to national governments, as well as international organisations; and
- Facilitate the measurement of progress towards sustainability.

1.3.18 West Rand District Municipality Draft Growth and Development Strategy (WRDM GDS, 2007)

This strategy document analyses the socio-economic environment, identifies potential growth sectors and aligns existing growth and development strategies to increase socio-economic and development potential for the region. The growth and development strategy is characterised by:

a) A higher regional growth;
b) Increased labour absorption capacity;
c) Higher standards of living; and
d) Generation of greater value added.

It is envisaged that a number of projects and structural alignments shall trigger economic activity so that the West Rand could experience greater economic growth, improved levels of unemployment and poverty reduction.

1.3.19 Gauteng Conservation Plan (Version 2)

The GDACE Conservation Plan Version 2 (C-Plan) provides an indication of ecologically important and irreplaceable sites located within the Gauteng province. C-Plan consists of biodiversity data, which has been collected and analysed to produce a map delineating irreplaceable sites, protected areas and important sites. The plan seeks to provide recommendations and policy strategies for the conservation and management of selected areas with the aim of protecting species of fauna and flora threatened with extinction. GDACE C-Plan information for the broader region is under consideration for this EIA.

1.3.20 GDACE's Ridge Guidelines

The proposed power line corridor alignments traverse through a Class 1 Ridge as defined by the GDACE's Ridges Guideline (GDACE, 2001) on the Development Guidelines for Ridges in Gauteng. This Guideline outlines the importance of Ridges in Gauteng. According to the GDACE Development Policy for Ridges, a ridge is any topographic feature in the landscape that is characterized by slopes of five degrees or more (i.e. > 8.8 %, > 1 in 11 gradient), as determined by means of a Geographical Information System (GIS) digital elevation model. Refer to **Appendix C 2** for a visual representation of the ridges, located within the study area, according to GDACE's Ridges Policy.

The Ridges Guideline states that "the quartzite ridges of Gauteng, together with the Drakensberg Escarpment, should be regarded as one of the most important natural assets in the entire region of the northern provinces of South Africa. They are characterized by a unique plant species composition that is found nowhere else in South Africa or in the world" (GDACE, 2001). The Ridges Guideline segregates ridges into four categories ranging from Classes 1 to 4, based on the varying degrees of anthropogenic transformation. Class 1 ridges are defined as the least transformed, with only 0-5 % transformation, while Classes 2, 3 and 4 are defined as increasingly transformed with 5-35 %, 35-65 %, 65-100 % transformation, respectively.

According to the Ridge's Guideline, the ridges occurring within the broader region are defined as Class 1 ridges, which are regarded as no-development zones.

1.3.21 Eskom Distribution Guideline: Building Line Restrictions, Servitude Widths, Line Separations and Clearances from Powerlines (April, 2004)

This guideline document is used to determine separation distances between parallel powerlines, tree and building restriction distances of various voltage power lines, as well as the height clearance of power lines over natural and man made features.

1.3.22 Eskom Distribution Guideline: Public Participation Meetings (March 2005)

This guideline is intended for the preparation of all Eskom Distribution Public Participation/Stakeholder Engagement Meetings. The guideline aims to enhance public involvement in environmental decision making on Eskom (Distribution) related projects, and to conduct successful and well co-coordinated meetings. The guideline

outlines the objectives and constraints of public participation. It also details how to prepare for the meetings in light of the objectives and constraints.

1.4 Project Team Details

1.4.1 Proponent Details

Name of Proponent:	Eskom Holdings Limited (ESKOM) – Distribution Division
Contact person:	Mr. Curtis Meintjies
Designation:	Environmental Manager
Physical Address:	204 Smit Street Braamfontein 2000
Postal Address:	P.O. Box 1091 Johannesburg 2000
Tel:	(011) 711 9111
Fax:	(011) 711 2189
E-mail:	curtis.meintjies@eskom.co.za

1.4.2 Details of Environmental Assessment Practitioner

Name of Consultant:	Arcus GIBB (Pty) Ltd – Environmental Services
Contact person:	Ms. Jaana-Maria Ball / Mr Reuben Heydenrych
Physical Address:	1410 Eglin Road Sunninghill
Postal Address	P.O. Box 2700, Rivonia, 2128
Tel:	+27 (0) 11 519 4600
Fax:	+27 (0) 11 807 5670
E-mail:	jball@gibb.co.za / rheydenrych@gibb.co.za

Ms. Jaana-Maria Ball – Director and Environmental Services Discipline Leader

Ms Ball holds a M.Sc. in Botany and a MBA. She is registered as a Professional Member of the South African Council for Natural Scientists from 1998 to date (PriSciNat No: 400049/89). She is an Environmental Scientist with 13 years experience in the environmental field. She is currently a Director of Arcus GIBB and the manager of Arcus GIBB's National Environmental Services Division. Ms Ball specialises in the management of large-scale SEAs, EIAs and EMPs, co-ordination and execution of public involvement processes (PIP), botanical and rehabilitation studies, integrated development planning (IDP) and management of multi-disciplinary large project teams. As a specialist botanist, Ms. Ball has undertaken numerous botanical and rehabilitation studies, particularly for mining activities the Cape West Coast.

Refer to **Appendix M** for the project team's Curriculum Vitae.

1.4.3 Details of Environmental Authorities

Department Name:	Department of Environmental Affairs and Tourism
Contact person:	Mr Takalani Maswime
Physical Address:	Fedsure Building 315 Pretorius Street

	Pretoria 0002
Postal Address:	Private Bag X447 Pretoria 0001
Tel:	(012) 310 3624
Fax:	(012) 320 7539
E-mail:	Tmaswime@deat.gov.za

1.4.4 Details of Specialists

Specialist Field:	Agricultural Potential
Company:	Agricultural Research Council – Institute for Soil, Climate and Water
Contact Person:	Mr. David Garry Paterson

Specialist Field:	Avi-fauna
Company:	Endangered Wildlife Trust
Contact Person:	Mr. Jon Smallie

Specialist Field:	Geology and Soils
Company:	Moore Spence Jones (Pty) Ltd
Contact Person:	Mr. Nino Welland

Specialist Field:	Heritage
Contact Person:	Mr. Johnny Van Schalkwyk

Specialist Field:	Visual
Company:	I-Scape
Contact Person:	Mr. Mader van den Berg

Specialist Field:	Ecology
Company:	David Hoare Consulting cc
Contact Person:	Mr. David Hoare

Refer to **Appendix L** for all specialists Curriculum Vitae.

2 PROJECT DESCRIPTION

2.1 Background Information

The generation, transmission and distribution of electricity in South Africa is described briefly below and illustrated in **Figure 3**.

2.1.1 Generation

In South Africa, coal is the most widely used primary fuel, accounting for approximately 77 % of the country's electricity production. On average, South Africa produces 224 million tonnes of marketable coal annually, of which 25 % is exported internationally, 53 % is used for electricity generation and the remainder is used in various local industries. The South African Chamber of Mines estimates that South Africa's coal reserves are at 53 billion tonnes, which has an expected supply of almost 200 years (http://www.bullion.org.za).

Electricity is produced from coal through the combustion and burning of pulverised, fine coal powder in boilers. The heat in the boiler causes the coal particles to generate heat that turns water into steam. The steam from the boilers is used to turn the blades of a giant fan or propeller, called a turbine. The turbine turns a coil made of copper wire (the rotor) inside a magnet (the stator), which together make up the generator. Most of Eskom's power stations generate electricity at about 22 000 volts (or 22 kV). Transformers are installed at the power stations to increase the voltage for transmission.

2.1.2 Transmission

Electricity is transported along power lines from the power stations to substations located in areas where the power is required. The distances between the power stations and areas where the power is required, necessitates the transmission of electricity at high voltages to compensate for the losses that occur during transmission over long distances. The transmission of high voltages also limits the number of power lines. Transmission power lines usually consist of overhead conductors suspended from transmission towers.

As indicated in **Figure 3**, the overhead power lines transmit electricity at voltages ranging from 22 kV up to 765 kV. Eskom is the first utility in the world to successfully operate transmission lines at 765 kV at high altitudes above sea level. Conductors are made of aluminium and steel in various combinations and in various shapes and sizes. Aluminium is used because it is a good conductor of electricity; steel is used to add strength. The electricity transmitted to substations must be reduced to a voltage that is suitable for the consumer. Transformers step-down the voltage and feed the electricity into the grid via distribution lines, which distribute the power to the end users.

2.1.3 Distribution

When the electricity arrives at the distribution station (3), bulk supplies of electricity at 22 kV are taken for primary distribution to towns and industrial areas, groups of villages, farms and similar concentrations of consumers.

The lines are fed into intermediate substations (4a and 4b) where transformers reduce the voltage to 11 kV. Secondary distribution lines radiating from these substations carry the power into the areas to be supplied and terminate at distribution substations (5). Here the voltage is reduced to its final level of 380/220V for use in shops, office buildings, schools and homes.

Some consumers use electricity in such quantities that they are supplied at a higher voltage than is used in the home. Heavy industries may have their own link (6) from the distribution station at 132 kV. Light industries (7) and hospitals are often supplied directly from substations at 11 kV. The railways have special substations (8) alongside the tracks, which draw electricity from distribution stations. The latest rail electrification schemes operate at 25 kV and 50 kV.

The distribution of electricity must be arranged as far as practicable, to prevent the interruption of electricity supply in the event that there is a fault in one section of the system. Lines carrying 132 kV run from the distribution station (3) to the substation (4a) and to the substation serving heavy industry (6). A further 132 kV line connects point (3) to point (6). If the direct connection to either substation breaks down, supplies can still be maintained by means of the connecting link. The reduced voltage such as 11 kV in large factories and 380 / 220 volts in shops and homes is distributed via distribution lines to the end users. The 132 kV power line proposed in terms of this EIA is regarded as a distribution power line.

2.1.4 Substations

Substations are self-contained units, which are controlled from the main control centres and are located mostly in remote areas. They are specially designed to work 24 hours a day without attention and to operate outdoors in all weather conditions. The switchgear is able to interrupt and reconnect very high voltages and very high amounts of power.

For the substation to perform it needs sophisticated protection equipment to detect faults and abnormal conditions and to receive messages from the control centres and also transmit back to the control centres if action is taken. Action consists of automatically switching the power off and on again to cater for abnormal conditions such as lightning strikes or trees falling on lines. This action is necessary to protect people when there is an accident or to keep the electricity supply constant.

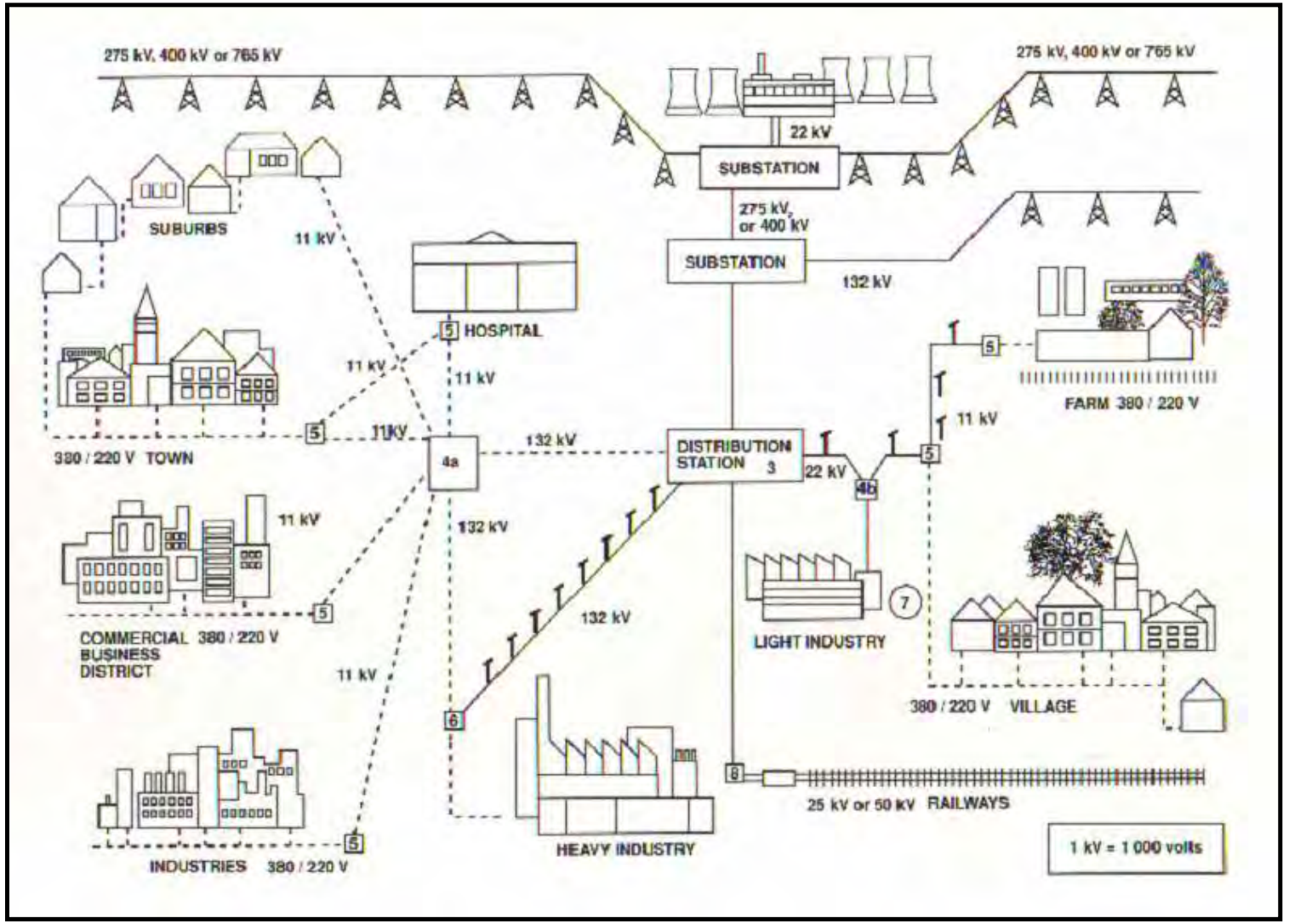


Figure 3 Diagram illustrating a typical distribution and transmission system (Eskom, 2005)

2.2 The Proposed Development

Eskom Distribution proposes to construct a new 132 kV distribution power line between the existing Westgate and Tarlton Substations and from the Tarlton Substation to the proposed new Kromdraai Substation. Eskom originally identified seven alternative corridor alignments and two alternative locations for the proposed Kromdraai Substation for consideration in this EIA. However, based on IAP input, one substation location and the power line corridor leading to the substation were eliminated from further consideration as feasible options. Further to this, two additional route alternatives were later identified by Eskom at the request of various landowners. Thus in total there are eight alternative corridor alignments for the proposed power line and one site proposed for the new Kromdraai Substation that were be considered in this EIA. The original and new proposed corridor alignments are discussed in further detail in **Chapter 6**.

2.3 Project Location

The project is located in Western Gauteng within the Mogale City and Ranfontein Local Municipalities of the West Rand District Municipality (WRDM). Tarlton, Krugersdorp and Magaliesburg are major towns within the broader region and the Cradle of Humankind World Heritage Site is a significant cultural feature characterising the broader study area.

The northern component of the study area occurs north of the N14 while the southern component of the study area occurs south of the N14. Parts of the study area occur south of the R24. The existing Tarlton substation occurs in close proximity to the intersection between the N14 and the R24. The Westgate substation occurs in close proximity to Kagiso and the new proposed substation occurs south of the K17. Please refer to **Appendix C 1** for clarity regarding the proposed power line corridors and the substation location.

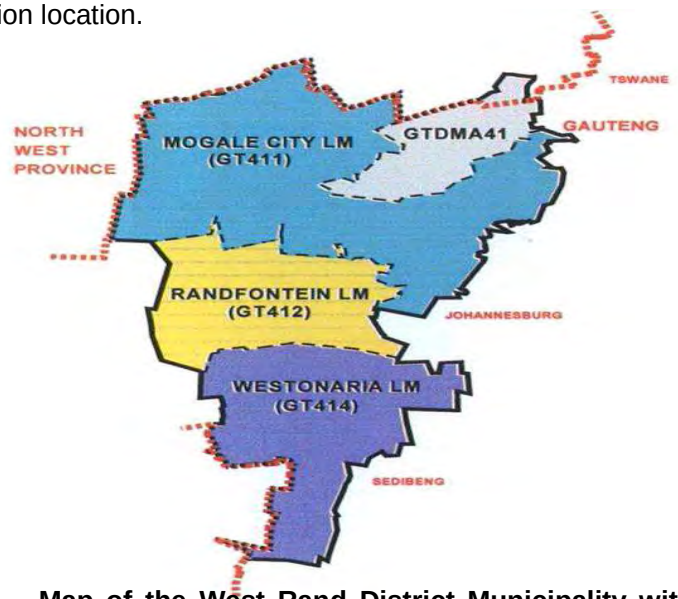


Figure 4: Map of the West Rand District Municipality with constituent local municipalities

2.4 Proposed Infrastructure Dimensions

The total length of the power line will be approximately 50 km, depending on the final alignment of the corridor with a width of 52 meters for double lines. The proposed Kromdraai Substation will require an area of 0.64 ha (80 m x 80 m).

2.5 Activities Associated with the Proposed Project

Prior to the construction of a new power line, a number of issues such as servitude acquisition, transmission power line and tower specifications, access roads and construction camps must be considered. The components discussed below play a role in determining the limitations of the required servitude for the line.

2.5.1 Access Roads and Construction Camps

As far as possible, existing access roads will be used. However, the creation of access roads and construction camps form part of the proposed project in the event that new access roads are required. Access roads will enable the transportation of construction material as well as construction teams to the site and will also facilitate maintenance activities once the power line has been constructed. Inaccessible areas may necessitate the delivery of materials by helicopter. Construction camps will be established at strategic positions to provide optimum access to the construction areas.

2.5.2 Construction of the power line

The construction of the power line involves teams working in phases. A summary of the different teams required for the construction of the power line is outlined below:

- Surveyors;
- Bush-clearing;
- Gate and fencing;
- Foundation-laying;
- Tower erection; and
- Stringing.

Eskom must ensure that an Environmental Control Officer (ECO) monitors the construction phase according to the approved Environmental Management Plan (EMP). Once the contract has been awarded to the contractor, the ECO will contact the landowners to discuss access, the conditions of the area and roads as well as the extent of the work that will transpire. The ECO maintains contact with the landowners throughout the construction of the power line, and monitors the status of crops or property. Once construction has been completed, the ECO will ensure that rehabilitation of the site is undertaken as stipulated. Landowners will be requested to sign a release form stating their satisfaction with the way in which the land has been rehabilitated.

Earthmoving equipment will be used to establish access roads. All areas that will be disturbed such as construction camps, access roads and the construction area around the towers will have the stripped topsoil stockpiled for later use.

The foundations are constructed first, followed by the assembly of the towers on the ground, then the erection of the towers and finally the stringing and regulation of the conductors. There could be several visits to the construction site by the contractors.

2.5.3 Property Ownership

A number of landowners were identified during the scoping process, as property owners who could be affected by the proposed power line and substation. A windeed search was conducted to identify these affected landowners. They were then notified of the proposed distribution power line in the study area through the distribution of BIDs and site notices and placement of newspaper advertisements in the relevant local newspapers.

2.5.4 Servitude Acquisition

Eskom will negotiate with the landowners individually for the servitude to be granted over their land to accommodate the power line. The exact location of the servitude will need to be discussed and negotiated with local landowners within the corridor proposed by the EIA after due consideration of the alternative alignments. An independent Evaluator will be appointed once authorisation has been granted by the relevant authority; all landowners will be compensated at a comparative market value. Once the negotiations for property have been handled, the servitude will be registered and all affected parties will receive payment thereafter.

2.5.5 Access and Local Context

Access to the distribution line will be required for the construction and occasional maintenance activities, thus access roads at agreed points within the servitude will be established if the existing road network is insufficient for this purpose.

2.5.6 Project Details

(a) Construction phase

This phase refers to all construction and construction-related activities that will occur within the servitude area until the project is completed. The first phase will involve pre-construction activities such as:

- Erection of campsites for the contractors' workforce;
- Negotiations for access roads to the servitude;
- Bush clearing to facilitate access and construction work for the proposed power line;
- Establishing of access roads along the servitude; and
- Transportation of equipment, materials and personnel.

The actual construction activities associated with the power line and substation follow:

- Building of foundations for the towers;
- Tower assembly and erection;
- Conductor stringing;

- Construction of the substation;
- Site de-establishment and clean up;
- Final inspection of the line and substation and taking over from contractor;
- Rehabilitation of disturbed areas;
- Signing off landowners after all rehabilitation is complete; and
- Releasing the contractor from site.

Construction camps will be clearly demarcated and areas sited for pylon installations will be buffered and subsequently fenced so as to keep animals out of the construction area.

(b) Operational phase

All post-construction activities, including the operation and maintenance of the proposed development are discussed in this section. Such activities will require routine maintenance work using access roads that will be built along the servitude of the power line.

The servitude also needs to be cleared from time to time to ensure that vegetation does not interfere with the operation of the line. Access roads will be monitored for erosion and the necessary corrective measures undertaken. Servitude maintenance therefore goes hand in hand with the use of and maintenance of access roads.

2.5.7 Design Specifications

Details of the planned 132 kV power line and proposed Kromdraai Substation, including the design specifications and the structural information are discussed below and presented in **Table 1.**

(a) Road Access for Construction and Maintenance of the power line and substation

Road access will be required as part of the servitude along the distribution line for easy access during the construction, and maintenance of the distribution line. This would need to meet specific requirements. Details regarding the required access roads can only be provided when the preferred corridor is chosen. These will be included in the final EMP for the project.

(b) Types of Towers/Pylons

Eskom have decided that the proposed powerlines will be constructed on a double circuit twin tern steel lattice structure. Should a different structure be used, this must be reassessed by the avi-faunal specialist regarding the risk of electrocution to birds.

Where necessary a different tower type to the one identified above could be used if it enables Eskom to address a site-specific technical constraint or issue.

(c) Servitude requirements for the proposed power line

Generally, 132 kV power lines require a servitude width of between 30 m and 52m. The majority of the proposed Westgate, Tarlton, and Kromdraai 132 kV power line will require a servitude width of 52 m (20 m either side of the centre line of the power line). A 52 m wide servitude is required for two lines. The servitude between the

Westgate Substation and the Tarlton Substation must cater for the future construction of an additional power line.

A 24 m separation distance will be required between the centre-line of the proposed power line and the centre-line of the proposed future power line, rendering the total width of the servitude between the Westgate Substation and the Tarlton Substation at 64 m wide. The servitude between the Tarlton Substation and the Kromdraai Substation will have a maximum width of 40 m.

Any extra space required outside the servitude shall be negotiated with the relevant landowners and approved by Eskom. All areas marked as no-go areas, identified by means of the EIA process, located inside the servitude shall be treated with the utmost care and responsibility.

(d) Line clearances

High voltage power lines require a large clearance area for safety precautions. The Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) provides for statutory clearances. **Table 1** summarises some of the key clearances relevant to the proposed 132 kV power line.

Table 1 Clearance specifications (Eskom, 2007a)

Clearances	Minimum Clearance Distance (m)
Ground clearance	6.7
Building structures not part of power line	3.8
Above roads in townships, proclaimed roads	7.5
Telkom telephone lines	2.0
Spoornet tracks	10.9

2.5.8 Maintenance of the Power Line Infrastructure

(a) Control of vegetation

Eskom has a programme in place to ensure the control of vegetation around the existing pylons to minimise the risk of fires.

(b) Anti-climb wires

The installation of anti-climb wires serve as a deterrent to unauthorised climbing of the pylons. It will not prevent a determined individual from climbing over and up the pylon. Eskom has programmes where the broken wires are replaced as part of the maintenance on the power line.

(c) Corrosion

Corrosion on structures is frequently found where the protective system, either galvanizing or a protective organic coating, has weathered, exposing the steel substrate. With routine maintenance, this form of corrosion can be avoided.

Corrosion problems can be avoided by the correct use of materials and their combination with each other. The overall atmospheric conditions expected in a location of an intended structure, and the local environmental effects produced by the erection of structures or installations of equipment should be considered in the selection of appropriate corrosion protection systems.

2.5.9 Use of services and resources during construction

(a) Water

Water will be required for potable use and in the construction of the foundations for the towers. The water will be sourced from approved water use points at locations closest to the area of construction.

(b) Sewage

A negligible sewage flow is anticipated for the duration of the construction period. On site treatment will be undertaken through the use of chemical toilets. The toilets will be serviced periodically by the supplier and will be stipulated in the EMP.

(c) Roads

Existing roads will be utilised as far as possible during the construction and operational periods. The use of roads on landowner property will be subject to the EMP specifications and can be further controlled by landowners during the negotiation process.

(d) Storm water

Storm water will be managed according to the Eskom Guidelines for Erosion Control and Vegetation Management as well as the EMP, which will be compiled for the construction phase.

(e) Solid waste disposal

All solid waste will be collected at a central location at each construction site and will be stored temporarily until removed to an appropriately permitted landfill site in the vicinity of the construction site.

(f) Electricity

Diesel generators will be utilised for the provision of electricity.

2.5.10 The steps in construction and operation of a distribution power line

The typical steps involved in the construction and operation of a distribution power line are summarised in **Table 2**.

Table 2: Summary of the work programme for the construction and operation of the proposed power line in the event that the proposed development is authorised

Step	Activity
1	EIA of alternative power line corridors and proposed substation site
2	Authority authorisation of power line corridor and proposed substation site
3	Negotiation of final power line alignment with landowners
4	Aerial survey of the alignment
5	Selection of best-suited structures and foundations
6	Final design of line and placement of towers
7	Vegetation clearance and gate erection (if necessary)
8	Construction tender advertised and awarded
9	Establishment of construction camp and construction of access roads (if necessary)
10	Construction of foundations
11	Assembly and erection of towers
12	Stringing of conductors
13	Rehabilitation of working areas and protection of erosion susceptible area
14	Testing and commissioning of power line
15	Ongoing maintenance

2.6 Project Need and Desirability

The requirement for the proposed substation and power line is based on the following information (Eskom, 2005b):

- The existing 11 kV lines in the area are experiencing load growth to such an extent that the system must be strengthened. New 11 kV lines are not an ideal solution as the feeder length causes low-voltage problems at the end of the feeders, therefore a new source must be created;
- The lines in the area (supplied from Springs Farm, Crocodile and Tarlton) are approaching their thermal limits[8] and strengthening is necessary in order to accommodate the additional load requirements based on Eskom's load forecast for the area, indicated in **Figure 5**;
- The voltage profiles of the existing MV lines are deteriorating (**Figure 6**);
- Substation loads are approaching their limits of installed capacity and load density; and
- Rights must be obtained as close to the load centre as possible to minimise losses, and improve performance with respect to the existing network performance. In addition to this, land is becoming increasingly scarce and should be obtained while still possible.

The proposed new Kromdraai Substation will be the source where loads will be picked up from existing substations. There are several feeders in the area, which are supplied from neighbouring substations. With Kromdraai commissioned, half of each feeder will be transferred to Kromdraai, which will de-load the existing substations and solve the low-voltage problems in the area.

[8] Thermal limitations contrain the capability of power lines, cables or transformers to carry electricity. The power line resists the flow of electrons through it causing the production of heat. Thermal limits are imposed because over-heating can lead to two potential problems such as 1) the power lines lose strength because of over heating, which can reduce the expected life of the line and 2) the power line expands and sags in the centre of each span between the supporting towers, thereby imposing of the clearance limits (www.eia.doe.gov/cneaf/pubs_html/feat_trans.capacity/w_sale.html).

The new proposed substation will thus improve network performance, reduce interruptions to customers and create additional capacity for growth.

Table 3: Feeders in the area and the load forecasting for each feeder (Eskom, 2005b)

	2006	2007	2008	2009	2010	2011
Orient (Springfarms)	1,616	1,632	1,648	1,665	1,682	1698
Marie (Crocodile)	3,210	3,435	3,675	3,932	4,208	4502
Oak (Tarlton)	2,266	2,334	2,404	2,476	2,550	2627
Kathy (Crocodile)	3,210	3,435	3,675	3,932	4,208	4502
Total load (kV)	**10,302**	**10,836**	**11,403**	**12,006**	**12,647**	**13,330**

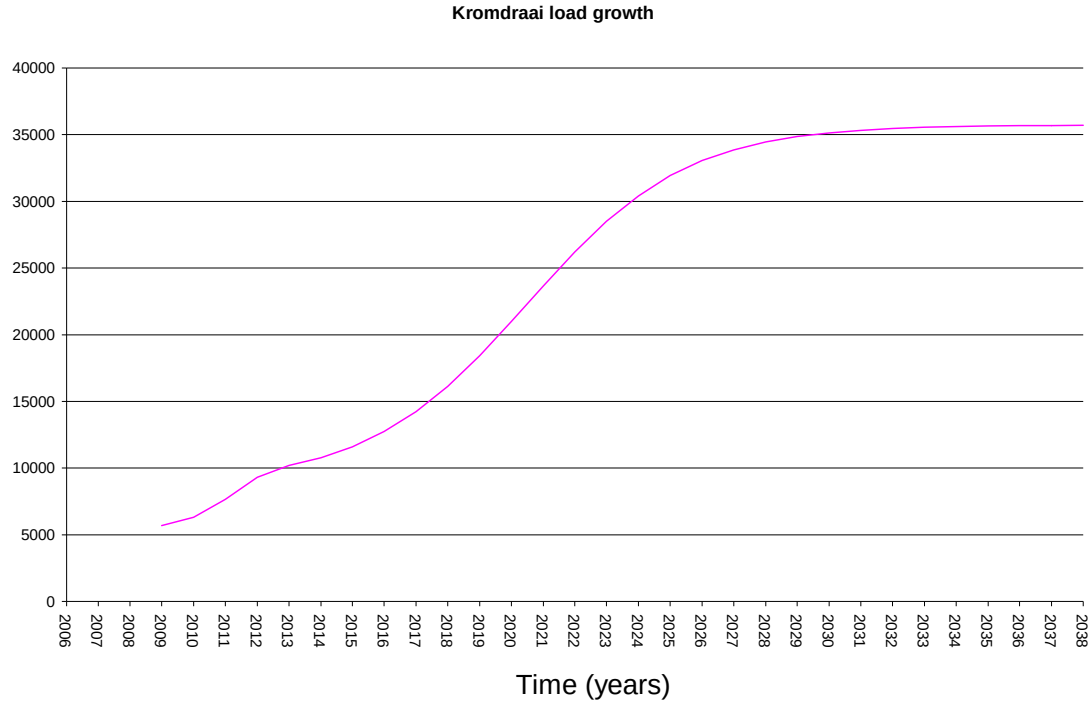
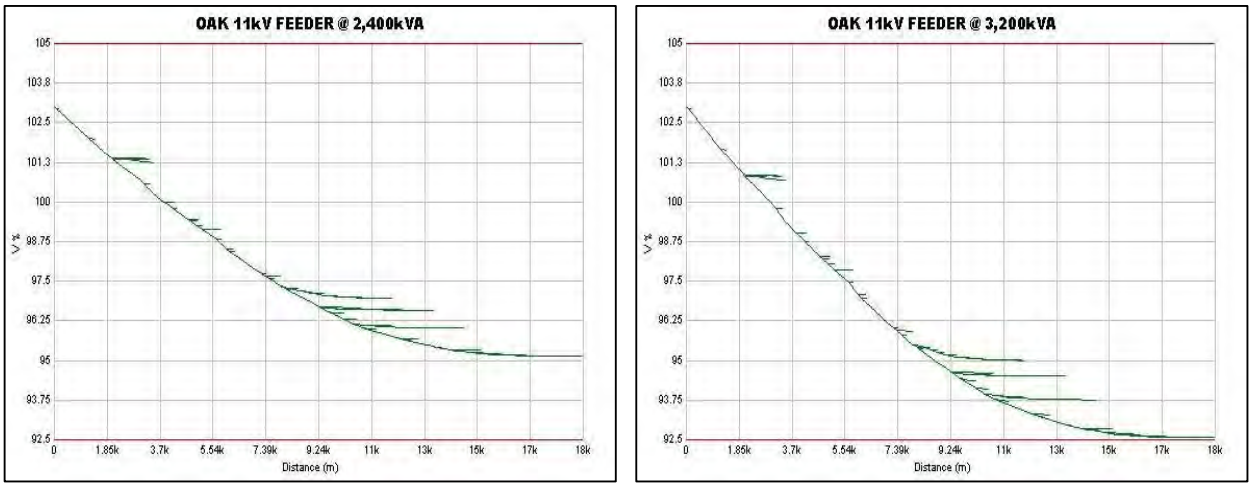


Figure 5: Kromdraai load (kilovolts) forecast (Eskom, 2005b)



2007 **2012**

Figure 6: Voltage Profiles indicating the network performance for the Oak Feeder (Tarlton), (Eskom Planning, 2009)

National and provincial government priorities which identify the need for such infrastructure development and improved service delivery include the National 2014 Vision, the National Spatial Development Perspective (NSDP) and the Gauteng Growth and Development Strategy (GDS). The NSDP assists in focussing government investments on those areas with the potential for sustainable economic development. New developments within the Mogale City Local Municipality include the Key West Shopping Centre with 130 shops and restaurants, further to this, plans are currently underway for more new developments such as the Amakhosi Stadium. Many retail, business and commercial areas have been developed within Mogale City. The GDS has 6 strategic objectives, the first of which is to provide social and economic infrastructure and services that will build sustainable communities and contribute to halving poverty (MCLM IDP 2008/09)

Furthermore, the West Rand District Municipality IDP (2008/09) has identified service delivery and infrastructure development as a key priority issue within the area, thus universal access to a basic service like electricity is expected by 2012. It is estimated that it could cost approximately R26.6million to eliminate the backlog and achieve the target of universal access to electricity in 2012. That is an estimated R4.478 million per annum until 2012. (WRDM 2008/09).

2.7 Financial Feasibility

It would cost Eskom R 1, 32 million per kilometre of single line and R 2.32 million per kilometre of a double circuit line to build. There is budget provision for the proposed power line and substation. Eskom subscribes to The Public Finance Management Act (Act 1 of 1999 as amended by Act 29 of 1999), thus making Eskom accountable for the use of public funds[9].

[9] Land and Rights Presentation by Shalandra Mallgee, 15 January 2009

3 OVERVIEW OF THE SCOPING PHASE

The Environmental Scoping Study identified the potential environmental (biophysical and social) impacts associated with the proposed project. A number of issues for consideration were identified by the environmental team and/or raised by IAPs during the consultation process. The Scoping Report was made available for public comment from 11 February 2008 until 11 March 2008. Comments from IAPs at a Public Meeting held on 04 March 2008 indicated significant opposition by landowners to the project alternatives and the project itself, resulting in Eskom re-evaluating the alternatives. This led to the revision of the Scoping Report and re-issuing a Revised Draft Scoping Report (RDSR) for public comment from 28 November 2008 to 2 February 2009. The Final Scoping Report was submitted to DEAT on 23 February 2009 and was approved by DEAT on 16 April 2009. Please see **Appendix B** for the letter of approval.

3.1 Anticipated Impacts

Potential impacts resulting from the construction of the proposed power line and substation were identified during the Scoping Phase. The potential impacts have been identified from baseline investigations and the PPP. A summary of the potential impacts identified for the construction and operational phases are provided in subsequent sections.

3.1.1 Construction Phase Impacts

Table 4 identifies the impacts that may result from the construction phase of the project.

Table 4: Potential Construction Phase Environmental Impacts

Affected Environment	Anticipated Impact
Ecological processes	Irreversible habitat destruction associated with the construction camp and new substation, are likely to be the largest sources of risk to faunal and floral communities in the broader region. The establishment of construction camps and access roads (where necessary) must be undertaken in consultation with the landowner and must take into account sensitive areas identified in the EIA. Specific management measures are provided in the EMP.
Avifauna	The potential impact on birds is primarily related to the destruction of habitat during access road construction and the establishment of the construction camp as well as the disturbance of normal bird behaviour patterns.

Affected Environment	Anticipated Impact
Surface and groundwater	The placement of towers on the banks of drainage lines may result in erosion of the banks and disturbance to the riparian vegetation. Contaminants such as hydrocarbons may drain into the surface and groundwater systems, thereby polluting these systems. Water may be sourced from rivers during the construction phases. A water use license is required in order to undertake this activity.
Geology and Soils	Removal of vegetation during site clearing may expose soils and render it susceptible to erosion. Soil contamination from hydrocarbon spills.
Land Use	The proposed power line will require the registration of a servitude in which, for safety reasons, no other land use will be allowed. The power line may alter flight patterns of local aircraft.
Heritage Resources	During construction and excavation activities there is the potential to disturb areas of historical, cultural or archaeological importance.
Socio-economic conditions	The potential issues are as follows: - Disruption of current and existing land use; - Disruption of social relations as a result of temporary work camps; - Windblown dust may pose a nuisance factor to surrounding land uses; - Increased traffic; - Potential for the creation of fires through worker activities such as cooking; - Compromised safety of landowners resulting from the presence of construction workers; - Spread of HIV/AIDS and other infectious diseases; and - Employment of local labour.
Noise	The movement of machinery and vehicles will constitute a source of noise in the area. It should be noted that this will be limited to the construction phase only and where possible the necessary noise abatement measures / technology will be implemented to mitigate the impact of the noise.
Residents, tourists and motorists	Alteration of the landscape character and sense of place as a result of the power line and substation.

3.1.2 Operational Phase Impacts

Table 5 identifies the impacts that may result from the operational phase of the project.

Table 5: Potential Operational Phase Environmental Impacts

Affected Environment	Anticipated Impact
Surrounding land users	Faults caused by lightening and vegetation encroachment for example can result in fires. Preventative maintenance is therefore essential to ensure that these problems do not arise. Exposure of flora, fauna and humans to electromagnetic fields (EMF)
Avifauna	Collision of large terrestrial birds and the earth wires of the proposed power line.
Flora and Fauna	The largest effect on faunal and floral habitat during the operational phase is likely to be that of the creation of the service roads and the actual servitude. The maintenance of the servitude may also result in the creation of vegetation structure and composition, which will differ from the surrounding landscape. These maintenance activities e.g. use of fire may influence the re-establishment of certain species over others. Faunal habitat that might be affected during the construction and operation of the proposed power line include flat, open spaces, whereby migration patterns may be disturbed. Areas that are likely to be affected the most are areas that will suffer total or partial habitat destruction, such as the areas earmarked for the substation and the construction camps.
Geology and Soils	Some soil in the broader region may be more susceptible to erosion than others. Ongoing use of poorly constructed access roads with inadequate provision for storm water management may increase erosion of areas.
Land Use	Once the servitude for the power line has been determined, land use within the servitude will be restricted for most land uses except grazing. Eskom personnel will be responsible for the maintenance of the servitude including the control of invasive plant species, control of erosion and the maintenance of firebreaks.
Visual impact	The following general risks are associated with the visual intrusion in the landscape and therefore apply to all corridor alternatives. These may result if the urge to keep the line as straight as possible persists: - The obscuring of views from existing farm houses; - The provision of views along the power line from existing roads. This will magnify the visual intrusion of the line in the landscape; - The degradation of areas of particular visual character; and - The exposure of the entire silhouette of the distribution tower by unnecessarily crossing plateaux or ridges.
Socio-economic conditions	Most negative socio-economic impacts related to the project will be observed during the construction phase. The power line may impact aircraft flight patterns. Satellite stations (supplied from Springfarms, Tarlton) are very sensitive to signals from space and are susceptible to EMF generated by power lines.

3.2 Identified Specialist Studies

The specialist studies were undertaken to verify the sensitivity status along the study area and to assess the significance of the potential impacts of the proposed activity. A summary of the specialist studies can be viewed in Chapter **8**. These specialists and their field of expertise are outlined in the table below:

Table 6: Project specialists and their respective fields of study

Name and Organisation	Field of Study	Reference
Dr. David Hoare (David Hoare Consulting cc)	Ecology	Appendix E
Mr. Johnny Van Schalkwyk	Heritage	Appendix I
Mr. Nino Welland (Moore Spence Jones)	Geology and Soils	Appendix G
Mr. Garry Paterson (Agricultural Research Council)	Agricultural Potential	Appendix H
Mr. Mader van den Berg (I-Scape)	Visual impact	Appendix J
Mr. Jon Smallie (Endangered Wildlife Trust)	Avifauna	Appendix F

4 PUBLIC PARTICIPATION PROCESS

The Public Participation Process (PPP) plays a vital role in the compilation of the Environmental Scoping Report and the Environmental Impact Report. PPP facilitates the planning, design and implementation of the project as a whole. The PPP for this project was designed according to Regulation 56 of GN R. 385 of 2006 and Guideline 4: Public Participation (2005)[10] and was aimed at achieving the following objectives:

- Facilitating negotiated outcomes;
- Creating trust and partnership;
- Minimizing negative effects;
- Maximizing positive effects;
- Providing an indication of issues which may:
    - Prevent the project continuing;
    - Cause costly delays later; and
    - Result in enhanced and shared benefits

The objectives of public participation in an EIA are to provide sufficient and accessible information to IAPs in an unbiased manner and to assist IAPs to achieve the following:

Scoping Phase:

- Identify issues of concern, and provide suggestions for enhanced benefits and alternatives;
- Contribute to local knowledge and experience; and
- Verify that their issues have been correctly captured and considered.

EIA phase:

- Verify that IAP issues have been considered; and
- Comment on the findings of the EIA, including the measures that have been proposed to enhance positive impacts and reduce or avoid negative ones.

Arcus GIBB conducted the PPP for the project. The PPP activities were aimed at involving as many IAPs as possible. All comments received, and issues arising from the public participation process have been incorporated into the Environmental Impact Report and have been used in identifying project alternatives and impacts as well as in determining mitigation measures for the project.

The main PPP activities undertaken to date can be summarised as follows:

- IAP Identification and Registration;
- Compilation of an Electronic IAP Database;
- Public Information Sharing Meetings; and
- Compilation of an Issues and Response Report.

[10] Department of Environmental Affairs and Tourism (2005)

Details regarding the PPP activities undertaken for the respective phases of the EIA are provided in the sections below.

4.1 Scoping Phase

The PPP activities undertaken during the scoping phase for the proposed project are outlined below:

4.1.1 Authorities Consultation

Consultation was undertaken with the Department of Environmental Affairs and Tourism (DEAT) who is the decision–making authority for this project. DEAT were consulted at all stages of the process. This was done to determine specific authority requirements regarding the project. Consultation with other relevant authorities was undertaken through written correspondence aimed at engaging these authorities and retrieving valuable input. The authorities consulted include:

- South African Heritage Resources Agency (SAHRA);
- West Rand District Municipality (WRDM);
- Mogale City Local Municipality (MCLM);
- Randfontein Local Municipality (RLM)
- Department of Minerals and Energy Affairs (DME);
- Department of Water Affairs and Forestry (DWAF); and
- Gauteng Department of Agriculture, Conservation and Environment (GDACE).

Authority consultation included the following activities:

- Submission of an application for environmental authorisation in terms of Section 24 and 24 (d) of NEMA – 27 August 2007;
- Submission of a Draft Environmental Scoping Report – 07 February 2008;
- Submission of a Revised Draft Environmental Scoping Report – 28 November 2008;
- Submission of a Final Environmental Scoping Report – 23 February 2009
- Submission of a Draft Environmental Impact Report – 13 July 2009; and
- Submission of a Final Environmental Impact Report – 31 August 2009.

4.1.2 Identification of IAPs and compilation of an IAP database

Although concentrated in the initial phases of the EIA, the identification of IAPs is an ongoing process throughout the duration of the EIA. IAPs were identified for this project through various approaches including two site visits to the area, advertisements in the local newspapers, use of existing IAP databases, deed searches via the local municipalities and completed comment sheets.

It was attempted to provide written notification of the project to every landowner along the route. This activity was continued during the revision of the scoping phase, additional landowners were identified and notified accordingly of the proposed development. Some properties, however, are vacant and it has accordingly not been possible to provide written notification of the project to every landowner along the

original and newly proposed routes. The measures taken to advertise the project are, however, considered to be reasonable given the linear nature of the activity.

An IAP database was developed for the project (**Appendix D1**). This database has been compiled in accordance with Regulation 57 of Government Notice R. 385 of 2006. Details of IAPs include name and surname, the organisation they represent and their relevant postal and or e-mail address details. The database was expanded through networking as new IAPs responded to the advertisements in the local newspapers.

The key organisations and stakeholders identified to date in addition to the authorities mentioned above include:

- Randfontein Estates;
- Harmony Gold Mines;
- Transtel Satellite;
- Sterkfontein Country Estates;
- Krugersdorp Game Reserve;
- Mogale Private Game Lodge
- Local businesses; and
- Residents Associations

IAPs will continue to be identified throughout the duration of the project and their details will be added to the IAP database. Every person on the database will be informed of the availability of any project documentation for comment and of the applicable commenting period. Notification is done via email, facsimile and post.

4.1.3 Compilation and Distribution of a Background Information Document (BID)

A BID and Comment Sheet (**Appendix D 2**) was compiled and distributed in the broader region in compliance with Regulation 56 (2)(b) of Government Notice R. 385. The BID introduced the proposed project and contains background information on the development proposal, the proponent, EAP and the proposed process to be followed for the EIA.

The BID was distributed to IAPs located in the vicinity of the proposed site on the 7th and the 23rd of November 2007. The BID was distributed to as many landowners and surrounding landowners along the proposed power line route as possible. The BID encouraged IAPs to register their interest in the project. It was also ensured that a copy of the BID was distributed to the relevant key stakeholders.

4.1.4 Placement of Site Notices

Arcus GIBB placed on-site notices on 07 November 2007 in strategic areas located in the vicinity of the proposed development in order to notify people of the development. The site notices were compiled in accordance with the requirements of Regulation 56(3) of GN R. 385 of 2006.

4.1.5 Advertising

Advertisements were placed in two (2) local newspapers informing the public of the proposed project. The advertisements were compiled in accordance with the

requirements of Regulation 56 (3) of GN R. 385 of 2006. Adverts were placed in the Randfontein Herald and Roodepoort Rekord in the week ending 11 January 2008.

A further two advertisements were placed in the Randfontein Herald and Roodepoort Rekord on 29 February 2008. These advertisements were aimed at informing the public that a stakeholder workshop for the project was to be held.

An advertisement was also placed in the Krugersdorp News and the Randfontein Herald on the week ending 28 November 2008. These advertisements were published to inform IAPs and members of the public that the DSR had been revised and was available for public review, in addition these advertisements also served as an invitation to a stakeholder workshop on the findings of the revised report.

4.1.6 Public Meetings

A public information-sharing meeting was held on 04 March 2008 at the Nelson Mandela Hall in Tarlton. All registered IAPs were notified of the meeting. The purpose of the meeting was to offer IAPs an opportunity to raise issues, concerns and any suggestions on the proposed project. This meeting indicated to the project team that various IAPs oppose the proposed alternatives, resulting in the need for Eskom to re-evaluate the proposed alternatives. This re-evaluation has led to the revision of the draft scoping report. Thus an additional public meeting was held on 15 January 2008 to present the findings of this report. The meeting took place at the Nelson Mandela Hall in Tarlton. The proponent, Eskom has been present at all public meetings held thus far to address the comments and concerns of IAPs.

4.1.7 Public Commenting Period

The Draft Scoping Report (DSR) was made available for public comment from 11 February to 11 March 2008 at the Randfontein Public Library and at the Tarlton Post Office. All comments received during this period were responded to in the Issues and Response Report. An additional public commenting period was held for the revised draft scoping report, for a period of 30 calendar days. The review period began on 27 November 2008 and ended on 02 February 2009. The report was placed at the Randfontein Public Library, Tarlton Post Office and at the Arcus GIBB offices (Rivonia). All IAPs were notified of the submission of the FSR to DEAT and were provided with the opportunity to review the FSR in order to assess whether their comments were adequately captured and addressed.

4.1.8 Issues and Response Report

An important element of the Scoping process is to evaluate the issues that are raised during the PPP in order to ensure that those identified as key issues are included within the scope for the Impact Assessment Phase of the EIA process. All the concerns and issues raised during the PPP are captured and responded to in an Issues and Response Report (IRR) (**Appendix D4**), which was compiled in accordance with the requirements of Regulation 29 (h) (iv) of Government Notice R.385 of 2006.

To date, the following issues were raised during the PPP, including the public meetings held on 04 March 2008 and 15 January 2009:

- IAPs sought the details of the landowners that Eskom had initially consulted as part of their preliminary investigations;

- The possible impact of the power line on Harmony Gold's dump reclamation project;
- Loss of land;
- Issue of expropriation and compensation;
- Concern of several Red Data species that may occur within the study area;
- Impact on the Kromdraai Palaeontological Reserve;
- Reconsideration of the proposed powerline alternatives; and
- Geotechnical stability of the certain areas to withhold such development.

Other queries pertained to the following:

- Location of the pylons and the substation;
- Security and safety of the substation;
- Impacts on aircrafts;
- Increased risk of lightning strikes with powerlines in close proximity;
- Health impact of high voltage powerlines;
- Devaluation of properties;
- PPP conducted to date
- Aesthetic impacts; and
- Access routes.

Issues and comments from the public review period of the revised draft scoping report have been incorporated into the issues and response report.

4.1.9 Website

A webpage was created for the project on the Arcus GIBB website. This enabled all IAPs to view and download the Scoping Report and its appendices. The webpage shall be continuously updated with the latest project documentation. The Arcus GIBB website is as follows: http://projects.gibb.co.za.

4.2 Environmental Impact Assessment Phase

4.2.1 Project Advertising

The commencement of the EIA Phase for the project was advertised in the following newspapers **(Appendix D3):**

- The Krugersdorp News – 15 July 2009
- Randfontein Herald – 09 July 2009

The purpose of these advertisements was to inform IAPs of the availability of the Draft Environmental Impact Report (DEIR) for public review and the public meeting to be held for the project. In addition to these advertisements, IAPs registered on the IAP Database were sent e-mails, faxes and posted letters.

4.2.2 Updating of IAP Database

IAPs will continuously be identified throughout the duration of the project and their details will be added to the IAP database. Every person on the database will be informed of the availability of any project documentation and the applicable commenting period.

4.2.3 Public Meetings

A public meeting is proposed to be held on 12 August 2009 at the Nelson Mandela Hall on Cecilia Street in Tarlton, to update IAPs of the proposed project. The aim of this meeting will be to:

- Provide IAPs and stakeholders with information regarding the EIA Process;
- Provide IAPs with additional information regarding the proposed development;
- Inform IAPs of the findings of the Draft Environmental Impact Report (DEIR);
- Provide an opportunity for IAPs to seek clarity on the project;
- Record issues and concerns raised; and
- Provide a forum for interaction with the project team.

In accordance with the requirements of the EIA Regulations, this meeting was advertised. Registered IAPs were also invited via email, posted letters and faxes to attend the public meeting. Key Stakeholder Workshops and Focus Group Meetings shall be scheduled if deemed necessary.

4.2.4 Updating of Issues and Response Report

All issues, comments and concerns raised during the public commenting period of the EIA Phase shall be incorporated into the Issues and Response Report. This report shall be continuously updated with comments received until the submission of the FEIR (**Appendix D4)**.

4.2.5 Public Commenting Period of the Draft Environmental Impact Report

The DEIR was made available for public review at the following public locations:

- Tarlton Post Office;

- Randfontein Public Library; and
- Arcus GIBB (Pty) Ltd – Sunninghill Office.

Review of the DEIR is also possible via the Arcus GIBB website, the link is as follows: http://projects.gibb.co.za.

The public commenting period commences on 13 July 2009 and will conclude on 27 August 2009. The availability of the DEIR was advertised as mentioned above and IAPs registered on the IAP database were notified via email, posted letters and faxes.

4.2.6 Final Environmental Impact Report

The Final Impact Report will be submitted to DEAT for review and decision-making once the commenting period for the Draft Environmental Impact Report is completed. All IAP comments received during the commenting period shall be included into the final report for consideration.

5 IMPACT ASSESSMENT METHODOLOGY

5.1 Introduction

The methodology employed in assessing the significance of the possible impacts associated with the project is described in this section.

The purpose of the Impact Assessment Phase of an EIA is as follows (DEAT, 2005):

- Address issues that have been raised during the Scoping Phase;
- Assess alternatives to the proposed activity in a comparative manner;
- Assess all identified impacts and determine the significance of each impact; and
- Formulate mitigation measures in order to minimise negative impacts and optimise the effects of positive impacts.

Numerous acceptable approaches and methodologies exist by which the above purpose can be achieved. The legislation in South Africa, including the guideline documents published in support thereof, does not provide a specific methodology for the assessment of impacts. Rather, an assessment framework is provided within which EAPs are expected to structure a project-specific assessment methodology. This assessment framework recognises that there are different methodologies available for assessing the impact of a development but that the specific methodology selected must provide for the following (DEAT, 2005):

- A clear process for impact identification, prediction and evaluation;
- The specification of impact identification techniques;
- Criteria for evaluating the significance of impacts;
- The design of mitigation measures to address impacts;
- Defining types of impacts (direct, indirect or cumulative); and
- Specification of uncertainties.

5.2 Methodology

The objective of the assessment of impacts is to identify and assess all the significant impacts that may arise as a result of the proposed power line and substation. The process of assessing the impacts of the project encompasses the following four activities:

- Identification and assessment of potential impacts;
- Prediction of the nature, magnitude, extent and duration of potentially significant impacts;
- Identification of mitigation measures that could be implemented to reduce the severity or significance of the impacts of the activity; and
- Evaluation of the significance of the impact after the mitigation measures have been implemented i.e. the significance of the residual impact.

The possible impacts associated with the proposed power line and substation project are identified in the Scoping Phase through public and stakeholder consultation.

These impacts are derived from the issues that are identified in respect of all phases of the development including the construction and operational phases. Additional impacts arise through the various specialist studies undertaken and through the ongoing consultation process with IAPs, during the detailed assessment phase of the EIA process,

In accordance with GNR 385, promulgated in terms of section 24 of NEMA, specialists will be required to assess the significance of potential impacts in terms of the following criteria:

- Cumulative impacts;
- Nature of the impact;
- Extent of the impact;
- Intensity of the impact;
- Duration of the impact;
- Probability of the impact occurring;
- Impact non-reversibility;
- Impact on irreplaceable resources; and
- Confidence level.

Table 7 provides a summary of the criteria and the rating scales, which will be used in this regard. The assignment of a rating[11] will be done based on past experience of the EIA Project Team, the professional judgement of the specialists as well as through desktop research.

Once the impacts have been assessed in terms of the above criteria a consequence rating will be applied as per the convention in **Table 8**. The consequence of the potential impacts will be determined according to the main criteria for determining the consequence of impacts, namely the extent, duration and intensity of the impacts. This assessment will be done initially for the scenario where no mitigation measures are implemented. The professional experience of the specialists will determine the allocation of the pre-mitigation impact consequence rating.

The overall significance of the impacts will be defined based on the result of a combination of the consequence rating and the probability rating, as set out in **Table 9**.

Mitigation measures will then be identified and considered for each impact and the assessment repeated in order to determine the significance of the residual impacts (the impact remaining after the mitigation measure has been implemented).

The criteria that will be used to determine the significance of the residual impacts will include the following:

- Probability of the mitigation measure being implemented; and
- Extent to which the mitigation measure will impact upon the assessment criteria in **Table 7**.

The results of the assessment of the significance of the residual impacts will then be linked to decision-making by authorities in the following manner:

[11] Cumulative impacts, impact non-reversibility, and impact on irreplaceable resources will together inform the impact intensity rating

- Low – will not have an influence on the decision to proceed with the proposed project, provided that recommended mitigation measures are implemented;
- Medium – should influence the decision to proceed with the proposed project, provided that recommended mitigation measures are implemented; and
- High – would strongly influence the decision to proceed with the proposed project regardless of the implementation of recommended mitigation measures.

Table 7: Impact Assessment Criteria and Rating Scales

Criteria	Rating Scales
Cumulative impacts (incremental impacts of the activity and other past, present and future activities on a common resource)	• Low (there is still significant capacity of the environmental resources within the geographic area to respond to change and withstand further stress) • Medium (the capacity of the environmental resources within the geographic area to respond to change and withstand further stress is reduced) • High (the capacity of the environmental resources within the geographic area to respond to change and withstand further stress has been or is close to being exceeded)
Nature	• Positive • Negative • Neutral
Extent (the spatial limit of the impact)	• Local (site-specific and/or immediate surrounding areas) • Regional (Gauteng) • National or beyond
Intensity (the severity of the impact)	• Low - where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected • Medium - where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected • High - where natural, cultural or social functions and processes are altered to the extent that it will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected
Duration (the predicted lifetime of the impact)	• Short-term (0 to 5 years) • Medium term (6 to 15 years) • Long term (16 to 30 years) - where the impact will cease after the operational life of the activity either because of natural processes or by human intervention
Probability (the likelihood of the impact occurring)	• Improbable – where the possibility of the impact occurring is very low • Probable – where there is a good possibility (<50 % chance) that the impact will occur • Highly probable – where it is most likely (50-90 % chance) that the impact will occur • Definite – where the impact will occur regardless of any prevention measures (>90 % chance of occurring)
Non-Reversibility (ability of the impacted environment to return to its pre-impacted state once the cause of the impact has been removed)	• Low (impacted natural, cultural or social functions and processes will return to their pre-impacted state within the short-term) • Medium (impacted natural, cultural or social functions and processes will return to their pre-impacted state within the medium to long term) • High (impacted natural, cultural or social functions and processes will never return to their pre-impacted state)
Impact on irreplaceable[12] resources (is an irreplaceable resource impacted upon)	• Yes • No
Confidence level (the specialist's degree of confidence in the predictions and/or the information on which it is based)	• Low • Medium • High

[12] A resource for which no reasonable substitute exists, such as Red Data species and their habitat requirements

Table 8: Convention for Assigning a Consequence Rating

Consequence Rating	Intensity, Extent and Duration Rating
HIGH Consequence	• **High intensity** at a **regional level** and endure in the **long term** • **High intensity** at a **national level** and endure in the **medium term** • **Medium intensity** at a **national level** and endure in the **long term** • **High intensity** at a **regional level** and endure in the **medium term** • **High intensity** at a **national level** and endure in the **short term** • **Medium intensity** at a **national level** and endure in the **medium term** • **Low intensity** at a **national level** and endure in the **long term** • **High intensity** at a **local level** and endure in the **long term** • **Medium intensity at a regional level** and endure **in the long term**
MEDIUM Consequence	• **High intensity** at a **local level** and endure in the **medium term** • **Medium intensity** at a **regional level** and endure in the **medium term** • **High intensity** at a **regional level** and endure in the **short term** • **Medium intensity** at a **national level** and endure in the **short term** • **Medium intensity** at a **local level** and endure in the **medium term** • **Medium intensity** at a **local level** and endure in the **long term** • **Low intensity** at a **national level** and endure in the **medium term** • **Low intensity at a regional level** and endure in the **long term**
LOW Consequence	• **Low intensity** at a **regional level** and endure in the **medium term** • **Low intensity** at a **national level** and endure in the **short term** • **High intensity** at a **local level** and endure in the **short term** • **Medium intensity** at a **regional level** and endure in the **short term** • **Low intensity** at a **local level** and endure in the **long term** • **Low intensity** at a **local level** and endure in the **medium term** • **Low intensity** at a **regional level** and endure in the **short term** • **Low to medium intensity** at a **local level** and endure in the **short term**

Table 9: Convention for Assigning a Significance Rating

Consequence Rating	Consequence x Probability
HIGH Significance	• High x Definite • High x Highly Probable • High x Probable • High x Improbable • Medium x Definite
MEDIUM Significance	• Medium x Highly Probable • Medium x Probable
LOW Significance	• Medium x Improbable • Low x Definite • Low x Highly Probable • Low x Probable • Low x Improbable

5.3 Assumptions and Limitations

5.3.1 Assumptions

- All information provided by the Proponent and Project Team to the Environmental Team was correct and valid at the time it was provided; and
- Due to the location and nature of the project, it is not possible to involve all IAPs individually**.** The assumption has thus been made that those representatives with whom there has been consultation, are acting on behalf of the parties which they represent.

5.3.2 Limitations

- Further detailed investigations are required to confirm the findings of the geo-technical and ecological assessments.

6 PROJECT ALTERNATIVES

6.1 Introduction

The DEAT EIA guidelines necessitate the consideration of various development alternatives or proposals as part of the EIA process. The consideration of project alternatives is a key requirement of an EIA as it provides a basis for choice for the competent authority and IAPs. In the NEMA EIA Regulations, alternatives in relation to a proposed activity are defined as "*different means of meeting the general purpose and requirements of the activity, which may include alternatives to the –*

(a) property on which or location where it is proposed to undertake the activity;
(b) type of activity to be undertaken;
(c) design or layout of the activity;
(d) technology to be used in the activity; and
(e) operational aspects of the activity;

Alternatives that are considered must be reasonable and feasible and should have the potential to reduce negative impacts that may occur due to the proposed project. Alternatives are considered as a means of reaching the same need and purpose as the originally proposed project in a way that minimises the impacts and maximises the benefits. The advantages and disadvantages that alternatives may have on the environment are described and a comparative assessment of all feasible and reasonable alternatives is made in the sections below.

This section considers alignment alternatives of the proposed power line corridors within the identified study area. Thereafter, technology alternatives and the no development option are assessed in view of the South African power context.

6.2 Proposed power line corridor alternatives

Prior to selecting possible corridor alternatives, several route selection criteria need to be considered[13]. These are discussed below.

- **Cadastral Boundaries -** Land rights of all landowners are considered, thus when possible Eskom endeavours to align the corridors to property boundaries.

- **Physical Environment –** Physical features such as terrain and topography of the study area are taken account of as accessibility during construction and maintenance of the proposed powerline is an important factor. Preserving the natural environment is also of significant importance hence the EIA Process.

- **Land Use -** Areas of high agricultural potential and dense business and residential developments are also taken account of.

[13] Eskom Presentation by Shalandra Mallgee on 15 January 2009

- **Existing Services -** Eskom identifies the existing corridors and infrastructure in the area before determining new corridors. This ensures proper planning of services.

- **Financial Costs –**Rand per kilometer of powerline approximates to R1,32 million per kilometre. Thus to reduce costs, Eskom prefers a powerline alignment as straight as possible .

The tables in this section provide a description of the corridors associated with the proposed alternative power line corridors. The descriptions utilise reference points associated with each corridor and substation location, which are derived from the base maps in **Appendix C 1**.

6.2.1 Power line corridors from the existing Westgate Substation to Tarlton Substation

6.2.1.1 **Corridor 1** – Indicated in **Red**

Corridor 1 begins at the existing Westgate Substation (A) and follows a specific route to the existing Tarlton Substation. **Table 10** describes the route of this corridor. Corridor 1 is approximately 19.2 km in length.

Table 10: Description of Corridor 1 (Existing Westgate Substation to the existing Tarlton Substation)

	From	General Direction and Approximate Distance	To
Corridor 1	Existing Westgate Substation	West 4.0 km (Approx.)	Randfontein Estates
	Randfontein Estates	North 2.6 km (Approx.)	Past Point B up to the farm Waterval 174-IQ located approximately 500 metres south west of Egoli Reduction
	Waterval 174-IQ located approximately 500 metres south west of Egoli Reduction	North west 5.3 km (Approx.)	Point C, past Point X, located on an open plot adjacent to the R24 (towards Rustenburg) and on the northern component of the farm Rietfontein 162-IQ
	Point C	North 2.0 km (Approx.)	North western corner of the farm Brickvale 161-IQ
	North western corner of the farm Brickvale 161-IQ	East 0.9 km (Approx.)	South western corner of plot 43 of Beckedan Extension 1 Agricultural Holdings
	South western corner of plot 43 of Beckedan Extension 1 Agricultural Holdings	North 1.7 km (Approx.)	Point D located ± one km north of David Street and at the southern component of portion 75 of the farm Vlakdrift 163-IQ
	Point D	West 2.7 km (Approx.)	Point E located at the existing Tarlton Substation

6.2.1.2 **Corridor 2** – Indicated in **Purple**

Corridor 2 follows the same route as Corridor 1 from the existing Westgate Substation to Point B, indicated on the maps in **Appendix C 1**. Thereafter, the route deviates up to Point C. From Point C, the route follows that of Corridor 1 up to the existing Tarlton Substation.

The deviation of the route between points B and C is described in **Table 11**. The length of the deviation is approximately 7.9 km, rendering the entire length of the corridor, between the existing Westgate and Tarlton Substations, to approximately 20.8 km.

Table 11: Description of Corridor 2 (Deviation between points B and C of Corridor 1)

	From	General Direction and Approximate Distance	To
Corridor 2	Point B	North west 1.7 km (Approx.)	Point Y located on Portion 1 of the farm Waterval 174-IQ
	Point Y	West 2.2 km (Approx.)	Point located in close proximity to portion 23 of the farm Waterval 174-IQ
	Point located in close proximity to portion 23 of the farm Waterval 174-IQ	North west 1.0 km (Approx.)	South eastern corner of Portion 6 of the farm Rietfontein 162-IQ
	South eastern corner of Portion 6 of the farm Rietfontein 162-IQ	North east 0.3 km (Approx.)	South eastern corner of the remaining portion of the farm Reitfontein 162-IQ
	South eastern corner of the remaining portion of the farm Rietfontein 162-IQ	North west 0.7 km (Approx.)	Close proximity to the south western corner of Portion 7 of the farm Rietfontein 162-IQ
	Close proximity to the south western corner of Portion 7 of the farm Rietfontein 162-IQ	North west 1.5 km (Approx.)	North west corner of the remaining portion of the farm Rietfontein 162-IQ
	North west corner of the remaining portion of the farm Rietfontein 162-IQ	East 0.5 km (Approx.)	Point C

6.2.1.3 **Corridor 3** – indicated in **Light Blue**

Corridor 3 is a crossover alternative from Corridor 2 to Corridor 1. The Corridor follows the same alignment as Corridor 2 up to the point located on Portion 1 of the farm Waterval 174 IQ (point Y), after which it deviates from Corridor 2 by proceeding directly to join Corridor 1 at point X. Corridor 3 is approximately 750 metres in length.

6.2.2 Power line corridors from the existing Tarlton Substation to the proposed Kromdraai Substation[14]

6.2.2.1 Corridor 4 – Indicated in Orange

Table 12 outlines the corridor from the existing Tarlton Substation to the proposed location for the new Kromdraai Substation. Corridor 4 is approximately 10.6 km in length.

Table 12: Description of Corridor 4 (Existing Tarlton Substation to the new Kromdraai Substation)

	From	General Direction and Approximate Distance	To
Corridor 4	Existing Tarlton Substation	North 2.8 km (Approx.)	North western corner of Portion 7 of the Farm Vlakdrift 163-IQ
	North western corner of Portion 7 of the Farm Vlakdrift 163-IQ	North east 2.4 km (Approx.)	Point F located on the north western component of Portion 77 of the Farm Sterkfontein 173-IQ
	Point F	East 3.4 km (Approx.)	Point I located on the north eastern corner of Portion 138 of the Farm Sterkfontein 173-IQ
	North eastern corner of Portion 138 of the Farm Sterkfontein 173-IQ	North east 1.2 km (Approx.)	North western corner of Portion 9 of the Farm Sterkfontein 173-IQ
	North western corner of Portion 9 of the Farm Sterkfontein 173-IQ	East 0.8 km (Approx.)	Point G (Kromdraai Substation)

6.2.2.2 Corridor 5 – Indicated in Pink

Corridor 5 follows Corridor 4 from the existing Tarlton Substation to Point F. Thereafter, the corridor deviates up to the proposed location of the new Kromdraai Substation. **Table 13** provides a description of the deviation from Corridor 4 up to the proposed location for the new Kromdraai Substation. The length of the deviation is approximately 5.6 km, rendering the entire length of Corridor 5 at approximately 10.6 km.

[14] Another corridor alternative from the Tarlton Substation to the alternative site for the proposed Kromdraai Substation was identified in the BID circulated. Since the alternative site for the proposed Kromdraai Substation is no longer available (See section 5.2), this corridor alternative has subsequently been removed.

Table 13: Description of Corridor 5 (Deviation from Corridor 4)

	From	General Direction and Approximate Distance	To
Corridor 5	Point F	North east 2.7 km (Approx.)	Point FG located on the north eastern corner of Portion 99 of the farm Sterkfontein 173-IQ
	Point FG	East 2.6 km (Approx.)	North eastern corner of Portion 35 of the farm Sterkfontein 173-IQ
	North eastern corner of Portion 35 of the Farm Sterkfontein 173-IQ	South 0.3 km (Approx.)	Location G (Kromdraai Substation)

6.2.2.3 **Corridor 6** – Indicated in **Blue**

Corridor 6 provides a linkage between Corridor 1 and Corridor 4. This corridor alternative would require a double servitude to be registered between the Tarlton Substation and Point D on the maps in **Appendix C 1**. **Table 14** provides a description of the corridor from the Tarlton Substation.

Table 14: Description of Corridor 6

	From	General Direction and Approximate Distance	To
Corridor 6	Tarlton Substation	East 2.9 km (Approx.)	Point K South east corner of Portion 76 of the farm Vlakdrift 163 IQ
	Point K	North 2.6 km (Approx.)	Point H
	Point H (following the same alignment as Corridor 4)	East 5.4 km (Approx.)	Location G (Kromdraai Substation)

The tables below provide a description of the corridors associated with the two new alternative power line corridors, namely corridors 7 and 8.

6.2.3 Power line corridors through consultation with IAPs

6.2.3.1 **Corridor 7** – Indicated in **Green**

Corridor 7 begins at the existing Westgate Substation (A) and travels to the existing Tarlton Substation (E), ending at G, which represents the proposed Kromdraai Substation site. Corridor 7 is a combination of other proposed alignments with the additional section running through the Krugersdorp Game Reserve. **Table 15** describes the specific route associated with this corridor. Corridor 7 is approximately 29.8 km in length.

Table 15: Description of Corridor 7 (Existing Westgate Substation to the existing Tarlton Substation ending at the proposed Kromdraai Substation)

	From	General Direction and Approximate Distance	To
Corridor 7	Existing Westgate Substation	West 4.0 km (Approx.)	Randfontein Estates
	Randfontein Estates	North 2.6 km (Approx.)	Past Point B up to the farm Waterval 174-IQ located approximately 500 metres south west of Egoli Reduction
	Waterval 174-IQ located approximately 500 metres south west of Egoli Reduction	North west 2.8 km (Approx.)	Point L located on an open plot adjacent to the R24 (towards Rustenburg) and about 100m east of the corner of Vanadium and Chromium Streets
	Point L	North 5.5 km (Approx.)	Point J located on portion 96 of Farm Sterkfontein 173 – IQ, just outside of the north western corner of the Krugersdorp Game Reserve
	Point J	West 5 km (Approx.)	Point E located at the existing Tarlton Substation
	Existing Tarlton Substation	North 2.5 km (Approx.)	North western corner of Portion 7 of the Farm Vlakdrift 163-IQ
	North western corner of Portion 7 of the Farm Vlakdrift 163-IQ	North east 2 km (Approx.)	Point F located on the north western component of Portion 77 of the Farm Sterkfontein 173-IQ
	Point F	North east 2.5 km (Approx.)	Point FG located on the north eastern corner of Portion 99 of the farm Sterkfontein 173-IQ
	Point FG	East 2.6 km (Approx.)	North eastern corner of Portion 35 of the farm Sterkfontein 173-IQ
	North eastern corner of Portion 35 of the Farm Sterkfontein 173-IQ	South 0.3 km (Approx.)	Location G (Kromdraai Substation)

6.2.3.2 **Corridor 8** – Indicated in **Dark Blue**

Corridor 8 utilises sections of the other proposed alignments, additional sections include that just south of the Tarlton Substation and another between the northern edge of the Krugersdorp Game Reserve and the southern portion of the proposed Kromdraai Substation site. Due to the fact that corridor 8 is disjointed and is not one continuous alignment **Table 16** describes the different routes associated with this corridor and has been labelled as 1, 2, 3 and 4. Corridor 8 is approximately 23.8 km in length.

Table 16: Description of Corridor 8

	Alignment	From	General Direction and Approximate Distance	To
Corridor 8	**1**	Point B located north west of the Randfontein Estates Gold Mine	North west 2 km (Approx.)	Point on the north eastern section of Portion 1 of the farm Rietfontein 162-IQ, just south of Point X
		Point on the north eastern section of Portion 1 of the farm Waterval 174-IQ, just south of Point X	West 1.4 km (Approx.)	Point on the north western section of Portion 1 of the farm Rietfontein 162-IQ, 300m south of the intersection of Helium and Cobalt Road
		Point on the north western section of Portion 1 of the farm Rietfontein 162-IQ, 300m south of the intersection of Helium and Cobalt Road	North west 5 km (Approx.)	Point M located on Northern most tip of portion 165 of Farm Rietfontein 162-IQ
		Point M	North west 1.5 km (Approx.)	Point located on the south eastern corner of Portion 244 of Eldarado Agricultural Holdings
		Point located on the south eastern corner of Portion 244 of Eldarado Agricultural Holdings	North west 0.5 km (Approx.)	Point located on the south western corner of Portion 56 of Eldarado Agricultural Holdings
		Point located on the south western corner of Portion 56 of Eldarado Agricultural Holdings	North east 0.5 km (Approx.)	Point located on the north eastern corner of portion 61 of Eldarado Agricultural Holdings, adjacent to the R24
		Point located on the north eastern corner of portion 61 of Eldarado Agricultural Holdings, adjacent to the R24	North 1 km (Approx.)	Point E located at the Tarlton Substation
	2	Point L located on an open plot adjacent to the R24 (towards Rustenburg) and about 100m east of the corner of Vanadium and Chromium Streets	North west 3 km (Approx.)	Point C located on an open plot adjacent to the R24 (towards Rustenburg) and on the northern component of the farm Rietfontein 162-IQ

		Point C	South west 1 km (Approx.)	Point M located on the northern most tip of portion 165 of Farm Rietfontein 162-IQ
	3	Point J located on portion 96 of Farm Sterkfontein 173 – IQ, just outside of the north western corner of the Krugersdorp Game Reserve	North east 1 km (Approx.)	A point located on the south-eastern tip of portion 8 of Farm Sterkfontein 173-IQ, adjacent to the R24
		A point located on the south-eastern tip of portion 8 of Farm Sterkfontein 173-IQ, adjacent to the R24	North 1.5 km (Approx.)	Point I, located on the north eastern corner of portion 138 of Farm Sterkfontein 173-IQ
	4	Point F	East 3.4 km (Approx.)	Point I located on the north eastern corner of Portion 138 of the Farm Sterkfontein 173-IQ
		Point I	North east 1.2 km (Approx.)	North western corner of Portion 9 of the Farm Sterkfontein 173-IQ
		North western corner of Portion 9 of the Farm Sterkfontein 173-IQ	East 0.8 km (Approx.)	Point G (Kromdraai Substation)

6.2.4 Assessment of alternative corridors

6.2.4.1 Corridor 1 - Red

Corridor 1 connects the existing Westgate Substation to the existing Tarlton Substation. For most of the length of this proposed corridor, there is an existing power line running adjacent to it. For this reason, this corridor is considered to be the preferred alternative from an avifaunal perspective. Placing new powerlines adjacent to existing powerlines is advantageous to birds as the powerlines become more visible, birds become accustomed to avoid already existing powerlines and the threat of a possible collision is limited as the powerlines are confined to a specific area and not spread out spatially.

In terms of ecological value, corridor 1 is the preferred corridor as majority of this alignment is through areas transformed by cultivation, small holdings, alien vegetation, mining and other activities. Further to this, approximately 24% of this alignment is within untransformed habitat.

Corridor 1 is least preferred from a geotechnical perspective due to the significant presence of dolomite, which is prone to forming sinkholes. However based on the heritage assessment, Corridor 1 is the preferred alternative due to the lack of heritage sites in this area.

6.2.4.2 Corridor 2 - Purple

Corridor 2 is an alternative to the southern portion of Corridor 1. The majority of this alignment lies in areas transformed or disturbed by a combination of alien trees, a mine dump, cultivation, urban areas and existing roads. There is, approximately 3.6 km of this alignment that is potentially problematic in terms of the conservation value of the grassland area that it traverses. A comparison between this alignment and the section of Corridor 1 that it replaces indicates that Corridor 1 is favoured over this alignment due to the fact that it contains no “Irreplaceable” habitat according to GDACE C Plan.

6.2.4.3 Corridor 3 – Light Blue

Corridor 3 links a portion of Corridor 2 to Corridor 1. It does lie in a disturbed area adjacent to an existing mine dump. This section is considered to be highly degraded based on fieldwork and is therefore of no conservation value. Due to the fact that Corridor 1 is marginally preferred over Corridor 2, this small connector (Corridor 3) could potentially provide a favourable link to avoid the majority of Corridor 2 where there are conservation issues and still allow the southern section of Corridor 2 to be used.

6.2.4.4 Corridor 4 - Orange

Corridor 4 is a northern alternative connecting the Tarlton substation to the proposed Kromdraai substation. Small holdings and associated disturbance occur near the eastern end, however it crosses mostly natural grassland and a single permanent wetland system. Thus, Approximately 71% of the alignment is within untransformed habitat. Although this alternative contains a number of ecologically sensitive sites, it is preferable to its direct comparison, Corridor 5.

Corridor 4 is a preferred alternative from the Tarlton substation to the proposed Kromdraai substation in terms of avoiding geotechnical constraints

6.2.4.5 Corridor 5 – Pink

Corridor 5 connects the existing Tarlton Substation to the proposed Kromdraai Substation. The Avifauna Study indicated that corridor 5 is the preferred corridor as it runs along existing transmission powerlines for most of its length. This reduces the disturbance and electrocution of birds. Furthermore, the construction of a new powerline to an existing powerline will eliminate the need for new access roads, further reducing the level of disturbance to birds and their habitats within the area.

The alignment includes a 2.1 km section of grassland classified in GDACE C-Plan as “Irreplaceable”. Thus, approximately 80% of the alignment is within untransformed habitat. Corridor 4 is thus preferable to this alignment in terms of conservation value.However, based on the sensitivity analysis undertaken during the ecological assessment, corridors 4 and 5 have a similar sensitivity.

Corridor 5 is also least preferred from a geotechnical perspective. However, this corridor is preferred from a cultural and heritage perspective due to distance from a number of palaeontological and early hominid sites located in that region, just north of the proposed Kromdraai substation.

This corridor is the preferred alternative from a visual impact perspective as it continues for a longer length along the existing transmission line, causing a fairly small visual change to the baseline condition.

6.2.4.6 Corridor 6 - Blue

This corridor links Corridor 1 to Corridor 4. It lies entirely within cultivated lands. There are therefore few conservation concerns within this alignment. From an ecological perspective, this is preferable to using the western section of Corridor 4, as there are two areas of grassland designated as “Irreplaceable” in GDACE C-plan that would be crossed by this section of Corridor 4.

6.2.4.7 Corridor 7 - Green

Corridor 7 begins at the existing Westgate Substation which then links to the existing Tarlton Substation, ending at the proposed Kromdraai Substation. This corridor passes through and runs adjacent to the Krugersdorp Game Reserve (KGR). This corridor alternative was suggested by IAPs at the public meeting held on 04 March 2008 and was assessed during an extension of the Scoping Phase. At the second meeting held on 15 January 2009 IAPs stated that this was a preferred alternative.

This area is open and undeveloped, with no existing linear infrastructure. It is thus considered to be an attractive area for several bird species such as korhaans and storks. For this reason, corridor 7 is opposed by the avifauna specialist.

Furthermore, the section through the reserve is designated as “Reserved” in GDACE C-plan and will meet with opposition from provincial conservation authorities. The nature reserve is also primarily untransformed natural grassland that is considered to be sensitive and to have elevated conservation value. This corridor is least preferred from an ecological conservation perspective.

Corridor 7 is also a preferred alternative from the Tarlton substation to the proposed Kromdraai substation in terms of avoiding geotechnical constraints. Based on comments from the Department of Environmental Affairs and Tourism (DEAT), the proposed Corridor 7 should be avoided or realigned due to the fact that it crosses an area of biodiversity conservation and also traverses a ridge categorised as Class 1 in terms of the Gauteng ridge policy guideline (DEAT, 2009).

Further to this, this corridor is not supported by the local authorities, namely the MCLM (MCLM, 2009) for the reasons set out below:

- Any negative visual impact will devalue the scenic beauty of the Game Reserve and has a direct bearing on the asset value;
- It is well known that the Krugersdorp Game Reserve is frequented by various birds of prey, placing these birds at risk of injury or death;
- Helicopters are used for game counting within the Reserve and the placement of the powerline within the area will be of high risk to aircrafts; and
- The proposed corridor traverses the lion camp which might pose a risk to Eskom’s maintenance team.

Based on the above, corridor 7 is considered an unfeasible alternative and shall not be considered any further as a possible alternative corridor.

6.2.4.8 Corridor 8 – Dark Blue

Corridor 8 is a disjointed corridor alternative as it is sections of all other seven corridors. All sections of corridor 8 link with other corridors to connect the existing Westgate Substation to the existing Tarlton Substation and then to the proposed Kromdraai Substation. Corridor 8 is the most favourable alternative based on input from IAPs (January, 2009).

The southern sections of corridor 8, between the Westgate and Tarlton Substations are not sensitive areas due to existing development. However, the sections between the Tarlton and proposed Kromdraai Substations are considered to be sensitive, particularly the section linking to the original corridor 4 and the section of corridor 8 on the farm Sterkfontein. These areas are open and free of infrastructure, from an avifaunal perspective, new powerlines in this area will have a significant impact on birds.

There are no ecological features of concern between the Tarlton substation and joining with Corridor 2. The favoured alignment from an ecological perspective would be to use the Corridor 2 link, follow the alignment that is common with Corridor 1 and then follow the remaining section of Corridor 8 to the Tarlton substation. The section south of the proposed Kromdraai substation to the northern boundary of the Krugersdorp Nature Reserve, crosses an area of untransformed grassland, which is thought to be potentially sensitive although it is not identified in GDACE C-plan as being of conservation concern.

In terms of geotechnical constraints, corridor 8 is preferred from the Westgate substation to the Tarlton substation. Corridor 8 running from the Westgate substation to the Tarlton substation is the preferred alternative based on reducing the visual impact on sensitive receptors as the alignment aligns with the general direction of a railway for approximately 7km before it turns north towards the Tarlton Substation. The route also avoids crossing through the agricultural holdings of the Central Region where a concentration of highly sensitive visual receptors reside.

The advantages and disadvantages of the identified corridor alternatives are provided in **Table 17**, below.

Table 17: Advantages and Disadvantages of the proposed corridor alternatives based on Specialist Input

Corridors	Advantages	Disadvantages
Corridor 1	▪ This corridor runs along existing power lines for almost the entire length and is thus advantageous from an avifaunal perspective. ▪ Majority of alignment in transformed areas of cultivation, mining and small holdings.	▪ Approximately 24% of the alignment is within untransformed habitat. ▪ Geotechnical constraint due to presence of dolomite.
Corridor 2	▪ Lies in areas transformed or disturbed by a combination of alien trees, a mine dump, cultivation, urban areas and existing roads.	▪ Approximately 45% of this alignment is potentially problematic in terms of the conservation value of the grassland. ▪ Geotechnical constraint due to presence of dolomite.
Corridor 3	▪ Highly degraded and therefore of no conservation value.	▪ Geotechnical constraint due to presence of dolomite.

Corridor 4	▪ Small holdings and associated disturbance occur near the eastern end of alignment. ▪ Little or no geotechnical constraint.	▪ Approximately 71% of the alignment is within untransformed habitat. ▪ Aligned in close proximity to heritage sites. ▪ Significant objections from IAPs.
Corridor 5	▪ This corridor runs along existing power lines for almost the entire length and is thus advantageous from an avifaunal perspective.	▪ Approximately 80% of the alignment is within untransformed habitat. ▪ Geotechnical constraint due to presence of dolomite. ▪ Aligned in close proximity to heritage sites. ▪ Least visual impact
Corridor 6	▪ Few conservation concerns within this alignment as it lies within an area of cultivated lands.	▪ Geotechnical constraint due to presence of dolomite.
Corridor 7	▪ Little or no geotechnical constraint on northern section of corridor. ▪ Whole alignment has a high visual impact	▪ This corridor traverses and runs adjacent to the Krugersdorp Game Reserve. ▪ No existing linear infrastructure in the area and relatively undeveloped land. ▪ The section through the Reserve is considered to be sensitive and to have elevated conservation value. ▪ Aligned in close proximity to heritage sites. ▪ Traverses a class 1 ridge. ▪ Significant opposition by relevant authorities.
Corridor 8	▪ No avifaunal sensitive areas between Westgate and Tarlton Substations. ▪ No ecological features of concern between Tarlton and joining with Corridor 2. ▪ Little or no geotechnical constraint on southern section of corridor.	▪ Certain sections between the Tarlton Substation and the proposed Kromdraai Substation are open and undeveloped, new powerlines will impact negatively on avifauna. ▪ Sections south of the proposed Kromdraai substation are potentially sensitive. ▪ Northern sections of corridor are aligned in close proximity to heritage sites. ▪ Southern section of corridor 8 has the least visual impact.

All alternative corridors were compared in terms of the findings of the various specialist studies and the results summarised as indicated in **Table 18**, below.

Table 18: Summary of specialist comparative analysis of alternative power line corridors

Specialist fields	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5	Corridor 6	Corridor 7	Corridor 8
Heritage resources	Preferred corridor from the Westgate Substation to the Tarlton Substation				Preferred corridor from the Tarlton Substation to the proposed Kromdraai Substation.			
Visual impact					Preferred corridor from the Tarlton Substation to the proposed Kromdraai Substation.			Southern section of corridor 8 is the preferred alternative between Westgate and Tarlton Substations.
Agricultural Potential	There is no clear alternative corridor that traverses a larger proportion of soils with a low agricultural potential.							
Avifauna	Preferred corridor from the Westgate Substation to the Tarlton Substation				Preferred corridor from the Tarlton Substation to the proposed Kromdraai Substation.		Least preferred corridor.	The sections of corridor 8 between Westgate and Tarlton Substations are not sensitive, however sections between Tarlton and the proposed Kromdraai Substations are considered to have a major impact on avifauna in the area.
Geotechnical suitability				Preferred corridor from the Tarlton Substation to the proposed Kromdraai Substation.			Also the preferred corridor from the Tarlton Substation to the proposed Kromdraai Substation.	Southern section of Corridor 8 from Westgate substation to the proposed Kromdraai substation is preferred.

Specialist fields	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5	Corridor 6	Corridor 7	Corridor 8
Ecology	Preferred corridor from the Westgate Substation to the Tarlton Substation	Equally suitable as alternative to corridor 1	Considered a favourable link between corridor 1 and 2.	Eastern section of corridor preferred from Tarlton Substation to the proposed Kromdraai Substation.	Equally suitable as alternative to corridor 4	Preferred corridor from Tarlton Substation to the proposed Kromdraai Substation.	Least preferred corridor	The favoured alignment from an ecological perspective would be to use the Corridor 2 link, follow the alignment that is common with Corridor 1 and then follow the remaining section of Corridor 8 to the Tarlton substation. The section south of the proposed Kromdraai substation is of conservation concern and not preferred.

6.3 Substation Locations

Prior to the commencement of the Scoping process, Eskom identified two locations for the proposed new Kromdraai Substation. The locations were identified on the basis of the assessments undertaken by Eskom's Land Rights and Planning Department. Further details pertaining to each location are outlined below.

6.3.1 Portion 149 of Sterkfontein 173 IQ[15]

This portion of land has been scoped out as a feasible alternative during the Scoping Phase and shall not be considered further due to objections raised by the landowner.

6.3.2 Portion 35 of Sterkfontein 173 IQ

The location for the new substation is identified by the letter 'G', on the maps in **Appendix C 1**. During the assessment undertaken by Eskom's Land Rights and Planning Department, the following factors were considered applicable to location G (Eskom, 2007b):

- This site is not located in close proximity to rivers;
- The terrain is flat and minimal earth works are foreseen;
- The substation can be built as per normal/standard design;
- The site is close to an existing MV line. These converge in the vicinity, minimising required line extensions to the new MV source; and
- A lot of applications are expected in this area due to the growth in opportunities in the area.

The following advantages and disadvantages associated with Portion 35 of Sterkfontein 173 IQ were outlined in Eskom's assessment (Eskom, 2007b):

Advantages:

- Close proximity to the existing network;
- Centrally situated and acceptable distance from Tarlton Substation;
- Easy assess from Main Road – lies close to the intersection of two main roads;
- Flat cultivated land;
- Sufficient space to accommodate the proposal; and
- The landowner did not have any objections to the location of the new substation on his property[16].

Disadvantages:

- Extended route of overhead lines to reach the proposed site;
- Cultivated land – compensation to landowners will be higher;
- Lines will traverse around an anthropological site to reach the substation;
- Quarrying practiced in the vicinity; and

[15] This site was identified by the letter J on the earlier maps circulated with the BID.
[16] Telephonic discussion with Mrs D Kathawaroo-Lunderstedt of Arcus GIBB held on the 7th January 2008.

- Route to be negotiated with owners of land in a newly developing upmarket residential area.

Table 19 below provides a summary of the advantages and disadvantages of the proposed location for the Kromdraai Substation based on input by technical specialists and IAPs.

Table 19: Advantages and Disadvantages of Portion 35 of Sterkfontein 173 IQ based on Specialist and IAP Input

Specialist fields	Advantages	Disadvantages
Heritage resources	No heritage resources are known to occur on the site.	A number of early hominid and palaeontological sites occur in the vicinity of the site.
Visual impact		The site will significantly increase the degree of visibility of the proposed substation.
Agricultural Potential	This site is not located on land of high or moderate agricultural potential.	Cultivated land will be traversed by the proposed powerlines to reach this site. However, minimal land will be affected due to the occasional placement of pylons.
Avifauna	Due to previous activities and the disturbed nature of the site, it is unlikely that the site will be inhabited by many bird species.	Many bird micro-habitats are located in close proximity to this site. I.e. wetland and exotic trees.
Geotechnical suitability		Medium to high risk of sinkholes and existence of steep slopes on site.
Ecology	The site is disturbed with weedy vegetation and is thus not considered to be ecologically sensitive.	Natural grassland surrounds the site.
Social impact	Landowner has no objections.	Issues of security during construction and operation of the site.

6.4 Technology

Table 20 provides a brief outline of the technological alternatives considered prior to the decision to improve the distribution network in the area.

Table 20: Assessment of technological alternatives

Demand and scheduling alternatives	Reason for rejection from further consideration
Delay new distribution lines until new generation facilities are constructed	Will not address short to medium term demand in the Tarlton area. The Distribution Division of Eskom must continue to expand and strengthen electrical networks into rural and urban areas to be in a better position to distribute electricity effectively and without incident when the capacity becomes available.
Improve energy efficiency of existing transmission power lines by installing capacitor stations between long sections of line	This is part of routine maintenance of existing lines and the energy-savings obtained will not be sufficient to meet the predicted demand.
Improve use of energy by consumers	An ongoing public awareness campaign by Eskom seeks to promote energy-efficiency. This is a long-term demand management strategy, which will not address the short to medium term problems.
Use underground cables as opposed to aboveground cables	Underground cabling for the length and type of the power lines proposed will be prohibitively expensive.

6.5 No development (No-go)

The no development alternative in the context of this project implies that the power line and new substation are not constructed.

The positive impact associated with the project not proceeding would be that all negative impacts associated with the development of the power line would be avoided. However, as indicated earlier, the existing power lines in the area (supplied from Spring Farms, Crocodile and Tarlton) are approaching their thermal limits and it is anticipated that the electricity demand requirements of the area will soon be exceeded. Should the project not proceed, development in the region will be negatively affected, as Eskom will not be in a position to ensure adequate quantity and quality of electricity supply. Ongoing development without an adequate supply of electricity will result in supply interruptions with corresponding negative impacts on residents in the area.

The benefits of this alternative are that most of the negative impacts associated with the proposed development option will be prevented. In particular, the following negative impacts will be prevented by the implementation of the no-project alternative:

- Impacts on ecological processes;
- Perceptions related to devaluation of properties;
- Impacts of possible expropriation; and
- Visual impacts.

Prevention of the above impacts will have a significant ecological, social and economic benefit. Notwithstanding the significant job creation potential and positive opportunities for local business, the largest cost of not proceeding with the project is that the positive impacts of the development option on the local economy would not be realised. Some of the possible consequences associated with this cost are as follows:

- A decline in supply of electricity;
- Cost of higher level maintenance on surrounding powerline networks; and
- Reduced efficiency due to blackouts caused by excessive loading on the current networks.

The above considerations demonstrate that whichever alternative is selected, there are likely to be ecological, social and economic consequences.

The potential for mitigation of consequences may be used as a criterion for determining which of the alternatives is preferred. By applying this principle, it is reasonable to deduce that mitigation of the impacts associated with the proposed development has greater potential than mitigation of the no-go project alternative. This is based on the rationale that through the use of appropriate mitigation measures most if not all impacts could be mitigated to an acceptable level.

The mitigation of the impacts associated with the no-go project alternative is largely reliant on reduced economic growth and development in the affected area. However it is observed that the opposite is occurring, thus placing more pressure on existing

electricity networks. For this reason, the proposed development, with the recommended mitigation measures, is considered to be the best option.

6.6 Conclusions

The alternatives discussed above were identified at a broad scale via input from IAPs, specialists and the project team. In terms of the powerline corridor alternatives it is the recommendation of Arcus GIBB that **Corridor 1** be used to link the existing Westgate substation to the Tarlton existing substation and that **Corridor 5** be used to link the existing Tarlton substation to the new proposed Kromdraai substation. The recommended powerline corridors were chosen due to the fact that they are aligned with existing powerlines and they avoid sensitive areas of ecological, historical and social significance.

In terms of alternative substation locations, Portion 35 of Sterkfontein 173 IQ is the preferred location as the alternative locations that have been considered are unfeasible. Based on specialist input there seems to be no impacts on the site that cannot be mitigated. Technological alternatives have been considered unfeasible due to time and cost constraints.

The No-Go alternative does not address the need to grow the existing electricity network and is thus not considered a feasible alternative.

In conclusion, the construction of the 132kv distribution powerline is recommended in corridors and 1 and 5 and the proposed substation on Portion 35 of Sterkfontein 173 IQ.

7 DESCRIPTION OF THE BASELINE ENVIRONMENT

7.1 Introduction

This section of the report provides a detailed description of the biophysical and socio-economic environment of the affected study area. Information from a Strategic Environmental Assessment (SEA) of the Magaliesburg and Surrounding Areas undertaken by Arcus GIBB in 2006 was utilised to describe the study area. This information has been augmented by more detailed site-specific information provided in the specialist reports and desktop research undertaken by Arcus GIBB. Throughout Section 7, reference is made to the 'broader region', which is defined as Mogale City and the Randfontein Local Municipalities, for the purposes of this document.

The Gauteng Province, in which the large majority of the broader region is located, is South Africa's smallest province. It is situated on the Highveld plateau with a surface area coverage of approximately 17 010 km^2. The province generates 33 % of the country's Gross Domestic Product (GDP) and is the largest sub-national African economy (http://www.gpg.gov.za/frames/gds-f.html).

Two local municipalities and one district municipality are recognised within the broader region. The local municipalities are the Mogale City Local Municipality (MCLM) in the west and the Randfontein Local Municipality (RLM) in the southwest. The West Rand District Municipality (WRDM) is responsible for a portion of the broader region between the MCLM and the City of Joburg Metropolitan Municipality (CJMM) known as the District Management Area (DMA). A DMA is usually an area of environmental sensitivity and in this case, is associated with the Cradle of Humankind World Heritage Site (COHWHS). Responsibility for the management and development of the portion of the COHWHS that falls within Gauteng currently lies with the Gauteng Provincial Government (WRDM IDP, 2004). **Figure 7** indicates that the vast majority of the broader region is within the jurisdiction of the MCLM.

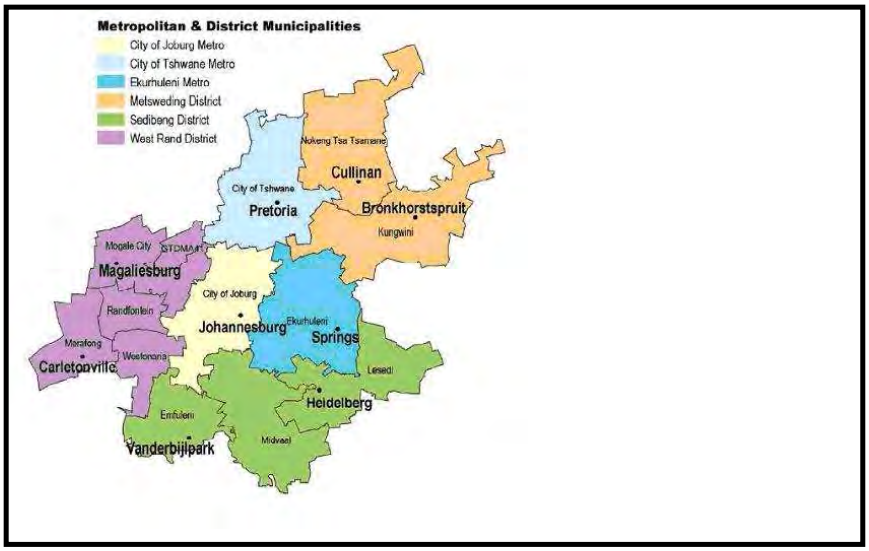


Figure 7: Municipal boundaries of Gauteng (Gauteng SOER, 2004)

7.2 Climate

7.2.1 Temperature

The broader region is characterised by a large variation between summer and winter temperatures. A significant portion of the broader region experiences a dry, sunny climate with temperatures during summer ranging between 20°C and 30°C[17]. The eastern part of the broader region experiences a lower mean annual temperature of 15°C[18]. Winter temperatures are low with Gauteng experiencing a daily mean temperature of 9.8°C in July. A well-defined inversion layer develops in the winter months, which prevents the mixing of the upper atmosphere with the lower atmosphere and thus the dispersion of pollution. Frost is a common occurrence in the winter months.

7.2.2 Rainfall

The annual average rainfall is 600 mm to 800 mm, which is mostly concentrated between October and March. Rain occurs mainly as thunderstorms in the late afternoons, sometimes with hail. The storms are typically very localised, with the weather clearing soon afterwards. Spectacular lightning displays are a distinguishing characteristic of the Highveld plateau. The mean annual precipitation and evaporation in the MCLM is 735 mm[19].

7.2.3 Wind

The prevailing wind direction in the broader region is north westerly in winter and south-easterly in summer. Moderate to strong winds are experienced infrequently and are generally limited to the autumn months[20].

7.3 Topography and Terrain

The majority of the broader region can be described as topographically complex with significant variation from one area to another. The ground slope is gentle (< 5°) over much of the study area with the lowest point in the north, 1450 meters above see level (masl) and the highest point in the south with a maximum of 1720 masl[21].

The northern portion of the study area is heavily influenced by a number of significant catchment areas that drain into the Rietspruit. The strength of the underground aquifers is due to the dolomite bedrock that underlies most of the proposed site, exemplified by the ubiquitous farm name Sterkfontein[22].

The geology of the area has resulted in a number of significant geomorphological features. The broader region comprises largely of a high-lying band, which runs in an east-west direction through the central area of the Gauteng Province (**Appendix C 1**).

[17] Strategic Environmental Focus, 2003, Mogale City State of Environment Report
[18] Department of Agriculture, Conservation, Environment and Land Affairs, 2004, Gauteng State of Environment Report
[19] Strategic Environmental Focus, 2003, Mogale City State of Environment Report
[20] Strategic Environmental Focus, 2003, Mogale City State of Environment Report
[21] Moore Spence Jones, 2008,Geotechnical Study for the proposed Westgate Tarlton Kromdraai Powerline EIA
[22] Moore Spence Jones, 2008,Geotechnical Study for the proposed Westgate Tarlton Kromdraai Powerline EIA

7.4 Geology and Soils

7.4.1 Geology

The majority of the broader region is characterised by six geological units within the Pretoria Group, namely the following:

- Magaliesberg formation (recrystalised orthoquartzite);
- Silverton formation (siltstones, shales interbedded with limestone and hornfels);
- Daspoort formation (orthoquartzite and shale partings);
- Strubenkop formation (Ferruginised shale and quartzite);
- Hekpoort formation (andesitic lava); and
- Timeball formation (shale, siltstone and slate)[23].

The specific study area is underlain by sedimentary rocks of Randian and Vaalian age belonging to the Karoo, Transvaal and Witwatersrand Supergroups. A number of diabase dykes occur mostly in the northern portion and are post-Transvaal in age but pre-Karoo. These weathered rocks may be overlain in part by a mantle of discontinuous sandy soils of mixed origin and significant residual products above the dolomite.

The Transvaal Supergroup is composite of fine-grained dolomite and Black Reef Quartzite sediments, which underlie majority of the study area. Significant rock outcrop of dolomite, chert and quartzite were observed during the site inspection[24]. Furthermore the occurrence of dolomite or soluble carbonate rocks at the base of the Transvaal Supergroup sediments was noted.

Fine–grained Karoo Supergroup Sediments underlie a significant portion of the study area to the north in shallow depressions on the areas of dolomite. The southern extremity of the study area is underlain by gold-bearing quartzite and shale of the Witwatersrand Supergroup.

7.4.2 Soil Cover

Soil structures are varied and 46 different land types occur, with a fair proportion of the soils classified as unstable, having high erosion potential or a high erosion hazard potential[25].

Four types of soil cover characterise the study area, they are:

- Transported aeolian sand;
- Alluvium;
- Pedogenic duricrusts; and
- Residual soils.

Transported aeolian sand occurs throughout the study area with the exception of areas of shallow or outcropping bedrock. This soil type is considered to be potentially

[23] Strategic Environmental Focus, 2003, Mogale City State of Environment Report
[24] Moore Spence Jones, 2008,Geotechnical Study for the proposed Westgate Tarlton Kromdraai Powerline EIA
[25] Strategic Environmental Focus, 2003, Mogale City State of Environment Report

collapsible and subject to creep movements, however it is neither expansive nor dispersive.

Thin to moderately thick alluvial soils do occur in the river and stream sections such as in the northern portion of the study area where the Rietspriut is found. Perched water tables and occasional flooding of the area may produce significant ground heaves and compressible soils.

Pedogenic duricrusts are secondary deposits, which consist of nodular to hardpan ferricrite and may only affect the central and northern portions of the study area. All proposed powerline route alignments and the proposed Kromdraai substation site will be affected by residual soils, however the thickness of this soil layer is not considered to be significant. Residual soils above the dolomite are expected to be highly variable from non-existent to deeply weathered chert and wad conducive to sinkhole and doline formation[26].

7.4.3 Mineral Resources and Undermining

Mineral resources, such as gold, silver and manganese occur in the underlying quartzite within the West Rand North Gold Field and manganese deposits within the Manganese Field underlain by the dolomite.

A number of mining activities occur in the southern portion of the study area notably gold mining and to a lesser extent clay mining for brick making. Shallow open-cast brick-making clay pits occur mostly within the Karoo deposits overlying the dolomite.

The most significant and active mine in close proximity is the Randfontein Estate Gold mine, now known as Mogale Gold. Harmony Gold Mining Company Ltd has expressed concern regarding undermining at shallow depth and the existence of soil pipes in the study area.

7.4.4 Seismicity

Most of the study area is affected by a very likely probability for liquefaction with a peak horizontal acceleration of > 200 cm2/s (Welland, 2002) and is based on a seismic intensity of VI (Modified Mercalli Scale) with a 10% probability of being exceeded in 50 years (Fernandez & Guzman, 1979)[27].

7.5 Flora and Fauna

7.5.1 Biodiversity

The presence of numerous ridges within the broader region and the variation in environmental conditions, which this creates, is the single-most important factor contributing to the high biodiversity ascribed to the area. In recognition of the importance of the area, the Magaliesberg Protected Natural Environment (MPNE) was established in terms of section 16 of the Environment Conservation Act, 1989 (Act 73 of 1989).

[26] Moore Spence Jones, 2008,Geotechnical Study for the proposed Westgate Tarlton Kromdraai Powerline EIA
[27] Moore Spence Jones, 2008,Geotechnical Study for the proposed Westgate Tarlton Kromdraai Powerline EIA

7.5.1.1 Vegetation

In terms of the vegetation classification of Low and Rebelo (1996), the dominant vegetation types within the study area is Rocky Highveld Grassland (Grassland Biome). The Rocky Highveld Grassland covers an area of approximately 24 063 km^2 within South Africa, approximately 65% of which has been transformed and 1.4% of which is currently conserved. The transformation within this Vegetation Type is mainly attributable to urbanization and agriculture. The study area is in a part of Gauteng where this vegetation type is relatively fragmented. The most important conservation areas that contain examples of this vegetation type are Suikerbosrand, Rustenburg, Abe Bailey and Boskop Dam Nature Reserves.

Acocks (1953) classified the broader region as Bankenveld. According to Acocks (1988), there are three variations of Bankenveld, a western, a central and an eastern one. The central variation occurs in the Witwatersrand area and represents the study area. It is a wiry and sour grassland found on poor, acidic soils. Important species include the following grasses *Trachypogon spicatus*, *Tristachya leucothrix*, *Panicum natalense*, *Elionurus muticus*, *Heteropogon contortus*, *Eragrostis chloromelas*, *Eragrostis racemosa*, *Eragrostis capensis*, *Diheteropogon amplectens*, *Brachiaria serrata*, *Schizachyrium sanguineum*, *Loudetia simplex*, *Tristachya rehmannii* and many more. A number of forbs also form part of the central variation, including *Helichrysum acutatum, Helichrysum pallidum*, *Sphenostylis angustifolius*, *Senecio coronatus, Senecio inornatus*, *Nidorella hottentotica*, *Justicia anagalloides*, *Cycnium adonense, Pearsonia cajanifolia*, *Vernonia natalensis* and many others. In sandier parts overgrazing results in an abundance of *Stoebe vulgaris*.

The proposed study area falls within two main vegetation types, namely Carletonville Dolomite Grassland and Soweto Highveld Grassland. There are other vegetation types in the surrounding areas, however these are not affected by the proposed development. These other vegetation types include Egoli Granite Grassland, Gold Reef Mountain Bushveld, Gauteng Shale Mountain Bushveld and Eastern Temperate Freshwater Wetlands. Refer to **Figure 8** below for an indication of the vegetation types within the study area.

The Carltonville Dolomite Grassland is a species-rich mosaic of plant community types occurring on undulating plains dissected by rocky chert ridges. It is a vegetation type that is characterized by the presence of the species, *Aristida congesta*, *Brachiaria serrata*, *Cynodon dactylon*, *Digitaria tricholaenoides*, *Diheteropogon amplectens*, *Eragrostis chloromelas*, *Eragrostis racemosa*, *Heteropogon contortus*, *Loudetia simplex*, *Schizachyrium sanguineum*, *Setaria sphacelata*, *Themeda triandra*, and a wide variety of herbaceous forbs and other grasses.This vegetation type is considered to be Vulnerable (Driver *et al*., 2005 and Mucina *et al*., 2006), and whilst the conservation target is 24%, only a small extent is currently protected and 23% is considered to be transformed, mostly by cultivation (17%), urbanization (4%), forestry (1%) and mining (1%) (Mucina *et al*. 2006).

The Soweto Highveld Grassland is a short to medium-high, dense, tufted grassland dominated almost entirely by Themeda triandra occurring on moderately undulating landscapes of the Highveld plateau. According to Mucina et al. (2006), this is a grassland that is characterized by the dominance of the species, *Themeda triandra*, accompanied by a variety of other grasses, such as *Elionurus muticus*, *Eragrostis racemosa*, *Heteropogon contortus* and *Tristachya leucothrix*. This vegetation type is considered to be Endangered (Driver *et al*., 2005 and Mucina *et al*., 2006). The

conservation target is 24%, only a small extent is currently protected. A total 47% is considered to be transformed, mainly by cultivation, urban sprawl, mining and building of road infrastructure (Mucina *et al*. 2006).

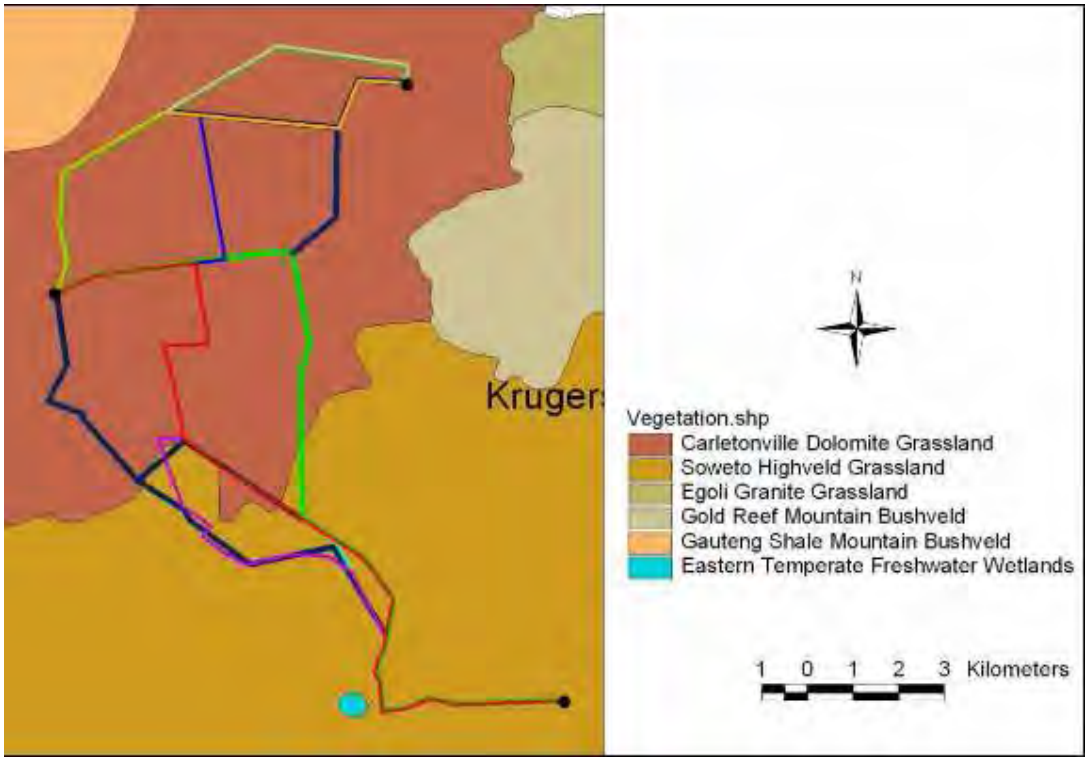


Figure 8: Broad vegetation types of the proposed study area (from Muicina, Rutherford and Powrie 2005).

In the area that will be affected by the proposed infrastructure, there are four small areas of grassland and one larger extent of grassland. All of these areas of grassland are affected to a large degree by the surrounding land-use. In the southern region of the study area mining activities has impacted heavily on remaining areas of natural vegetation thus the grassland tends to be in poor condition and often extensively invaded by exotic trees, primarily *Acacia mearnsii*. This area constitutes the remaining areas of the Endangered Soweto Highveld Grassland occurring primarily on Black Reef quartzite geology. In the broad study area, this is a medium to short grassland dominated by the grasses and forbs *Cynodon dactylon*, *Eragrostis curvula*, *Sporobolus fimbriatus*, *Setaria sphacelata*, *Aristida congesta*, *Pollichia campestris*, *Bulbostylis burchellii*, *Eragrostis chloromelas*, *Brachiaria serrata*, *Conyza canadesis*, *Hyparrhenia hirta* and *Pentarrhinum insipidum*. This species composition is indicative of a high disturbance regime.

The larger area of grassland in the northern half of the study area between Tarlton and Kromdraai, including the area within the Krugersdorp Nature Reserve falls within Carletonville Dolomite Grassland and is classified as Vulnerable and occurring primarily on Chuniespoort dolomite geology. This area has been cultivated to a large degree, however many of the shallower soils were not ploughed thus these, along with some areas of sandier soils constitute the remaining expanse of grassland. There are portions of these grasslands that are in relatively good condition. In the

broad study area this is medium height grassland dominated by the grasses and forbs *Schizachyrium sanguineum*, *Themeda triandra*, *Brachiaria serrata*, *Digitaria erianthe*, *Eragrostis racemosa*, *Panicum natalense*, *Sporobolus fimbriatus*, *Eragrostis gummiflua*, *Heteropogon contortus*, *Diheteropogon amplectens*, *Eragrostis curvula*, *Eragrostis chloromelas* and *Cynodon dactylon*.

The remaining patches of grassland are considered to have elevated conservation importance due to poor rates of conservation nationally. Untransformed natural grassland is considered to have a high sensitivity and conservation importance within the study area along the proposed corridor alignments.

Two threatened orchid species (*Habenaria barbertoniae* and *Habenaria mossii*) have a high probability of occurring within the study area, and the threatened species *Melolobium subspicatum* has a medium probability of occurring in the study area.

Two species (*Hypoxis hemerocallidea* and *Eucomis autumnalis* subsp. *clavata*) classified as declining have a medium and high probability of occurring in the study area. These species are not of concern as they are both very widespread and disturbance to a small part of the total population will not in any way impact on the chance of survival of these species in the future.

Two species that are listed as data deficient (DD) (*Cheilanthes deltoidea* subsp *nov.* and *Lotononis adpressa* subsp. *leptantha*) have a medium probability of occurring in the study area. These species are unlikely to be affected by the proposed infrastructure.

7.5.1.2 Fauna

No red data mammals have been confirmed for the proposed study area. However, Geoffroy's horseshoe bat (*Rhinolophus clivosus*), Peak-saddle Horseshoe bat (*Rhinolophus blasii*), Temminck's hairy bat (*Myotis tricolor*), White-tailed rat (*Mystromys albicaudatus*) and the South African Hedgehog (*Atelerix frontalis*) occurred here historically (museum records). Other vertebrate species with a distribution and habitat preference that co-incides with the proposed study area are the Striped Harlequin Snake and Giant Bullfrog.

On the basis of habitat preference and geographical distribution, the White-tailed rat and South African Hedgehog have a medium chance of occurring at sites along the proposed corridor alignments, however no signs of any of them were found. The Southern African Hedgehog occurs in a wide variety of terrestrial habitats where there is ample ground cover. It could therefore occur in any untransformed terrestrial habitats in the study area. The White-tailed Rat occurs in Highveld and montane grassland, where it requires sandy soils with good cover. It has been previously recorded in this grid and could therefore occur in grasslands within the study area.

There is one Red List reptile species that could occur in the study area, the Striped Harlequin Snake. This species has a medium chance of occurring in the study area. On the basis of habitat requirements it could occur in old termitaria or under rocks in grassland. It could therefore occur in the grasslands in the study area.

There is one Red List amphibian that could occur in the study area, the Giant bullfrog. This species occurs in seasonal, shallow grassy pans in flat open areas, but also utilizes non-permanent vleis and shallow water on the margins of waterholes and

dams. It has not previously been recorded in the proposed study area and, on the basis of habitat requirements, has only a medium chance of occurring in the study area as a whole.

7.5.2 Biophysically sensitive and protected areas

There are two main wetland areas within the study area, one located in the south near the Westgate substation and the other in the north near the proposed Kromdraai substation and southwards from there. The southern wetland constitutes a seasonal marsh wetland associated with an unchannelled drainage line. The northern wetland is considered to be a permanent marsh wetland associated with the Rietspruit stream, a small tributary of the Bloubankspruit that flows into the Crocodile River. Within the marsh wetlands a number of habitats may be distinguished, based on the vegetation structure such as the vegetation physiognomy, life form structure and floristic composition of the constituent plant communities. The major factors influencing the distribution of these zones include frequency and duration of inundation and/or elevated soil moisture levels. The lower parts of the slopes tend to be more channelled and contain more permanent wetlands than further up-slope, where temporary wetlands may occur. Within the study area, seasonal to temporary wetlands have been heavily impacted by mining, cultivation and urbanisation and as a result are not in good condition. In some places, especially close to existing infrastructure, these wetlands are heavily invaded by alien plant species.

It is difficult to assess the floristic value of affected wetlands along the proposed alternative corridors due to the fact that no comprehensive regional conservation assessment of these systems has been undertaken for the Highveld region. However, wwetland vegetation is considered to have elevated conservation importance due to the importance of these habitats in hydrological and ecological processes. There is one animal species (Marsh sylph butterfly) that could occur within this vegetation type in the type of habitats available in the study area. Wetlands are therefore considered to have a high sensitivity and conservation importance where it occurs along the proposed corridors.

Other important conservation areas in proximity to the study area include the following:

- Magaliesberg Protected Natural Environment;
- Kings Kloof Natural Heritage Site;
- Cradle of Humankind World Heritage Site;
- Krugersdorp Game Reserve;
- Kromdraai Conservancy and other conservancies;
- Private game farms; and
- Blougat Nature Reserve.

Appendix C3 illustrates the location of environmentally sensitive areas, identified as such by GDACE C-Plan Version 2 in terms of the following three categories:

- Important site;
- Irreplaceable site; and/or
- Protected area.

The areas of ecological importance identified are indicative of areas in which important ecological processes take place, which sustain not only the immediate area within and around the study area but which also influence the regional environment. Most of these processes are associated with the ridges within the broader region. Pollination, nutrient cycling, hydrological processes, groundwater dynamics, wildlife dispersion and cave ecosystem dynamics are some of the ecological processes associated with the ridges in the broader region. Areas of important ecological processes are represented in **Appendix C 4** and **Appendix C 5**.

Some of these processes e.g. cave ecosystem dynamics are not well understood and significant research is still needed to develop our understanding of the functioning of these processes.

7.6 Sites of Archaeological, Cultural and Heritage Interest

The Cradle of Humankind World Heritage Site (COHWHS) is the most important cultural resource in the study area. The area contains a rich diversity of Stone Age relics and hominid fossils considered to be between 3 million and 1.5 million years old contained in dolomite caves. It is one of the world's richest hominid fossil site[28].

Tools from the Early Stone Age (ESA) were found in the vicinity of watercourses located in Sterkfontein. During Middle Stone Age (MSA) times, people became more mobile, occupying areas formerly avoided. Open sites were still preferred near watercourses.

During the Late Stone Age (LSA) people had more advanced technology and therefore succeeded in occupying more diverse habitats. There is now evidence of people's activities derived from material other than stone tools such as ostrich eggshell beads, ground bone arrowheads, small bored stones and wood fragments with incised markings. A number of sites dating to this period have been studied by Wadley (1987) in the Magaliesburg area. In the case of the LSA, a rich legacy of rock art has been left behind, which is an expression of people's complex social and spiritual beliefs. Some rock engravings occur near Hekpoort. LSA people preferred to occupy rock shelters and caves, of which a few smaller ones are known from the study area.

The occupation of the broader region by Iron Age communities did not start much before the 1500s. Due to climatic fluctuations, bringing about colder and drier conditions, people were forced to avoid this area. Following a dry spell that ended just before the turn of the millennium the climate became better again until about AD 1300. This coincided with the arrival of the ancestors of the present day Sotho-, Tswana- and Nguni-speakers in southern Africa, forcing them to avoid large sections of the interior.

By approximately AD 1500 the climate again changed for the better and we found that early Sotho-Tswana speakers moved into areas formerly avoided. The climate become warmer and wetter, creating conditions that allowed Late Iron Age (LIA) farmers to occupy areas previously unsuitable, for example the Witwatersrand and the Free State. At the same time, new cereal crops, e.g. maize, was introduced from Maputo and grown extensively. This increase in food production probably led to increased populations in coastal area as well as the central highveld interior by the

[28] http://www.places.co.za/html/sterkfontein_caves.html

beginning of the 19th century. This wet period came to an end sometime between 1800 and 1820 by a major drought lasting 3 to 5 years. The drought must have caused an agricultural collapse on a large, subcontinent scale. This was also a period of great military tension. Qriqua and Korana raiders were active in the northern Cape and Orange Free State by about 1790. The Xhosa were raiding across the Orange River about 1805. Military pressure from Zululand spilled onto the highveld by at least 1821. Various marauding groups of displaced Tswana moved across the plateau in the 1820s. Mzilikazi raided the plateau extensively between 1825 and 1837. The Boers trekked into this area in the 1830s.

Recent research has indicated that some of the stone walled sites, e.g. those at Doornspruit, appear similar to Zulu settlements in plan and can most likely be associated with Mzilikazi and the Ndebele (Huffman 2004).

As a result of this troubled period, Tswana people concentrated into large towns for defensive purposes. Because of the lack of trees they built their settlements in stone. From the air, these homesteads and towns are easily recognised and it is also possible to determine variations in smaller detail.

The MCLM also has a significant range of heritage sites including relics from the Anglo-Boer War, Second World War graves, Blockhouses, a water separation point on the highest natural ground level in the West Rand (north and south of the Windsor Road) and the Kagiso township to name but a few.

Originally the trekkers who settled in the area occupied themselves with farming. After the discovery of gold on the Witwatersrand, exploration also started in this area, e.g. the well known Harry and Fred Struben were exploring in the Sterkfontein area during 1884. One of the oldest gold mines was established in 1874 at Blaauwbank and another in 1891 on the farm Kromdraai. By this time the fossil-bearing caves were already known and lime quarrying started about 1895. However, it was more than forty years later, in 1936, that Robert Broom first identified the remains of a number of fossil hominids. During the Anglo-Boer War, a number of battles took place in the area. The biggest battle was in the vicinity of Krugersdorp at Nooitgedacht (Magaliesberg range) on 13 December 1900. Krugersdorp was captured in June 1900 by Gen. Hunter. Most histories are still under presented in terms of contemporary history. Although it might be to recent and therefore hold a lot of pain for people that were involved, communities should be approach and sounded out as to appropriate commemoration and memorialization of recent events.

7.7 Surface and Groundwater

7.7.1 Surface Water

Just outside the western portion of the broader region, is the primary drainage area of the Limpopo River in the North West Province. Wetlands, pans and dolomitic eyes fed by underground water resources are characteristic of this part of the broader region.

Major rivers within the portion of the broader region falling within the MCLM include the Crocodile, Magalies and Bloubank Rivers. The area also includes a number of wetlands such as peat lands, pans and marshes. An east-west watershed dominates

the larger part of the MCLM, which drains via the Crocodile River and forms part of the Limpopo catchment. Water bodies within the MCLM cover an area of ± 280 ha.[29]

7.7.2 Groundwater and Seepage

Groundwater is expected to be generally deep (>15m), except in the low-lying areas occupied by drainage paths. A number of isolated marshy areas were identified within both sections. The project area traverses DWAF tertiary drainage regions C22 in the south to A21 in the north (DWAF, 1999), which marks the main Watershed/Continental Divide. The area to the north comprises the Limpopo-Indian Drainage Basin and to the south the Vaal-Orange-Atlantic Drainage Basin

Hydrogeologically the bedrock aquifers can be classed as intergranular and fractured and are classed as minor aquifers (DWAF & WRC, 1999), except for the dolomite occurrence confined mostly to the Tarlton-Kromdraai corridor, but also in the northern and central portions of the Westgate-Tarlton corridor. The dolomite is classed as a major and sensitive strategic resource aquifer. Better yields are usually found on the upper and lower contacts of the diabase dykes.

In terms of aquifer susceptibility, the area to the south and east of the dolomite occurrence is classed as *medium* (due to moderate vulnerability and minor aquifer classification). The dolomite is classed as *highly susceptible* and all aquifers to the west of the dolomite have a *low susceptibility* (DWAF & WRC, 1999).

The Tarlton-Kromdraai link is affected by dyke barrier intrusions which have compartmentalised the dolomite into the Steenkoppies Compartment to the west and the Zwartkrans Compartments to the east.

A number of important springs also occur such as Maloneys Eye to the west and Kromdraai and Danielspruit Eye to the east. The groundwater generally occurs at a depth of more than 15m below surface.

The groundwater quality is suitable for most uses as indicated by an EC value of 70 to 300 mS/m and TDS of < 300 mg/l. Underground precautionary measures for concrete or reinforcing are not envisaged due to groundwater but a low pH in the transported soils should be accounted for.

A perched groundwater should also be expected at the interface of the surficial soils and the underlying bedrock or hardpan ferricrete.

7.8 Regional Socio-Economic Structure

7.8.1 Demographics

According to Statistics South Africa, the 2007 Community Survey shows that the population in the West Rand District Municipality has grown from 533 675 in 2001 to 539 038 in 2007, which means there has been a growth of 5 363 persons. The survey illustrates a population decline in Randfontein, Westonaria and the District Management Area (DMA) with a population growth in Mogale City of 29 806 persons.

[29] Strategic Environmental Focus, 2003, Mogale City State of Environment Report

Table 21: Population Statistics of the West Rand District Municipality, Statistics South Africa, Community Survey 2007

Municipalities	Census 2001	Community Survey 2007
Mogale City,	289 835	319 641
Randfontein	128 731	117 261
Westorania	109 328	99 218
DMA	5781	2 918
Total WRDM	5 33 675	539 038

7.8.2 Health

The MCLM on the whole is faced with a host of problems related to inadequate health care service provision. Though good health service infrastructure exists, there is still a high prevalence of Tuberculosis (TB) in the region (though this could be linked with the high incidence of HIV/AIDS). Coliform bacterial levels in water are over allowed limits and there is occurrence of Bilharzia in surface water[30]. Clinics within the broader region can be found in Magaliesburg and Hekpoort. Twenty-four hour medical services are not available in the area. Community health facilities are available in the WRDM, a total of 28 clinics are operational. The WRDM received R 18 million for primary health care[31].

7.8.3 Education

The West-Rand operates under the South African education system which is divided between a public education system that largely serves low-income people and a private sector education system which largely serves the middle- to upper-income groups. There has been an improvement in terms of access to education however the low level of functional literacy (completed grade 7 or higher) among the black population affects the quality of labour being offered[32].

Within the MCLM, approximately 40 % of the population have had no schooling at all, with the majority of the population having attained only secondary level education[33].

Table 22: Functional literacy: age 20+, grade 7 or higher for 2005 in the West Rand District Municipality – Global Insight Data

	Mogale City	Randfontein	Westonaria
Black	82.6%	79.6%	68.2%
White	99.7%	99.6%	99.5%
Coloured	78.2%	91.3%	95.8%
Asian	96.9%	100.0%	97.0%
Total	88.0%	84.3%	74.1%

[30] Strategic Environmental Focus, 2003, Mogale City State of Environment Report
[31] West Rand District Municipality, 2008/09, Integrated Development Plan
[32] West Rand District Municipality, 2008/09, Integrated Development Plan
[33] http://www.demarcation.co.za/info

Table 23: Education dashboard (Highest level of education: age 15+) in the West Rand District Municipality – (Global Insight Data)

Level of education	1996	2005	1996-2005, Percentage Change
No schooling	40220	19146	-6%
Grade 0-2	2055	5027	16%
Grade 3-6	56940	49779	-1%
Grade 7-9	111953	114368	0%
Grade 10-11	85754	104049	2%
Less than matric & certif/dip	7899	3401	-6%
Matric only	75322	126320	8%
Matric & certificate	2889	4513	6%
Matric & diploma	8918	14769	7%
Matric & Bachelors degree	4315	6621	6%
Matric & Bachelors & honours	461	419	-1%
Matric & Bachelors & diploma	736	1085	5%
Matric & Masters degree	507	490	0%
Matric & Doctors degree	127	118	-1%
Matric & Other qual	6751	10506	6%

7.8.4 Employment

Even though the employment rate has reduced over the period depicted in **Figure 9** below, an increasing trend can be observed over the period 2001 to 2005.

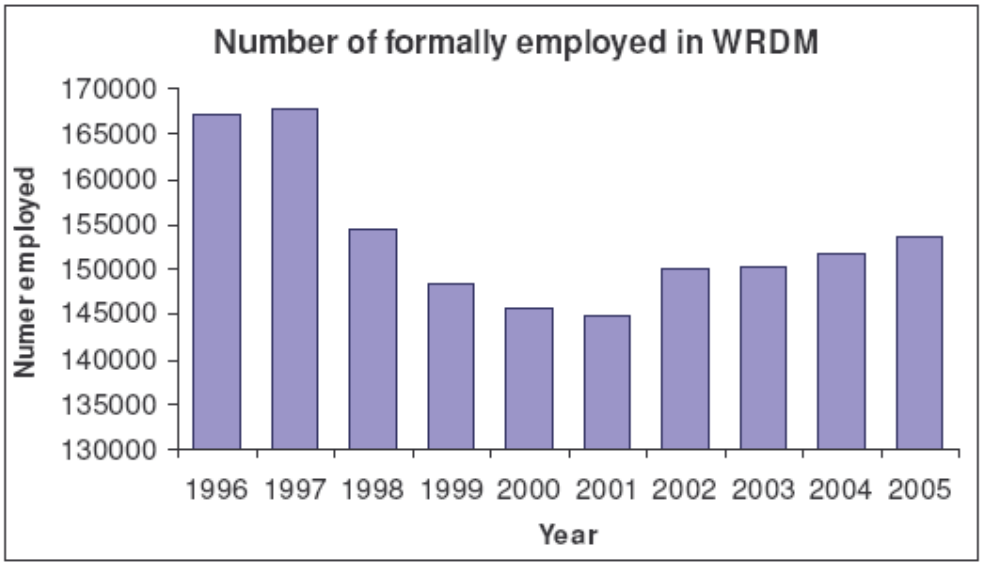


Figure 9: Trend of employment in the WRDM – (Global Insight Data)

The largest employers by sectors are considered to be mining, trade, community services and manufacturing, each employing more than 20 000 people in the WRDM. There is a decline in the mining sector which requires the diversification of industry to

absorb the additional supply of labour[34]. **Figure 10**, below indicates the number of people employed per sector in the WRDM.

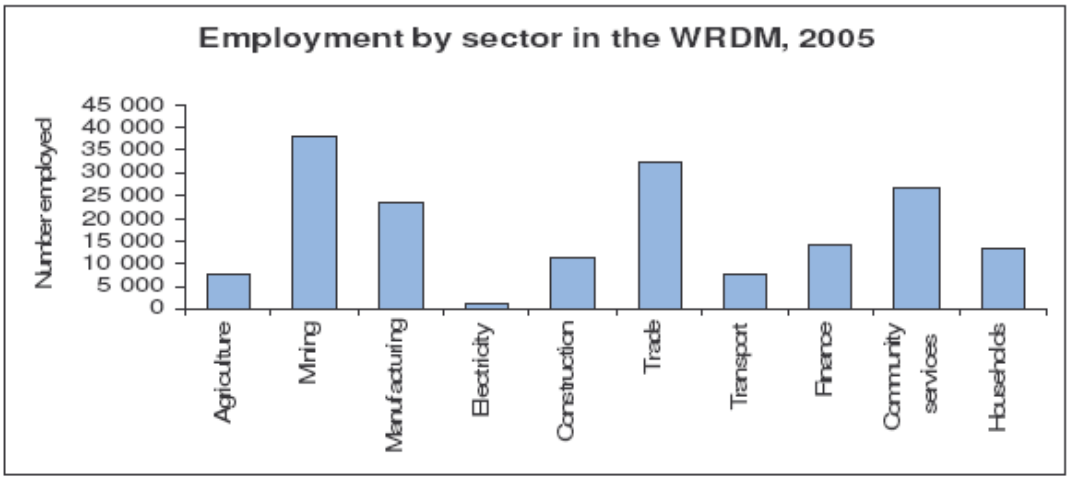


Figure 10: Employment by Sector in the WRDM, 2005 – (WRDM GDS 2007)

Persistent low economic growth, substantial capitalisation of production processes and the relatively small increase in labour productivity are responsible for the high unemployment rate and poverty in the study area. Unemployment has been increasing since the 1990's. Job losses have been significant in the mining and agriculture sectors. In addition to this, changes in investment and exports have direct effects on growth and employment, the WRDM has experienced weak investment, thus limiting the ability to create jobs.[35] **Table 24** and **Table 25** indicate the number of people unemployed and the unemployment rate within the WRDM respectively.

Table 24: Number of unemployed in the WRDM – (Global Insight Data)

Year	Mogale City	Randfontein	Westonaria
1996	25 188	18 557	19 991
1997	27 719	20 625	22 205
1998	31 074	23 837	25 982
1999	32 446	25 255	28 442
2000	32 446	25 255	28 442
2001	37 655	29 981	33 822
2002	40 652	32 489	35 726
2003	41 764	33 512	36 999
2004	41 504	33 857	38 054
2005	41 318	34 301	39 290

[34] West Rand District Municipality, 2007, Growth and Development Strategy
[35] West Rand District Municipality, 2007, Growth and Development Strategy

Table 25: Percentage Unemployed within the WRDM – (Global Insight Data)

Year	Mogale City	Randfontein	Westonaria
1996	24.4%	29.7%	20.3%
1997	25.6%	31.4%	21.4%
1998	27.5%	34.6%	23.9%
1999	27.5%	35.1%	25.0%
2000	28.1%	36.5%	26.4%
2001	29.5%	38.4%	27.6%
2002	31.1%	40.5%	28.5%
2003	31.4%	41.1%	29.1%
2004	29.8%	40.3%	30.0%
2005	30.8%	40.9%	29.6%

Within the MCLM, there are 97 493 people employed (46.42%), 50 409 people unemployed (24%) and 62 105 (29.57%) economically inactive[36].

7.8.5 Provision of services

Most of the population within the MCLM have access to water and sanitation facilities as well as some health care facilities. As with a number of other local municipalities however, there is a backlog in the provision of Free Basic Services[37].

Service delivery and infrastructure development is an important government priority therefore universal access to basic services includes the following[38]:

- Eradicating bucket system by 2007;
- Access to basic water supply by 2008;
- Access to basic sanitation by 2010;
- Access to electricity by 2012; and
- Universal access to housing by 2010.

7.8.6 Housing

The 2001 Census data suggests that 58 % of the housing within the MCLM is a brick structure on a separate stand. Informal dwellings make up 28 % of the total[39]. MCLM is working towards reducing the housing backlog of 30 000 housing units which increase at least 2, 5 % per year.

The governments housing programme has assisted in the provision of more formal RDP houses, **Table 26** illustrates a general increase in formal housing since the census 2001.

[36] Mogale City Local Municipality, 2008/09, Integrated Development Plan
[37] Strategic Environmental Focus, 2003, Mogale City State of Environment Report

[38] West Rand District Municipality, 2008/09, Integrated Development Plan
[39] Mogale City Local Municipality, 2008/09, Integrated Development Plan

Table 26: Figures of dwelling types of census 2001 and community survey 2007 – (Statistics South Africa, Community Survey 2007)

Area	Formal		Informal		traditional		Other		Total
	01	07	01	07	01	07	01	07	
Mogale City	68.9	71.7	29	27	1.7	-	0.3	1,3	100
Randfontein	79.2	83.7	19.6	15	1.0	0.3	0.2	1,0	100
Westonaria	42.7	57,1	55.2	41,9	1.6	0	0.4	0.8	100
DMA	85.7	81.1	15.3	12.1	5.2	5.6	.0.9	1.1	100

7.8.7 Land use

In terms of the central part of the study region within the MCLM, there is an urban region in the eastern part, rural small holdings dominated by agriculture in the central zone (Hillside, Delarney, Golden Valley, Spring Farm, Doornboshfontein, Koestersfontein, Malony's eye) and natural habitat areas (which account for the largest land use within the municipality) towards the west (COHWHS). Irrigated agriculture is mainly concentrated in the Hekpoort valley (predominantly maize). **Appendix C 6** illustrates the agricultural potential of the broader region.

There is the need to identify areas for high-tech industries within this area, as there is currently no provision thereof. There is competition between the land uses of agriculture, tourism and conservation/natural habitat within the broader region[40].

Within the COHWHS, most of the land is used for farming purposes. A large proportion of the land has also been demarcated as conservation land due to palaeontological sites, Red Data species and ridges and wetlands found in the area. **Figure 11** below indicates the land use of the study area.

[40] Mogale City Local Municipality, 2008/09, Integrated Development Plan

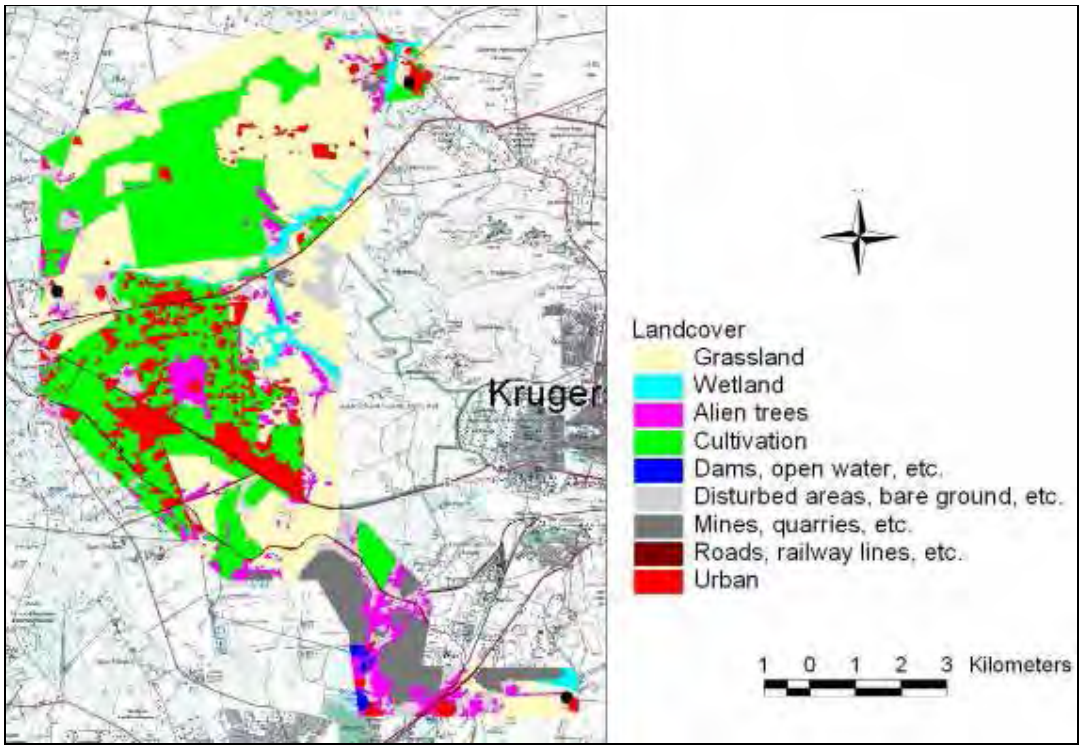


Figure 11: Land use of the study area (David Hoare Consulting, 2008)

7.8.8 Local Economy

The tertiary sector has contributed 63% to WRDM Gross Domestic Product (GDP). The fastest growing sub-sectors within the tertiary sector are insurance, real estate, financial intermediation and business services growing at 8.3%. Wholesale, retail trade, catering and accommodation are at 7.2% with transport, storage and communication at 6.9%.

Table 27: The average growth of WRDM industries per Local Municipality (Global Insight Data)

1996-2005, Average growth in GDP	Mogale City	Randfontein	Westonaria
1 Agriculture	1.2%	1.3%	1.4%
2 Mining	-5.4%	-5.3%	-5.4%
3 Manufacturing	2.3%	1.0%	2.7%
4 Electricity	-0.7%	-2.4%	-4.6%
5 Construction	2.9%	2.3%	3.4%
6 Trade	3.6%	2.9%	4.1%
7 Transport	6.3%	5.5%	6.0%
8 Finance	3.3%	3.2%	2.7%
9 Community services	1.2%	1.0%	0.9%
Total (Gross Domestic Product)	**2.7%**	**1.1%**	**-1.9%**

MCLM is the fastest growing area within the WRDM. In all three constituent municipalities, the mining industry has shrunk the fastest with a decline in the electricity industry as well.

7.8.9 Electricity

In brief, the power line network in the broader region consists of the following:

- Two substations (Westgate and Tarlton);
- A number of Sub substations (Randfontein Estates, Egoli Reduction, SAR Millsite, South Sub, Eltro West Deep, Monarch Shaft, Rand Centre)
- One existing 132 kV line between the Westgate and Tarlton Substations.

Tarlton is supplied from the Westgate 132 kV network. At the Tarlton Substation, both 11 kV and 44 kV are distributed to the area. A 44 kV line exits the Tarlton Substation and supplies the Magaliesburg and Springfarms Substations. A 400 kV power line is situated towards the north of the Tarlton Substation. Registered servitudes are in place for the existing power lines.

According to the 2001 Census data, approximately 68 % of the population in the MCLM has access to electricity for cooking and heating. The remainder of the population makes use of primarily paraffin, then coal, wood and gas. The primarily rural nature of the broader region has resulted in relatively limited development of electricity distribution infrastructure.

Eskom Distribution and the MCLM are responsible for providing electricity in the region. The most pressing challenges within the broader region with respect to electricity provision are the following:

- Provision of free basic electricity particularly in rural areas;
- Electrification of rural areas;
- Service backlogs;
- Poor payment levels;
- New connections and upgrading of existing networks;
- Legal compliance;
- Illegal connections; and
- Metering problems.

7.8.10 Sewerage

The MCLM has a well-developed waterborne sewage reticulation system consisting of three bulk wastewater treatment plants, ten pump stations and approximately 1200 km of pipelines. Sludge produced at the treatment plants is irrigated to farmland used for the cultivation of instant lawn.

A total of 79965 (95.74%) households within the MCLM have access to sanitation whilst 3566 households (4.26%) have no access. **Table 28** below indicates the types of sanitation used within the study area[41].

[41] Mogale City Local Municipality, 2008/09, Integrated Development Plan

Table 28: Types of sanitation utilised within the MCLM – (IDP 2008/09)

Flush toilet (connected to sewerage system)	59 622	71.73
Flush toilet (with septic tank)	5 352	6.40
Chemical toilet	1 384	1.65
Pit latrine with ventilation (VIP)	1 615	1.93
Pit latrine without ventilation	10 101	12.09
Bucket latrine	1 891	2.26
None	3 566	4.26
Total	83 531	100 %

7.8.11 Solid waste

The MCLM aims to provide a weekly refuse removal service for all premises in the municipality. In addition, a street-cleaning service for all roads in business areas and along main routes has been planned and a cleaning service to remove all illegal dumping on council-owned land. The MCLM has embarked on a similar process to that utilised by the CJMM in that they are systematically providing 240 L wheelie-bins to all premises within the municipality, including those within rural areas. The refuse removal service is, however, still being developed and it is acknowledged that the most serious challenge remains the servicing of the rural areas. According to the 2001 census data, approximately 18 % of the population in the MCLM make use of their own refuse sites. This figure escalates to 88 % within the DMA. Illegal dumping within the MCLM part of the broader region is being tackled through the provision of public drop off facilities. Methods of waste removal are highlighted in **Table 29** below.

Table 29: Methods of waste removal in the MCLM (IDP 2008/09)

Removed by local authority at least once a week	61 985	74.20
Removed by local authority less often	849	1.01
Communal refuse dump	2 321	2.77
Own refuse dump	14 670	17.56
No rubbish disposal	3702	4.43
Total	83 527	100 %

The availability of appropriate equipment and vehicles is regarded as a constraint to providing the service. The availability of adequate waste disposal facilities is a significant issue within the broader region with only two sites in operation namely the Luipaardsvlei Landfill Site (servicing urban areas) and the Magaliesburg Landfill Site (servicing rural areas) in operation. The sites do not meet the standards of the Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998). It is the intention of the MCLM for the Luipaardsvlei Landfill Site to be replaced by a new, properly designed and constructed facility. Two-transfer stations/drop off facilities are also planned for the municipality.

8 ENVIRONMENTAL IMPACT ANALYSIS

8.1 Introduction

The significant environmental impacts identified in the Scoping Phase as well as newly identified possible impacts have been assessed through the various specialist studies. The findings of the impact assessment have been consolidated into this section of the report. The impacts have been classified according to the relevant assessments that have been conducted. The significance of residual (post-mitigation) impacts is marked according to the following colour code:

	Impact of high significance
	Impact of medium significance
	Impact of low significance

The significance of the residual impact (impact after mitigation) for most impacts was assessed to be of low significance.

The only negative residual impacts of high significance are the destruction or permanent loss of individuals of Red List species.

Negative residual impacts of medium significance are as follows:

- Change in the existing qualities of the visual resource due to the construction and operation of the proposed Kromdraai substation;

Negative residual impacts of low significance are as follows:

- Destruction or disturbance to sensitive ecosystems;
- Destruction of vegetation in the footprint of tower structures;
- Fragmentation of sensitive habitats;
- Disturbance of natural vegetation;
- Impairment of the movement and/or migration of animal species;
- Increased soil erosion, increase in silt loads and sedimentation;
- Establishment and spread of declared weeds and alien invader plants;
- Damage to wetland areas;
- Increased dust during construction;
- Increased noise pollution during construction;
- Increased risk of veld fires;
- Collision of birds with conductor & earth wire;
- Electrocution of birds on towers;
- Electrocution of birds at proposed Kromdraai substation;
- Habitat destruction;
- Disturbance to avi-fauna;
- Electrical faulting as a result of birds;
- Loss of agricultural land;
- Destruction of heritage resources;

- Change in the existing qualities of the visual resource due to the construction and operation of the proposed Kromdraai substation

8.2 Impacts on vegetation and fauna

A major significant potential risk that the proposed development poses is to that of the ecological systems in the study area. David Hoare Consulting cc undertook the ecological study. The ecological study served to identify vegetation and faunal species. Sensitive habitats and plant and animal communities were also recorded. Refer to **Appendix E** for the full Ecological Study.

Potential impacts are described and assessed below and provided in summary in **Table 30**. Identified impacts may arise due to a number of activities, including the placement of pylons, temporary construction, access and service roads and vegetation clearing within servitude.

Potential impacts and specific mitigation measures from an ecological perspective are as follows:

- **Destruction or disturbance to sensitive ecosystems**
  This will lead to localized or more extensive reduction in the overall extent of a particular habitat. Consequences of this may include:

  - Increased vulnerability of remaining portions to future disturbance;
  - Negative change in conservation status of habitat;
  - General loss of habitat for sensitive species;
  - Loss in variation within sensitive habitats due to loss of portions of it;
  - General reduction in biodiversity;
  - Increased fragmentation (depending on location of impact); and
  - Disturbance to processes maintaining biodiversity and ecosystem goods and services.

  The potential magnitude of this impact is low due to the fact that grassland vegetation is not cleared below power lines. It will have an impact at the scale of the infrastructure such as pylons and access roads, which is local in extent. The duration of the impact will be permanent and the probability of occurrence is definite, unless the proposed powerline is aligned away from sensitive habitats.

- **Destruction of vegetation in the footprint of tower structures**
  This may only be an issue if the tower is situated within a sensitive habitat or within a species population of special concern.

  The potential magnitude of this impact is minor due to the small size of the pylons relative to the overall extent of the natural vegetation. It will have an impact at the scale of the proposed infrastructure, which is local. The duration of the impact will be permanent and the probability of occurrence is definite.

- **Fragmentation of sensitive habitats**
  This impact will arise due to destruction of habitat in such a way as to divide areas of habitat partially or fully into smaller parts. Consequences of this may include:

  - Impaired gene flow within fragmented populations;
  - Breakdown of ecological relationships, e.g. pollinator-plant;
  - Breakdown of migration routes; and
  - Reduced functional use, e.g. grazing.

  Fragmentation may occur if vegetation is completely cleared below the powerline, which is not the case in the study area where grasslands occur. It is therefore assumed that no clearing will take place and that localised fragmentation may only occur where access roads are to be constructed. The potential magnitude of this impact is therefore low. This is not too arguable if the impact is located on the edge of the natural area of vegetation, but could be more severe if it cuts a contiguous block of vegetation into pieces. It will have an impact at the scale of the proposed infrastructure, which is relatively regional in extent, although fragmentation is only likely to occur in localised areas. It is therefore scored as being local. The duration of the impact will be permanent and the probability of occurrence is probable.

- **Destruction/permanent loss of individuals of Red List species during the construction and/or operational phase**
  This may arise if the proposed infrastructure is located where it will impact on such individuals. Consequences of this may include:

  - Negative change in conservation status of affected species;
  - Fragmentation of populations of affected species;
  - Reduction in area of occupancy of affected species; and
  - Loss of genetic variation within affected species.

  If populations or individuals of Red List species are directly affected by the proposed infrastructure, then the potential magnitude of this impact depends on the overall distribution and abundance of the species concerned. No such species have been confirmed along the proposed alignment, but their presence in the vegetation communities in the general area is noted. The impacts is therefore speculative in nature. At worst a Critically Endangered or Endangered species may be affected if they occur within the powerline servitude, in which case the impact would be high in magnitude, possibly having a severe impact on the probability of survival of the species. If a Critically Endangered or Endangered species is affected then the scale of the impact could be global. The duration of the impact will be permanent and the probability of occurrence is highly probable, depending on the final alignment of the proposed powerline.

- **Disturbance of natural vegetation through trampling, compaction by motor vehicles**
  This may occur around construction sites. Consequences of this may include:

  - Destruction of vegetation or habitat;
  - Degradation of vegetation or habitat;
  - Loss of sensitive habitats;

- Loss or disturbance to individuals of rare, endangered, endemic and/or protected species; and
- Fragmentation of sensitive habitats.

The potential magnitude of this impact is moderate. It will have an impact at the scale of the proposed infrastructure, although this is relatively regional in extent and is therefore scored as regional. The duration of the impact will be long-term, since the vegetation may recover, and the probability of occurrence is probable, unless sensitive habitats are avoided.

- **Impacts on the movement and migration of animal species**
  This will occur if the infrastructure imposes an insurmountable barrier to movement. Consequences of this may include:

  - Impaired gene flow within fragmented populations;
  - Breakdown of ecological relationships, e.g. pollinator-plant; and
  - Breakdown of migration routes.

  Clearing under the proposed powerline or other infrastructure may cause barriers to movement of animals. This is usually only a problem where the height of the vegetation is physically managed, which is not usually done in grasslands. The potential magnitude of this impact is therefore potentially small since it is unlikely to result in impairment of processes. However, if it affects a population of a sensitive species, the magnitude could be more serious and is scored as moderate. It will have an impact on remaining natural vegetation at the scale of the proposed infrastructure, which would be local in extent, but could affect regional population structure and is therefore scored as regional. The duration of the impact will be permanent and the probability of occurrence is probable, unless the powerline is aligned away from sensitive animal populations in which case the significance can be reduced from a MEDIUM to a LOW negative impact.

- **Increased soil erosion, increase in silt loads and sedimentation**
  This will occur during soil disturbance, especially along the steeper slopes and increased run-off from compacted areas. Consequences of this may include:

  - Loss of or disturbance to indigenous vegetation;
  - Loss of sensitive habitats;
  - Loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
  - Fragmentation of sensitive habitats; and
  - Impairment of wetland function

  Where there are erodable soils, it is possible that construction of infrastructure may result in local exposure of the soil surface or increase in runoff of impermeable surfaces. The most severe likely impact would be on wetland systems, where siltation may occur. The potential magnitude of this impact is moderate. It will have an impact at the scale of the proposed infrastructure and possibly downstream, if drainage areas are affected. The proposed infrastructure is relatively regional in extent and potential impacts may extend beyond the study area in terms of impacts on wetlands. The impact is therefore scored as regional. The duration of the impact will probably be medium-term and the probability of occurrence is probable. The significance

can be reduced from a MEDIUM to a LOW negative impact if mitigation measures are implemented effectively.

- **Establishment and spread of declared weeds and alien invader plants**
  This may occur in disturbed areas and/or where propagules of these plants are readily available. Consequences of this may include:

  - Loss of indigenous vegetation;
  - Change in vegetation structure leading to change in various habitat characteristics;
  - Change in plant species composition;
  - Change in soil chemical properties;
  - Loss of sensitive habitats;
  - Loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
  - Fragmentation of sensitive habitats;
  - Change in flammability of vegetation, depending on alien species;
  - Hydrological impacts due to increased transpiration; and
  - Impairment of wetland function.

  On the basis of existing alien invasions in the study area, the potential magnitude of this impact is considered to be high. It will have an impact at the scale of the proposed infrastructure, which is relatively regional in extent and is therefore scored as regional. The duration of the impact will be long-term and the probability of occurrence is highly probable, unless effective measures are put in place to reduce the possibility of alien invasions.

- **Damage to wetland areas:**
  This may occur if wetlands are directly affected by the construction of infrastructure. Consequences of this may include:

  - Impairment of wetland function;
  - Reduction in water quality, potentially leading to impacts on wetland flora and fauna; and
  - Change in hydrological regime, usually increased runoff.

  The potential magnitude of this impact is moderate to high due to the fact that physical alteration to wetlands can have a severe impact on the functioning of those wetlands. It will have an impact at a localised scale, but could result in downstream impacts further away and is therefore scored as regional. There may also be secondary impacts beyond the boundaries of the study area, such as reduction in water quality downstream of the proposed development. The duration of the impact will be long-term and the probability of occurrence is improbable since it is unlikely that the pylons would be located within major wetlands occurring in the study area. If the powerline pylons and associated infrastructure is kept away from sensitive wetland habitats then the potential impact can be avoided in which case the significance can be reduced from a HIGH to a LOW negative impact.

- **Increased dust during construction**
  This may affect animals and vegetation in the vicinity. Consequences of this may include:

- Cause stress in individuals of various animal species, which may result in them moving away or cause changes in behaviour;
- Cause some territorial animals to be displaced; and
- Result in deposition of dust on vegetation leading to impaired photosynthesis and respiration, potentially causing damage to individual plants.

The potential magnitude of this impact is low to moderate. It will have an impact at the scale of the proposed infrastructure. It is unlikely to be a uniform impact across the entire length of the proposed powerline and more likely to be a localised issue. The impact is therefore scored as local. The duration of the impact will be short-term, primarily for the construction phase and the probability of occurrence is probable.

- **Increased noise pollution during construction**:
  This may affect animals in the vicinity. Consequences of this may include:

  - Cause stress in individuals of various animal species, which may result in them moving away or cause changes in behaviour; and
  - Cause some territorial animals to be displaced.

  The potential magnitude of this impact is low to moderate. It will have an impact at the scale of the proposed infrastructure. It is unlikely to be a uniform impact across the entire length of the proposed powerline and more likely to be a localised issue where construction is occurring. The impact is therefore scored as local. The duration of the impact will be short-term, primarily for the construction phase and the probability of occurrence is highly probable, depending on the method of construction.

- **Increased risk of veld fires:**
  There is a higher risk of veld fires around construction sites due to the use of fires for cooking and warmth by construction workers. Consequences of this may include:

  - Damage to sensitive habitats;
  - Damage to populations of sensitive plant species; and
  - Loss of vegetation production leading to reduction in available grazing for wild or domestic animals.

  The potential magnitude of this impact is low due to the fact that vegetation already experiences seasonal burning. It is unlikely to be a uniform impact across the entire length of the proposed powerline and more likely to be a localised issue where construction is occurring. The impact is therefore scored as local. The duration of the impact will be short-term, primarily for the construction phase and the probability of occurrence is highly probable. The significance can be reduced from a LOW to a LOW(er) negative impact, should mitigation measures be implemented effectively.

  The likelihood of the occurrence of the identified impacts is probable and the only method of controlling these is to effectively manage the effects of the construction phase. This may be undertaken by controlling the following:

- Undertake surveys to locate potentially occurring populations of Red List species. Such populations should be avoided. Recommendations for such surveys include a Red List plant survey, Invertebrate study and a small mammal study;
- During and after construction of the proposed infrastructure, ensure effective storm water management around permanent infrastructure, rehabilitate disturbed areas, protect topsoil and avoid sensitive soils on steep slopes. This will reduce the possibility of soil erosion;
- Avoid translocating topsoil stockpiles from one place to another or importing topsoil from other sources that may contain alien plant propagules;
- Alien plants must be controlled along the proposed powerline and service road servitude as well as within any areas controlled by Eskom. This should take place during and after construction and may require long-term follow-up;
- Control dust on construction sites and access roads by using water-sprayers; and
- During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible.

Table 30: Assessment of identified impacts on the ecology of the study area

	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE		STATUS	CONFIDENCE
					Without Mitigation	With Mitigation		
Destruction or disturbance to sensitive ecosystems	Local	Long Term	Low	Definite	Low	Low	Negative	High
Destruction of vegetation in the footprint of tower structures	Local	Long Term	Low	Definite	Low	Low	Negative	High
Fragmentation of sensitive habitats	Local	Long Term	Low	Probable	Low	Low	Negative	High
Destruction/permanent loss of individuals of Red List species	National	Long Term	High	Probable	High	High	Negative	High
Disturbance of natural vegetation	Local	Long Term	Medium	Probable	Medium	Low	Negative	Medium
Impairment of the movement and/or migration of animal species	Regional	Long-term	High	Probable	High	Low	Negative	Medium
Increased soil erosion, increase in silt loads and sedimentation	Local	Medium-term	Medium	Probable	Medium	Low	Negative	Medium
Establishment and spread of declared weeds and alien invader plants	Local	Long-term	High	Highly probable	High	Low	Negative	High
Damage to wetland areas	Regional	Long-term	High	Improbable	High	Low	Negative	Medium
Increased dust during construction	Local	Short-term	Low	Probable	Low	Low	Negative	Medium
Increased noise pollution during construction	Local	Short-term	Low	Highly probable	Low	Low	Negative	Medium
Increased risk of veld fires	Local	Short-term	Low	Highly probable	Low	Low	Negative	High

8.3 Impacts on avifauna

All forms of powerlines pose risks to birds to some degree. Endangered Wildlife Trust undertook the avifaunal study to determine the impacts of this proposed development. The study served to identify bird species, sensitive habitats and the impacts of the proposed development on these species. Refer to **Appendix F** for the full Avifaunaa Study.

Potential sources of risk to birds are described and assessed below and provided in summary in **Table 31**.

Potential impacts and specific mitigation measures from an avifaunal perspective are as follows:

- **Electrocutions**
  In the context of overhead lines above 132 kV, electrocutions are not a major issue. Electrocution refers to the scenario where a bird is perched or attempts to perch on electrical structures this causes an electrical short circuit. Due to the large size of the clearances on most overhead lines of above 132kV, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between the dangerous components. In fact, transmission lines have proven to be beneficial to many birds. Electrocution on the proposed power line is improbable given the adequate clearances. Electrocution of birds is possible in the substation yard on the various electrical infrastructure. This is a potential impact of the proposed Kromdraai Substation, likely to affect the more common species that are tolerant of high disturbance levels and human activity.

- **Collisions**
  Collisions are the biggest single threat posed by powerlines to birds. Most heavily impacted upon are bird species that are heavy-bodied with limited maneuverability, making it difficult for them to avoid colliding with power lines Unfortunately, many of the collision sensitive species are considered threatened 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 small areas. These species have not evolved to cope with high adult mortality. Thus, consistent high adult mortality 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 non-discriminatory as far as age is concerned and therefore contribute to adult mortality. It is not known what the cumulative effect of these impacts could be over the long term. Collision of certain bird species, particularly at wetland and river crossings is anticipated to be an impact of the proposed power lines.

- **Habitat destruction**
  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 levelling 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 modification of habitat. Habitat destruction could be an impact in the grassland and wetland areas, where natural vegetation is still relatively intact.

- **Disturbance**
  Similarly, the above mentioned construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. This impact could potentially occur in the northern region of the study area, but is unlikely in the southern region where existing disturbance levels are high due to mining and other activities.

  According to the avifaunal specialist study the implementation of the following mitigation measures will reduce the significance of the identified impacts:

  - The high risk sections of line should be marked with a suitable anti collision marking device on the earth wire as per the Eskom guidelines;
  - Vegetation clearing should be kept to an absolute minimum. The proposed powerline should be aligned alongside existing infrastructure to prevent negative impacts on new areas of habitat;
  - Care should always be taken to prevent disturbance by construction workers; and
  - Monitoring of the proposed infrastructure on birds must be ongoing to allow for site specific recommendations.

Table 31: Assessment of identified impacts on birds

	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE		STATUS	CONFIDENCE
					Without Mitigation	With Mitigation		
Collision of birds with conductor & earth wire	Local	Long term,	Low	Improbable	Medium	Low	Negative	High
Electrocution of birds on towers	Local	Long term,	Low	Improbable	Low	Low	Negative	High
Electrocution of birds At proposed Kromdraai Substation	Local	Long Term	Low	Improbable	Low	Low	Negative	Medium
Habitat Destruction	Local	Long Term	Low	Improbable	Low	Low	Negative	Medium
Disturbance	Local	Short Term	Low	Improbable	Low	Low	Negative	Medium
Electrical faulting as result of birds	Local	Long Term	Low	Improbable	Low	Low	Negative	Medium

8.4 Geo-technical Suitability

Moore Spence Jones (Pty) Ltd conducted the geotechnical study with the purpose being to provide information on the geological suitability of the proposed corridor alternatives and the substation site Groundwater issues were also investigated with details on erosion, groundwater conditions and subsurface drainage. Refer to **Appendix G** for the full Geotechnical Study.

The following types of bedrock geology and soil cover may pose potential geotechnical constraints for the proposed development:

- **Transvaal Supergroup Sediments and Igneous Rocks**
  Underlies the majority of the project area and weathers to deep, highly erodible and compressible residual soils. The geotechnical study showed significant rock outcrop of dolomite, chert and quartzite. Of specific interest is the occurrence of dolomite or soluble carbonate rocks at the base of the Transvaal Supergroup sediments. The geotechnical affects have been restricted to an estimation of founding conditions based on the depth of weathering. Hard excavation or even blasting may be required to achieve foundation and a key-in depth of 2m or more in the northern region (shallow and outcropping dolomite bedrock) and towards the southern region on the Black Reef Quartzite. Groundwater is expected to be shallow to deep and the ground slopes gentle and thus access will not be a constraint. This type of geology will affect all the alternative corridors and the proposed substation site.

- **Karoo Supergroup Sediments**
  The fine-grained sediments underlie the majority of the project area to the north in shallow depressions on the dolomite areas and normally weather to deep, expansive residual soils. Soft excavation is expected to achieve foundation and a key-in depth of 2m or more. Groundwater is expected to be shallow to deep and the ground slopes gentle, thus access will not be a constraint.

- **Witwatersrand Supergroup**
  The southern extremity of the study area is underlain by gold-bearing quartzite and shale of the Witwatersrand Supergroup. This area is expected to be underlain by hard shallow bedrock, outcropping ridges and a deep water table and gentle slopes. Access will not be a constraint however foundations will require blasting to achieve required key-in depth. Outcrop mining and shallow under-mining exists within the study area and could affect all the alternative corridors in this southern region of the study area.

- **Diabase Dykes**
  The combination of the softer sediments and intrusions of diabase has contributed to the formation of impermeable subterranean groundwater barriers in the northern region of the study area. Alternative corridors to the north from the Tarlton substation to the proposed Kromdraai substation will be affected by this lithology, The diabase dykes are, however, expected to be deeply weathered to medium expansive clay but the lateral width of less than 50 m can be avoided by adjusting the pylon placements.

- **Transported Aeolian Sand**
  This soil type is expected throughout the site, except in areas of shallow or outcropping bedrock, especially to the extreme northern and southern regions of the study area. The soil fabric is expected to be potentially collapsible and subject to creep movements. The topography is gentle and the groundwater deep. Slope stability should not be a problem as foundation excavation into the bedrock will not be excessive. Foundations can be placed through the aeolian cover onto the underlying bedrock. Only the northern region will be affected by soils with a moderate erodibility index of between 9 and 15, whilst the remainder of the study area reflect a low erodibility index of 16 to 20. These soils are neither expansive nor dispersive.

- **Alluvium**
  Thin to moderately thick alluvial soils can be expected in the river and stream sections and most significantly in the Rietspruit in the northern region of the study area. Moderately expansive conditions producing significant ground heaves and compressible soils are expected with perched water tables and occasional flooding of the area. Foundation for the pylons in this area will require over-excavation to the residual soils or bedrock, temporary shoring of the side-walls and possible de-watering and flood protection of the excavations. Mass concrete bases will be required to resist any lateral erosion forces and scour due to stream flow. Access and maintenance roads will require subgrade treatment that is the addition of dumprock, road-bed elevation and possibly culvert protection. A practical solution is to plan the pylon locations to span these areas where possible.

- **Pedogenic Duricrusts**
  If these secondary deposits occur they will consist of possibly nodular to hardpan ferricrete. The foundation conditions will vary from good to excellent, depending on the degree of cementation but the main constraint may be the hard excavation, possibly even pneumatic assistance or localised blasting may be required to achieve the minimum foundation depth to satisfy key-in depth to prevent overturning and resist wind forces.This soil type may only affect the central and northern regions of the study area.

- **Residual Soils**
  Majority of the proposed corridor alternatives and the substation site will be affected by this soil type, but the thickness of this soil layer is not thought to be significant. Residual soils above the dolomite are expected to be highly variable from non-existent to deeply weathered chert and wad conducive to sinkhole and doline development. Groundwater is expected to be deep and the ground slope gentle. Access and maintenance roads should not encounter any problems. Foundation design for the pylons and substation will be dependent on the inherent risk of the underlying dolomite and residuum and in the worst case will probably entail either soil mattresses and RC rafts or piling to dolomite bedrock.

The following recommendations have been proposed:

- Abandoned shallow stopes up to 2 m wide may create sudden and differential settlements of this order at ground level and relocation of the pylon positions to solid ground would be the preferred option. The most suitable area would be to the west of the shallow stoping;

- Existing pylons located on areas of shallow stoping should not be burdened with any additional new power lines;
- Plans for all corridors in close proximity to existing slimes dams should be discussed with the mining company concerned since sufficient space for maintenance, expansion and re-processing will be required; and
- It is essential that a dolomite stability investigation be completed for the final chosen route, so that appropriate foundation and water precautionary measures can be recommended.

8.5 Agricultural Potential Assessment

The Institute for Soil, Climate and Water of the Agricultural Research Council (ARC-ISCW) carried out a soil investigation to describe and map the soils that occur within the study area, as well as to assess their broad agricultural potential. Refer to **Appendix H** for the full Agricultural Study.

The main impact would be the loss of potentially high potential agricultural land which is assessed in **Table 32**. However, a power line will have only a limited impact, due to the occasional placement of the pylons. Most cultivated agriculture can take place below power lines. As far as mitigation is concerned, the actual area of agricultural land that would be lost is quite small. This is a permanent impact, so no mitigation is possible.

In the construction phase, however, as well as for the maintenance of any access roads that might be required to service the power line, care should be taken to minimise any possible soil erosion. No significantly erodible soils are expected in the study area, and most of the steeper slopes are rocky, which adds to the soil stability. However, measures should involve minimal vegetation removal and construction of contours and drainage ways on any areas with steeper slopes.

Where the proposed power line and any service road crosses a waterway, as long as normal mitigation measures are followed in the construction of a bridge, avoiding excess sedimentation and/or disturbing normal stream flow, there should be no adverse impact.

Table 32: Assessment of identified impacts on the soils characterising the study area

	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE		STATUS	CONFIDENCE
					Without Mitigation	With Mitigation		
Loss of agricultural land	Local	Short-term	Low	Improbable	Low	Low	Negative	High

8.6 Cultural Heritage Resources Assessment

Dr. J. Van Schalkwyk assessed sites of potential cultural and heritage value along the proposed corridor alternatives. The aim of the study was to locate, identify, evaluate and document sites; objects and structures of cultural importance found within the boundaries of the study area. Refer to **Appendix I** for the full Cultural Heritage Resources Study.

Although a large number of heritage resources are known to exist in the region, based on current knowledge, few would be impacted on by the proposed development. The only area of concern is in the northern section, in the vicinity of the proposed Kromdraai Substation and the corridors leading from that station. In this region, a number of early hominid and palaeontological sites are located. However, these sites are well documented and it will be easy to avoid them.

The heritage and cultural specialist recommended the following mitigation measures to prevent the destruction of heritage resources:

- An archaeologist must inspect each site selected for the erection of a pole structure, construction roads and construction campsites. If a particular pole structure impacts on a heritage site but cannot be shifted, the controlled excavation of the site prior to development, can be implemented. This can only be done by a qualified archaeologist after obtaining a valid permit from SAHRA;
- Riverbanks, rims of pans and smaller watercourses should be avoided as far as possible.
- Saddle or neck between mountains, hills and/or outcrops) should also be avoided;
- Avoid all patches of bare of vegetation unless previously inspected by an archaeologist;
- Rock outcrops might contain rock shelters, engravings or stone walled settlements, and should therefore be avoided unless previously inspected by an archaeologist;
- Communities living close to the proposed corridors should be consulted as to the existence of sites of cultural significance; and
- All graves or cemeteries should be avoided, unless when totally impossible.
- Archaeological material, by its very nature, occurs below ground. It should therefore be kept in mind that archaeological sites might be exposed during construction.

Table 33: Assessment of identified impacts on the cultural and heritage resources within the study area

	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE		STATUS	CONFIDENCE
					Without Mitigation	With Mitigation		
Destruction of heritage resources	Local	Permanent	Low	Improbable	Low	Low	Negative	High

8.7 Visual Assessment

I-Scape undertook a Visual Impact Assessment to address concerns about compromising the 'sense-of-place' / ambience of natural areas. The study aimed to assess the value of the visual resource based on its ecological, cultural and historic importance, scenic quality and sense of place. Refer to **Appendix J** for the full Visual Impact Assessment.

Due to the fact that the Cradle of Humankind (COH) overlaps with the northern region of the study area, it could be argued that this area has exceptional value from a socio-cultural point of view. The greater topographic elevation causes fairly interesting landforms and drainage patterns contributing to the ecological value of the landscape. The international social and cultural value that is brought about by the status of the World Heritage Site is a significant contributor to the value of the landscape. Furthermore, the Sterkfontein Caves is considered to impart a significant sense of place due to its palaeontological findings. However, the fairly common landscape in this region is rated as having a moderate scenic quality.

The central region comprises mostly small scale farming on agricultural holdings. In exception to this, the Krugersdorp Game Reserve is situated along a drainage corridor with some exceptional natural features, such as wetlands, waterfalls and deeply fissured valleys. The wildlife in the game reserve is an added attraction in terms of tourism value and contributes to the ecological and conservation importance of the central study area. This region is considered to have moderate scenic value.

The scenic value of the southern region is considerably less than the northern or central regions. The southern region of the study area consists of an undulating landscape and is greatly modified by urbanisation and mining activities. This region falls outside the COH and is therefore considered less important from a cultural perspective.

The following typical visual impacts may occur as a result of the construction and operation of the proposed development:

- The project will noticeably change existing features or qualities of the visual resource;
- The project will introduce new features which are uncharacteristic or in contrast with the existing character of the environment; and/or (to a lesser extent if the proposed powerline is aligned parallel to an existing powerline)
- The project may remove or blocks aesthetic features of the landscape, thus affecting the scenic quality of the study area.

The following mitigation measures are recommended:

- Usually the eye will move up in valleys and down ridges of a mountainous scene. These are the obvious locations where power lines and substations should be restricted in order to maintain visual coherence of the horizon line;
- Each study area has a natural screening capacity, either through topographical variation or vegetative screening, or a combination of both. The study area provides the opportunity to locate certain sections of the power line

through the exotic woodlands which will in effect completely or partially conceal the power line from outside vantage points;

- Relocation of the substation to a less exposed site is preferred otherwise the screening capacity of the site can be enhanced through additional screen planting;
- It is highly recommended that the existing power line network be upgraded. Where an existing power line can be dismantled and substituted by a single larger capacity power line, the option must be considered as this will have the least visual change;
- Locate construction camps and stock yards in the least visible areas. Make use of the natural screening capacity of the site by placing these facilities in the lower lying areas of the site or adjacent to a dense vegetation patch with sufficient height to conceal these project components;
- Keep the construction camp neat and tidy at all times;
- Establish limits of disturbances during construction through demarcating construction areas to the minimum area required for construction;
- Keep to existing road infrastructure as far as possible to minimise the physical damage to vegetation in the power line corridor;
- Retain as much of the existing vegetation as possible, specifically existing mature trees that contributes to the natural screening capacity of the site;
- Implement rehabilitation of disturbed areas as soon as possible to limit the duration of exposed surfaces;
- Minimise unsightly cut- and fill areas by stepping in the substation building platform and thereby lowering the structure by as much as possible;
- Shape the cut and fill embankments by rounding the edges and giving it a more natural appearance if space permits;
- Establish tree lanes in strategic places namely on the property boundary of all the substations, adjacent properties or in passing road reserves;
- Avoid construction during weekends and holidays near residential areas and tourist attractions such as guest houses, nature or conservation areas;
- Signage should be simple and unobtrusive and not be placed against the skyline;
- A definite effort should be made to reduce the height and scale of the structures, if at all possible;
- Maintenance of the servitude in terms of clearing up littering and dumped refuse is highly recommended;
- All lighting, especially perimeter security lighting at the Kromdraai Substation must be shielded to minimise light spillage and pollution;
- Previously rehabilitated areas must be monitored to prevent the infestation of alien vegetation species that may become an unsightly feature; and
- Screen planting that was specifically established to minimise the intrusiveness of the power line or substation must be maintained and dead or sick plants replaced for a determinate period after construction.

	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE		STATUS	CONFIDENCE
					Without Mitigation	With Mitigation		
Construction Phase								
Change in the existing qualities of the visual resource due to the construction of the powerline	Regional	Short term	Medium	Highly probable	Medium to High	Low	Negative	High
Change in the existing qualities of the visual resource due to the construction of the proposed Kromdraai substation	Local	Short term	Medium	Highly probable	High	Medium	Negative	High
Operational Phase								
Change in the existing qualities of the visual resource during the operational phase of the proposed powerline	Regional	Long term to permanent	Low	Highly probable	Medium to High	Low	Negative	High
Change in the existing qualities of the visual resource during the operational phase of the proposed Kromdraai substation	Local	Medium term	Medium	Highly probable	High	Medium	Negative	High

9 RECOMMENDATIONS

The impact analysis highlighted most impacts as being of low significance with the exception of the destruction or permanent loss of individuals of Red List species which was rated a high significance rating and the change in the existing qualities of the visual resource due to the proposed Kromdraai substation. The impact on Red List species is, however, speculative. Although Red List species are known to occur within the broader area, none were identified along the proposed powerline route.

The destruction or permanent loss of individuals of Red List species is a negative impact which is unlikely to happen as the implementation of recommended mitigation measures significantly reduces the likelihood of the impact occurring. Thus, this impact is not considered a fatal flaw. However, it does not reduce the significance of the impact should it occur.

The alteration of the visual/aesthetic appeal of the study area is considered to be short to medium term in duration as the effective implementation of mitigation measures will reduce this impact to a lower significance in the longer term.

Section 6.2.4 assessed the alternative corridors for the proposed distribution powerline. Based on this assessment the recommended corridor leads from the **Westgate substation to the Tarlton substation** (**Corridor 1 – Red**)**.** This corridor is the preferred alternative in terms of reducing negative impacts on heritage resources, sensitive environments and avifauna. This is due to the fact that Corridor 1 runs along existing powerlines for most of its length. Corridor 1 is also acceptable in terms of agricultural potential as this impact is limited due to the occasional placement of the pylons. However in terms of geotechnical constraints, corridor 1 does traverse a significant portion of dolomite. This can be mitigated by undertaking detailed geotechnical investigations during the placement of the pylons. Based on the visual impact, corridor 1 is not the preferred alternative due to the concentration of highly sensitive visual receptors in the central region of the corridor. However, with the recommended mitigation measures this impact is considered to be of low significance. Furthermore, this region is considered to be highly disturbed by various other activities, including transmission powerlines which corridor 1 will be aligned with.

From an economic perspective corridor 1 will cost about R 89 million to construct and with nineteen (19) affected properties the cost of compensation to landowners is also significant. Based on IAP input during the Scoping Phase it is noted that there is significant opposition to corridor 1 mainly due to the perceived depreciation of the value of the affected properties. However, should the proposed development be authorised, this shall be addressed through compensation of the servitude required for the powerline.

Also based on the assessment in Section 6.2.4 the recommended corridor leading from the **Tarlton Substation to the proposed new Kromdraai Substation** is **Corridor 5 – Pink.** Even though corridor 5 is considered sensitive due to the section of grassland which is classified as being “Irreplaceable” by GDACE C Plan (V2), this is not considered to be a significant impact as the grassland vegetation is not cleared beneath powerlines. Furthermore with effective implementation of mitigation measures this impact can be reduced even further. In addition, this corridor is the preferred alternative with respect to the protection of heritage resources, sense of place or aesthetic appeal, agricultural resources and avifauna. This is due to the fact that corridor 5 is aligned with existing transmission powerlines for most of its length.

In terms of geotechnical constraints, corridor 5 is the least preferable as it traverses dolomite. However this can be mitigated by undertaking detailed geotechnical investigations during the placement of the pylons. This corridor has the least visual impact, which may reduce the opposition by IAPs in the northern region.

From an economic perspective corridor 5 will cost about R 48 million to construct and with nineteen (19) affected properties the cost of compensation to landowners is also significant.

In terms of the new proposed Kromdraai substation site the major impact is the visual impact of the substation in the area as the northern region of the study area is considered to have high scenic quality. However, as discussed previously, mitigation measures should reduce this impact during and after construction. Furthermore, opposition to the proposed site is limited, if any.

Thus, the construction of the proposed Westgate Tarlton Kromdraai 132kV distribution powerline, Kromdraai substation and associated infrastructure with suggested mitigation measures is recommended within corridors 1 and 5 and portion 35 of Sterkfontein 173 IQ for the proposed Kromdraai substation.

10 CONCLUSION

The Environmental Impact Assessment (EIA) process for the proposed Westgate Tarlton Kromdraai 132kV distribution powerline and Kromdraai substation has been undertaken in accordance with the EIA Regulations (GN No's R385 to R387 of 2006).

A range of relevant legislation, policies and plans have been considered in the assessment of the proposed development. Further to this the relevant legislation has informed the identification and development of appropriate management and mitigation measures that must be implemented in order to minimise potentially significant impacts associated with all phases of the development.

The conclusions and recommendations of this Draft Environmental Impact Report are a result of comprehensive studies and specialist assessments. These studies were based largely on issues identified during the Environmental Scoping Phase and the continuation of the public participation process through to the EIA Phase. The public consultation process has been comprehensive, and every effort has been made to inform all stakeholders and IAPs.

The potentially significant environmental impacts associated with the proposed project as discussed in this EIR include:

- Potential impacts on wetlands;
- Potential impacts on avi-fauna, fauna and flora;
- Potential impacts on geology;
- Potential impacts on the land use and soils;
- Potential impacts on scenic value; and
- Potential impacts on heritage resources.

During this EIA, relevant stakeholders and IAPs were encouraged to provide input regarding alternative corridors. All suggestions made by IAPs have been considered and assessed. The alternatives identified and discussed in **Chapter 6** was thus the result of input from IAPs, specialist assessments and the EIA Project Team. The following alternatives were considered:

- Proposed corridor alternatives;
- Substation locations;
- Technology alternatives; and
- No-Go Alternative.

All alternatives excluding the alternative corridors were considered as being unfeasible.

Identified impacts and associated mitigation measures for the construction and operation of the proposed development must be implemented via an Environmental Management Plan (EMP) during the construction phase of the proposed development. Refer to **Appendix K** for the Draft EMP.

The findings of the EIA for the construction of the proposed Westgate Tarlton Kromdraai 132kV powerline, Kromdraai substation and associated infrastructure show that there are no environmental fatal flaws that should prevent the proposed project from proceeding.

11 REFERENCES

Arcus GIBB 2006. Strategic Environmental Assessment for Magaliesberg and Surrounding Areas.

Department of Environmental Affairs and Tourism 2005. Guideline 3: General Guide to the Environmental Impact Assessment Regulations, 2005, Integrated Environmental Management Guideline Series, Department of Environmental Affairs and Tourism (DEAT), Pretoria

Department of Environmental Affairs and Tourism (online). Mogale City Local Municipality State of Environment Report 2003. Accessed November 2007. http://www.environment.gov.za/soer/

Department of Environmental Affairs and Tourism (online). North West Department of Agriculture, Conservation, Environment and Tourism. State of Environment Report 2003. Accessed November 2007. http://www.environment.gov.za/soer/

Department of Environmental Affairs and Tourism (online). Gauteng Department of Agriculture, Conservation, Environment and Tourism. State of Environment Report 2004. Accessed November 2007. http://www.environment.gov.za/soer/

Eskom 2005a. Transmission and Distribution of Electricity (Rev 2). GFS 0029 Distribution Communication.

Eskom 2005b. Planning proposal: Westgate Tarlton Kromdraai servitude (strategic).

Eskom 2007a. Building line restrictions, servitude widths, line separations and clearances from power lines.

Eskom 2007b. Motivation for site(s) for proposed Kromdraai 132 kV substation.

Gauteng Department of Agriculture, Conservation and Environment 2001. Development Guidelines for Ridges.

Gauteng Department of Agriculture, Conservation and Environment 2001. Red Data Plant Policy for Environmental Impact Evaluations.

Gauteng Provincial Government (online). A Growth and Development Strategy for the Gauteng Province. Accessed November 2007. http://www.gpg.gov.za/frames/gds-f.html

Integrated Development Plan Nerve Centre (online). Mogale City Local Municipality Integrated Development Plan 2004. Accessed November 2007. http://www.idp.org.za/

Integrated Development Plan Nerve Centre (online). Mogale City Local Municipality Integrated Development Plan 2008/2009. Accessed November 2008. http://www.idp.org.za/

Integrated Development Plan Nerve Centre (online). West Rand District Municipality Integrated Development Plan 2004. Accessed November 2007 . http://www.idp.org.za/

Integrated Development Plan Nerve Centre (online). West Rand District Municipality Integrated Development Plan 2008/2009. Accessed November 2008 http://www.idp.org.za/

Integrated Development Plan Nerve Centre (online). City of Johannesburg Metropolitan Municipality Integrated Development Plan 2004. Accessed November 2007. http://www.idp.org.za/

Low, A.B. & Rebelo,A.G. (edit.) 1996, Vegetation of South Africa, Lesotho and Swaziland. Pretoria: DEAT.

Municipal Demarcation Board (online). Accessed November 2007. http://www.demarcation.co.za/info

Republic of South Africa. Energy White Paper of 1998. Department of Minerals and Energy. Pretoria: Government Printer.

Statistics South Africa (online). Accessed November 2007. www.statssa.gov.za

West Rand District Municipality Growth and Development Strategy, 2007

www.eia.doe.gov/cneaf/pubs_html/feat_trans.capacity/w_sale.html, accessed November 2007

www.routes.co.za/gp/magaliesburg/index.html**,** accessed January 2009

http://www.geoscience.org.za/samindaba/maps/gauteng.htm, accessed October 2007

http://www.bullion.org.za, accessed October 2007

http://www.gpg.gov.za/frames/gds-f.html, accessed November 2007

http://www.places.co.za/html/sterkfontein_caves.html, accessed November 2007

http://www.demarcation.co.za/info, accessed November 2007

http://www.ucsusa.org/greatlakes/glimpactplace.html, accessed November 2007

http://www.eia.doe.gov/cneaf/pubs_html/feat_trans.capacity/w_sale.html, accessed October 2007

DOCUMENT CONTROL SHEET (FORM IP180/B)

CLIENT: Eskom Distribution – Central Region

PROJECT: Environmental Impact Assessment for the proposed Westgate Tarlton Kromdraai 132 kV Distribution Powerline and Kromdraai Substation

TITLE: Draft Environmental Impact Report

PROJECT NO: J26219

	Prepared by	Reviewed by	Approved by
ORIGINAL	NAME **K Moodley**	NAME **R Heydenrych**	NAME **R Heydenrych**
DATE **July 2009**	SIGNATURE	SIGNATURE	SIGNATURE

REVISION	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE

REVISION	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE

Arcus GIBB (Pty) Ltd
PO Box 2700
Rivonia
2128
Tel : +27 11 519 4600
Fax : +27 11 807 5670
Email : jball@arcusgibb.co.za
Website: www.arcusgibb.co.za