February 2009
Impact Assessment Phase

ENVIRONMENTAL IMPACT ASSESSMENT

Bravo Integration Project –Bravo 3: Construction of a 400 kV line from Bravo (Kusile) Power Station to Lulamisa.

DEAT REF NO: 12/12/20/1094

Proponent: Eskom Transmission

DRAFT ENVIRONMENTAL IMPACT REPORT

Project 10637

PURPOSE OF THIS DOCUMENT

The growing demand for electricity is placing increasing pressure on Eskom's existing power generation and transmission capacity. Eskom is committed to implementing a Sustainable Energy Strategy that complements the policies and strategies of National Government. Eskom aims to improve the reliability of electricity supply to the country, and in particular to provide for the growth in electricity demand in the Gauteng and Mpumalanga provinces. For this reason, Eskom obtained environmental authorisation to construct the new 400 kV Bravo (Kusile) coal-fired Power Station between Bronkhorstspruit and Witbank in 2007. Construction of this power station has already commenced.

Due to this construction, the new Bravo power station needs to be integrated with the existing Eskom electricity infrastructure. This proposed project is to construct a new 400 kV overhead power line from the Bravo power station to the Lulamisa substation. Each of these lines is approximately 100 km in length.

Eskom Transmission has appointed Zitholele Consulting (Pty) Ltd, an independent company, to conduct an EIA to evaluate the potential environmental and social impacts of the proposed project.

The first phase of the EIA (Scoping Phase) has been completed. The second phase of an EIA is the Impact Assessment Phase. In the Scoping Phase public issues, concerns and suggestions were identified and these were used to shape the terms of references for the specialist studies that were conducted. The findings of the specialists are being reported on in this document – the culmination of the second phase (Impact Assessment Phase) of the EIA.

An Environmental Impact Assessment (EIA) must show the authorities, the stakeholders and the proponent what the impact of the proposal on a particular alternative will be in environmental, economical and social terms and provide informed findings of the specialist investigations.

In accordance with the EIA Regulations, Interested and Affected Parties (I&APs) must be given the opportunity to verify that all the issues mentioned during the stakeholder engagement process, have been addressed in the Impact Assessment. This is the main purpose of this Draft Environmental Impact Report (DEIR).

After public review, the Draft EIR will be updated and submitted to the lead authority, the National Department of Environmental Affairs and Tourism (DEAT) for a decision about the project.

Summary of what the Draft Environmental Impact Report Contains

This report contains the following for comment by stakeholders:

- A complete overview of the proposed project;
- An overview of the EIA process followed;
- A complete summary of the Public Participation (PP) Process followed;
- Project alternatives including the "No-go" (no development) option;
- An overview of the baseline receiving environment;
- The assessment by specialists of the potential environmental impacts of the proposed project along with the mitigation measures to reduce the negative impacts and enhance the positive impacts; and
- An Environmental Management Plan (EMP).

AN EIA CONSISTS OF SEVERAL PHASES

Scoping Phase	→	Impact Assessment Phase	→	Environmental Impact Report	→	Decision-making Phase
To identify issues, to focus the EIA		Detailed studies of potential impacts, positive and negative		Consolidate findings of impact assessment studies		Proponent and authorities use EIA findings to decide if project goes ahead

YOUR COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT REPORT

The Draft Environmental Impact Report is available for comment from Monday, 16 February 2009 to Monday, 16 March 2009 (4 weeks). This Draft Environmental Impact Report has been distributed to the authorities, all key stakeholders and all those that have requested a copy. Copies of the report are available at strategic public places in the project area (see below).

List of public places where the Draft Environmental Impact Report is available:

PLACE	CONTACT PERSON	TELEPHONE
Blue Valley Golf and Country Estate, HALFWAY HOUSE	Bothma, Lise	(011) 512 0538
City of Johannesburg: Human Development, HALFWAY HOUSE	Kubheka, Kaiser	(011) 203 3419
Delmas Public Library, DELMAS	Mehlape, Lydia	(013) 665 2425
Kungwini Public Library, BRONKHORSTSPRUIT	Smith, Brenda	(013) 665 2425
Leandra Public Library, LEANDRA	Potgieter, A M	(017) 683 0055
Lebogang Public Library, LESLIE	Mosako, Rosina	(017) 683 3000
Midfield Homeowners Association, MIDSTREAM ESTATES	Du Preez, Tarynlee	(012) 661 0456
Midlands Homeowners Association, MIDSTREAM ESTATES	De Wet, Lizette	087 805 3610
Midstream Homeowners Association, MIDSTREAM ESTATES	van der Westhuizen, Durette	(012) 661 0915
Olievenhoutbosch Library, OLIVENHOUTBOSCH	Nkonki, Bongi	(012) 652 1001
Phola Public Library, OGIES	Mabena, Agnes	(013) 645 0094
Secunda Public Library, SECUNDA	Griesel, Tertia	(017) 620 6183

The reports are also available electronically from the Public Participation office.

You may comment on the Draft Environmental Impact Report by:

- Completing the comment sheet enclosed with the report;
- Writing a letter, or producing additional written submissions; or
- By email or telephone to the public participation office.

DUE DATE FOR COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT REPORT

Monday, 16 March 2009 to the Public Participation Office:

Anelle Odendaal
Public Participation Office
Zitholele Consulting (Pty) Ltd
P O Box 6002
HALFWAY HOUSE, 1685
Tel: (011) 254-4855
Fax: (011) 805-2100
Email: aodendaal@zitholele.co.za

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1.1 Background Information

1.1.1 Eskom Holdings

Eskom Holdings is South African utility that generates, transmits and distributes electricity. Eskom supplies approximately 95% of the country's electricity, and approximately 60% of the total electricity consumed on the African continent. Eskom's' vision *"Together building the powerbase for sustainable growth and development."* [1] places a responsibility on the company to ensure that sustainable development in the country becomes a reality. Eskom further plays a major role in accelerating growth in the South African economy by providing a high-quality supply of electricity. Eskom's vision means: [1]

TABLE 1: ESKOM'S VISION.

Together	One Eskom, unified, working together in partnership with others
Building	Planning for the future, building South Africa's economy
Powerbase	Providing the electricity foundation for positive sustainable development
Sustainable	Ensuring continued delivery on economic, environmental and social outcomes
Growth	Empowering South Africa, its people and the economy
Development	Securing a brighter future for all and integrating the first and second economy

The details of the proponent are as follows:

Company: Eskom Transmission: Land and Rights

Contact: Project Manager: Mr Vuledzani Thanyani

Address: Eskom Transmission, Mega Watt Park, Maxwell Drive, Sunninghill

Landline: 011 800 5601

Fax: 011 800 3917

For more information regarding Eskom please refer to the Eskom website at www.eskom.co.za

[1] Taken from the Eskom website, 27 August 2008 (http://www.eskom.co.za/live/content.php?Category_ID=58)

1.2 Purpose and Motivation for the Proposed Project

In South Africa, our most abundant source of energy is coal. Eskom therefore relies on coal-fired power stations to produce approximately 90% of its electricity. Coal mining in South Africa is relatively cheap compared to the rest of the world. In Europe, by contrast, costs are almost four times higher.

In order for the electricity generated by these power stations to be transmitted safely and efficiently, it must be at a high voltage (Typically 400 kilo Volts [kV]) and a low current. The transmission system carries the electricity from source (power stations) to consumption areas.

Electricity delivered by transmission circuits is then stepped down in facilities called substations to voltages more suitable for use. At distribution substations electricity is stepped down to 11 kV for local distribution and then further reduced according to need, for example, 220 volts for domestic use. Substations are used to transform power from one voltage level to another; interconnect alternative sources of power; connect generators, transmission or distribution lines and loads to each other, as well as provide switching for alternate connections and isolation of failed or overloaded lines and equipment. Substations are also used to interconnect adjacent power systems for mutual assistance in case of emergency.

1.2.1 Increased Electricity Supply Plan

For many years Eskom has operated in an environment of surplus capacity. However, this surplus capacity has now been exhausted with increased consumer demand. Eskom’s power system will remain tight over the next five years with an increased likelihood of power interruptions. This trend is set to continue at least until the first new coal-fired base load power station (Medupi power station) is commissioned in 2011.

During the Integrated Strategic Electricity Planning (ISEP) process Eskom identified long-term options regarding both the supply and demand sides of electricity provision in South Africa. The ISEP is informed by the White Paper on the Energy Policy of the Republic of South Africa (1998), the Integrated Energy Plan (2003) and the National Integrated Resource Plan (2003/ 2004).

The latest ISEP (October 2005) has identified the need for increased base load electricity supply by the year 2010, while peaking generation is being attended to in the shorter term. The National Energy Regulator of South Africa (NERSA) is the regulatory authority responsible for the electricity supply industry in South Africa. In its National Integrated Resource Plan (NIRP), NERSA has determined that, while various alternative and renewable electricity generation options should be continually investigated, coal should still provide the main fuel source in South Africa. Accordingly, coal-fired power stations will be required for the expansion of generation capacity during the next 20 years.

On 29 February 2008 Eskom awarded contracts for its "Bravo Project", a coal-fired power station to be built near Emalahleni in Mpumalanga by 2017. Site clearance for this station has already started. The first unit is planned to be online by 2013.

The proposed Bravo Integration Project is necessary to integrate and connect Bravo power station (which will aid in the delivery of additional electricity supply) into the existing Eskom electricity network.

For additional information on the Eskom build programme, or increased electricity supply plan, please visit the Eskom website: http://www.eskom.co.za/live/content.php?Item_ID=5981&Revision=en/2.

1.2.2 Bravo Integration Project

The Bravo Integration project consists of the following five components ():

Phase 1: Sol – Camden By-Pass Power Line

The intention of Bravo 1 is to build two 400 kV by-pass lines for Zeus substation, the two 400 kV lines from Sol Substation and the two 400 kV power lines from Camden power station will be disconnected from Zeus substation and joined to each other to form two Camden- Sol 400 kV power lines. The location of the two by-pass lines is planned to be within approximately 10 km radius of the Zeus substation. The project is located within the Govan Mbeki District Municipality.

Phase 2: Apollo and Kendal loop in and loop out lines

Eskom propose to construct four new 400 kV overhead power lines, located within the Emalahleni Local Municipality in Mpumalanga, to loop in and out of Bravo Power Station. The existing Kendal-Apollo line will be looped in and out of Bravo to form the Bravo-Apollo and Bravo-Kendal lines. In addition, the existing Duvha-Minerva 400 kV overhead power line will be looped in and out of Bravo Power Station, to form the Bravo-Duvha and Bravo-Minerva lines. The study area in which the alternatives were selected is within the 10 km radius surrounding the new Bravo Power Station and each of the alternative 400 kV power lines will be not exceed 10 km in length.

Phase 3: Construction of a 400 kV power line from Bravo Power Station to Lulamisa Substation

In order for the Bravo power station to be integrated within the existing Eskom infrastructure, Eskom propose to construct a new 400 kV power line from the new Bravo Power Station to the existing Lulamisa substation, near Diepsloot. This line will be approximately 150 km in length. The construction of this proposed 400 kV power line is aimed to ensure sufficient electricity supply to the Diepsloot and Johannesburg North areas, where currently frequent electricity shortages are experienced. The alternative Bravo power line corridors are located on the eastern Highveld of Southern Africa. The corridors cover an area from Witbank in the east, to Diepsloot in the west.

Phase 4: Two new 70 km Kendal –Zeus 400 kV Power Lines

Eskom propose to construct two new 400 kV power lines, one from Bravo to Zeus and the other one from the Kendal Power Station (near Ogies) to the Zeus substation (near Secunda), Mpumalanga. These lines will run parallel to each other and will be approximately 70 km's in length. The three alternative route corridors will be 5 km's wide. These three alternative corridors merge into two corridors approximately 30 km's from the Zeus substation.

Phase 5: New 10 km Bravo-Vulcan Power Line

Eskom propose to construct a 400 kV overhead power line, by-passing the existing Duvha substation, to form a new Bravo-Vulcan line near Emahlahleni, Mpumalanga. This by-pass line is planned to be approximately 10 km in length. The area to be investigated for this by-pass line is a 10 km radius surrounding the existing Duvha substation.

1.2.3 Context of this Report

This report constitutes the Draft Environmental Impact Report, a key component of the Environmental Authorisation Process for Phase 3 Construction of new Bravo (Kusile) to Lulamisa 400 kV power line.

1.3 The Project Team

The project team for the proposed Bravo – Lulamisa power line is divided into various role players as follows:

- The Applicant / Proponent;
- The Environmental Assessment Practitioner (EAP); and
- The Decision Making Authority.

1.3.1 The Applicant / Proponent

Eskom Holdings, the *"Proponent" is* applying for the Environmental Authorisation from the Department of Environmental Affairs and Tourism (DEAT). As the land owner and operator of the proposed Bravo – Lulamisa power line Eskom will remain the responsible legal entity and will carry the environmental liability for the proposed project.

1.3.2 The Environment Assessment Practitioner (EAP)

In terms of the EIA Regulations, the Proponent has appointed the following independent environmental consultants to undertake the detailed EIA Phase of this project:

ZITHOLELE CONSULTING

PO Box 6002, Halfway House, 1685
Tel: +27 (11) 254 4982
Fax: +27 (11) 011 805 2100
email : jacquih@zitholele.co.za

CYMBIAN
ENVIRO-SOCIAL CONSULTING SERVICES
PTY (LTD) 2006/022502/07

PO Box 1676, Cresta, 2118
Tel: +27 (11) 678 6680
Fax: +27 (11) 476 4108
email : warren@cymbian.co.za

FIGURE 1: ENVIRONMENTAL ASSESSMENT PRACTITIONERS.

The environmental consultants were selected on the basis of their experience in environmental management and assessment, their familiarity with EIA requirements specifically for projects related to the industry, and their knowledge of the project area. Neither Zitholele Consulting (Pty) Ltd (ZC) nor Cymbian Enviro-Social Consulting Services (Pty) Ltd (Cymbian) have any vested interest in the proposed project.

1.3.3 The Decision Making Authority

The Department of Environmental Affairs and Tourism (DEAT) is the delegated lead authority responsible for authorising this project. However, in the spirit of co-operative governance, the following government departments will be consulted before making a decision:

- Department of Water Affairs and Forestry (DWAF);
- Mpumalanga Department of Agriculture and Land Administration (MDALA);
- Gauteng Department of Agriculture, Conservation, and Environment (GDACE);
- Emalahleni Local Municipality; and
- Nkgangala District Municipality.

1.4 Project Progress

To date the following has been completed by the Environmental consulting team.

- Pre-application consultation with relevant stakeholders and authorities;
- Completion and submission of the relevant Screening / EIA Application documentation;
- Compilation, submission, and approval of the Plan of Study for Scoping;
- Placement of advertisements;
- Compilation and distribution of a Background Information Document;
- Hosting a public meeting;
- Compilation of a Draft Scoping Report; and
- Compilation, submission and approval of the Final Scoping Report and Plan of Study for EIA;
- Specialist Studies.

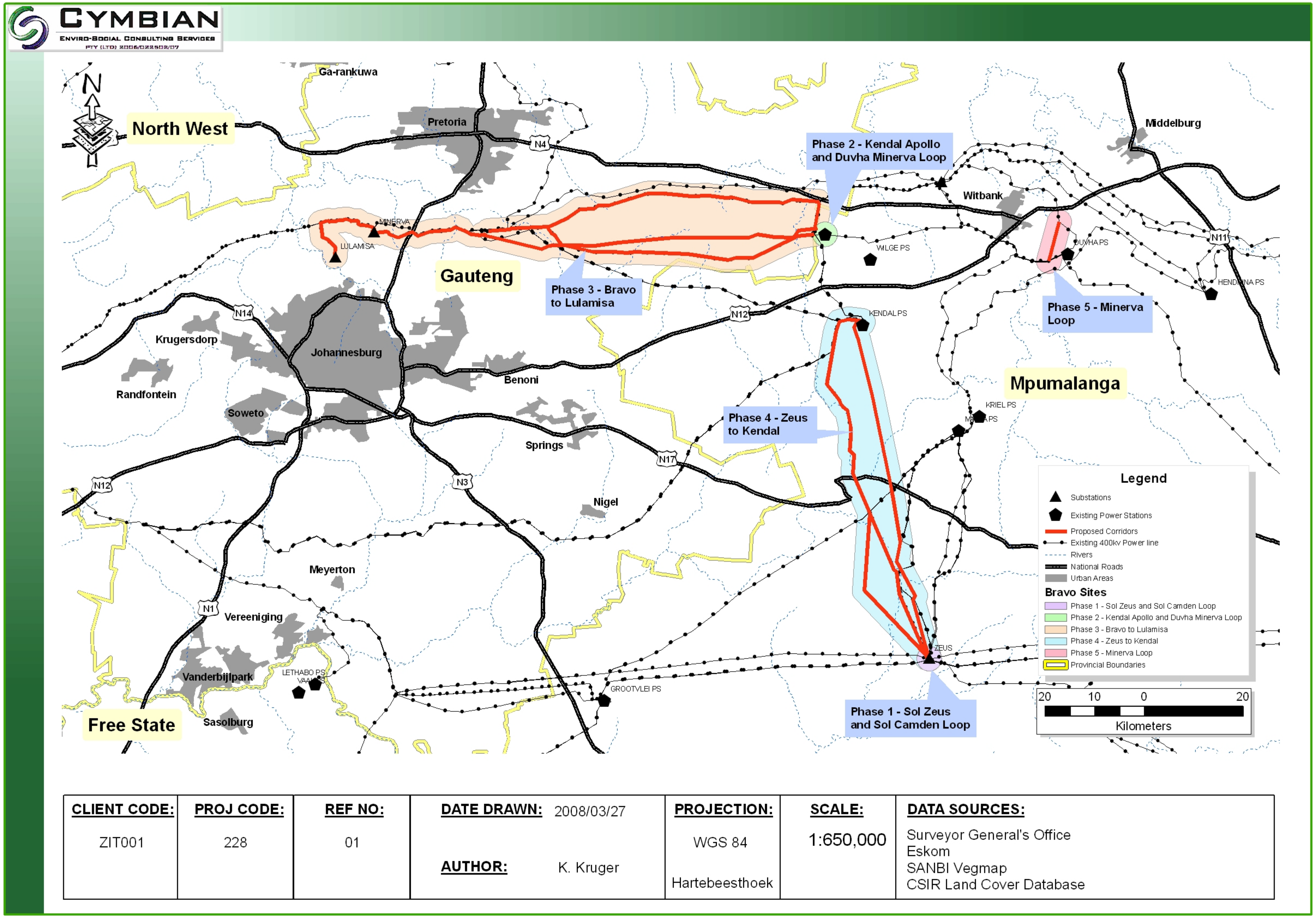


FIGURE 2: OVERVIEW OF THE BRAVO INTEGRATION PROJECT.

2 LEGAL CONTEXT

2.1 National Environmental Management Act (No 107 of 1998)

The EIA for this proposed project will be conducted in terms of the EIA Regulations that were promulgated in terms of Section 24 (5) of the National Environmental Management Act (NEMA). The National Department of Environmental Affairs and Tourism (DEAT) is the competent authority responsible for issuing environmental authorisation for the proposed project.

A full EIA is applicable to all projects likely to have significant environmental impacts due to their nature or extent, activities associated with potentially high levels of environmental degradation, or activities for which the impacts cannot be easily predicted.

In terms of Government Notice Regulation (GNR) 387, activity 1(l), a full Environmental Impact Assessment comprising both Scoping and Impact Assessment, is necessary for the proposed new 400 kV overhead power lines. This activity is listed as follows:

- *Activity 1(l):* *The transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more.*

The following activities in accordance with Regulation GNR 386 are also included in the EIA application, to provide for supporting infrastructure associated with the proposed power lines construction:

- *Activity 1 (p):* *The temporary storage of hazardous waste;*
- *Activity 12:* *The transformation or removal of indigenous vegetation of three hectares or more, or of any size where the transformation or removal would occur within a critically endangered ecosystem listed in terms of section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004);*
- *Activity 14:* *The construction of masts of any material of type and of any height, including those used for telecommunications, broadcasting and radio transmission, but excluding (a) masts of 15m and lower exclusively used by (i) radio amateurs; or (ii) for lighting purposes, (b) flagpoles; and (c) lightning conductor poles;*
- *Activity 15:* *The construction of a road that is wider than four metres or that has a reserve wider than six metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long;*
- *Activity 16 (b):* *The transformation of undeveloped, vacant or derelict land for residential, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than one hectare; and*
- *Activity 23:* *The decommissioning of existing facilities or infrastructure, other than facilities or infrastructure that commenced under an environmental authorization issued in terms of the Environmental Impact Assessment Regulations 2006 made under*

section 24(5) of the Act and published in Government Notice No. R. 385 of 2006, for -. (a) electricity generation

The NEMA can be regarded as the most important piece of general environmental legislation. It provides a framework for environmental law reform and covers three areas, namely:

- Land, planning and development;
- Natural and cultural resources, use and conservation; and
- Pollution control and waste management.

The law is based on the concept of sustainable development. The objective of the NEMA is to provide for co-operative environmental governance through a series of principles relating to:

- The procedures for state decision-making on the environment; and
- The institutions of state which make those decisions.

The NEMA principles serve as:

- A general framework for environmental planning;
- Guidelines according to which the state must exercise its environmental functions; and
- A guide to the interpretation of NEMA itself and of any other law relating to the environment.

2.1.1 What are the NEMA principles?

Some of the most important principles contained in NEMA are that:

- Environmental management must put people and their needs first;
- Development must be socially, environmentally and economically sustainable;
- There should be equal access to environmental resources, benefits and services to meet basic human needs;
- Government should promote public participation when making decisions about the environment;
- Communities must be given environmental education;
- Workers have the right to refuse to do work that is harmful to their health or to the environment;
- Decisions must be taken in an open and transparent manner and there must be access to information;
- The role of youth and women in environmental management must be recognised;
- The person or company who pollutes the environment must pay to clean it up;

- The environment is held in trust by the state for the benefit of all South Africans; and
- The utmost caution should be used when permission for new developments is granted.

2.1.2 Department of Environmental Affairs and Tourism Integrated Environmental Management Information Series

The Department of Environmental Affairs and Tourism (DEAT) Information Series of 2002 and 2004 comprise 20 information documents. The documents were drafted as sources of information about concepts and approaches to Integrated Environmental Management (IEM). The IEM is a key instrument of NEMA and provides the overarching framework for the integration of environmental assessment and management principles into environmental decision-making. The aim of the information series is to provide general guidance on techniques, tools and processes for environmental assessment and management.

2.2 Environmental Conservation Act (Act No 73 of 1989)

The Environment Conservation Act (ECA) is a law that relates specifically to the environment. Although most of this Act has been replaced by the NEMA there are still some important sections that remain in operation. These sections relate to:

- Protected natural environments;
- Littering;
- Special nature reserves;
- Waste management;
- Limited development areas;
- Regulations on noise, vibration and shock and
- Environmental impact assessment (EIA).

Perhaps the most important sections are the ones that deal with EIA. The government has made certain Regulations under the EIA sections so that anyone who wants to undertake a development (e.g. erect a hotel, or build a factory) must first put together a report about how the development will affect the environment. This report is then used by government to decide whether permission for the development will be granted, and whether there will be any limits placed on the development.

2.3 Additional Legal Requirements and Frameworks

2.3.1 White Paper on the Energy Policy of the Republic of South Africa – 1998

Development within the energy sector in South Africa is guided by the White Paper on the Energy Policy, published by DME in 1998. This White Paper sets out five objectives for the further development of the energy sector. The five objectives 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.

Furthermore, the Energy Policy identified the need to undertake an Integrated Energy Planning (IEP) process in order to achieve a balance between energy demand and resource availability, whilst taking into account health, safety and environmental aspects. In addition, the policy identified the need for the adoption of a National Integrated Resource Planning (NIRP) approach to provide a long-term cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

2.3.2 Integrated Energy Plan (IEP) – 2003

DME commissioned the IEP to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance in providing low cost electricity for social and economic development, ensuring security of supply and minimizing the associated environmental impacts. The IEP projected that the additional demand in electricity would necessitate an increase in electricity generation capacity in South Africa by 2007. Furthermore, the IEP concluded that, based on energy resources available in South Africa, coal will be the primary fuel source for the current expansion period.

2.3.3 National Integrated Resource Plan (NIRP) – 2003/2004

In response to the White Paper's objective relating to affordable energy services, the National Electricity Regulator (now NERSA) commissioned a NIRP. The objectives of the NIRP are to determine the least-cost supply option for the country, provide information on the opportunities for investment into new power stations and evaluate the security of supply.

The national electricity demand forecast took a number of factors into account. They are:

- A 2.8% average annual economic growth;
- The development and expansion of a number of large energy-intensive industrial projects;
- Electrification needs;
- A reduction in electricity-intensive industries over the 20 year planning horizon;
- A reduction in electricity consumers – NIRP anticipates people switching to the direct use of natural gas;
- The supply of electricity to large mining and industrial projects in Namibia and Mozambique; and
- Typical demand profiles.

In addition to the ECA and NEMA, the following Acts have some bearing on the proposed activities:

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

The proposed overhead power lines comprise certain activities (e.g. changing the nature of a site exceeding 5 000 m^2 and linear developments in excess of 300 m) that require authorisation in terms of Section 38 (1) of the Act. Section 38 (8) of the Act states that, if heritage considerations are taken into account as part of an application process undertaken in terms of the ECA, there is no need to undertake a separate application in terms of the National Heritage Resources Act. The requirements of the National Heritage Resources Act have thus been addressed as an element of the EIA process, specifically by the inclusion of a Heritage Assessment.

2.3.5 Expropriation Act (No. 63 of 1975)

Eskom has a policy of “willing buyer, willing seller”, and therefore endeavours to purchase land where ever possible or necessary. However, the State and State-owned-enterprises can acquire the rights to use or possess the requisite land through the Expropriation Act (No 63 of 1975). The Expropriation Act requires the determination of compensation based on the principle of market value (i.e. what would the value be in the event of both a willing buyer and a willing seller trading the land). There is a suite of additional legislation, which, in conjunction with the Expropriation Act, would be used to determine the compensation value.

2.3.6 Occupational Health and Safety Act (Act No 85 of 1993)

This Act makes provisions that address the health and safety of persons working at the proposed plant. The Act addresses amongst others the:

- Safety requirements for the operation of plant machinery;
- Protection of persons other than persons at work against hazards to health and safety, arising out of or in connection with the activities of persons at work;
- Establishment of an advisory council for occupational health and safety; and
- Provision for matters connected therewith.

The law states that any person undertaking upgrades or developments for use at work or on any premises shall ensure as far as is reasonably practicable that nothing about the manner in which it is erected or installed makes it unsafe or creates a risk to health when properly used.

3 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

3.1 Study Approach and Progress to Date

The EIA Process being followed for this project complies with the new EIA Regulations as amended and administered by the DEAT and promulgated in April 2006 in terms of the Section 24 (5) of the National Environmental Management Act (NEMA) (Act 107 of 1998). The technical and public participation process undertaken for this EIA is summarised below and schematically represented in Figure 3.

3.1.1 Pre-Application Consultation

On notification and receipt of the appointment letter from Eskom, a project inception meeting was held on 13 November 2007 between Eskom and Zitholele Consulting Project Team. During this project kick-off meeting the following was discussed:

- Project Scope and Requirements;
- Project Schedule;
- Identification of key stakeholders and role players; and
- Analyse the preliminary Bravo – Lulamisa power line route alignments.

A pre-application consultation with Mr. Wayne Hector of the DEAT was held on 21 April 2008. During this meeting the proposed project was presented to the authorising authority and the project-specific requirements for environmental authorisation were discussed and finalised.

3.1.2 Submission of an Application for Authorisation

The EIA application form (Appendix A) for the proposed project was submitted to the DEAT on 7 January 2008. The potentially affected landowners are attached as Appendix C to this report.

3.1.3 Site Visit

A site visit was conducted by Mr Johan Hayes and Mr Andre Joubert from Zitholele Consulting on 24 April 2008. The objective of this site visit was to familiarise the project team with the area.

3.1.4 Draft Scoping Report and Terms of Reference for Specialist Studies

This Draft Scoping Report (DSR) was prepared on the basis of information and issues identified during the Scoping Phase of this EIA. The Terms of Reference (ToR) for the envisaged specialist studies during the Environmental Impact Assessment Phase and a Plan of Study for EIA were compiled. The DSR was later updated based on public review and comments obtained from the I&APs. After the public review period, the Final Scoping Report was submitted to the DEAT for approval to commence the Environmental Impact Phase.

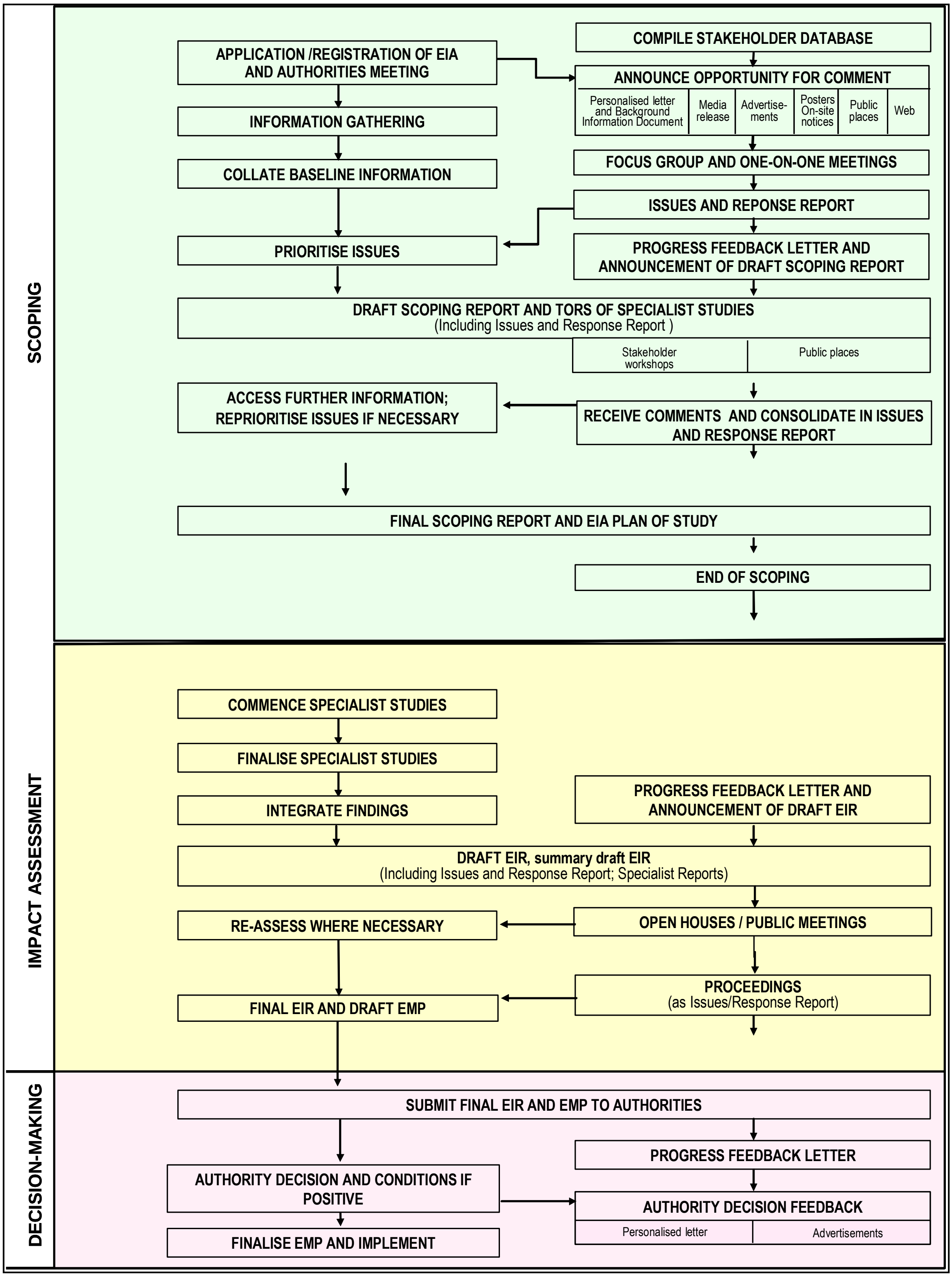


FIGURE 3: TECHNICAL AND PUBLIC PARTICIPATION PROCESS AND ACTIVITIES THAT COMPRISE THE ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF A NEW 400 KV POWER LINE FROM BRAVO POWER STATION TO LULAMISA SUBSTATION.

3.1.5 Public Participation Process

Public participation is an essential and legislative requirement for environmental authorisation. The principles that demand communication with society at large are best embodied in the principles of the National Environmental Management Act (Act 107 of 1998, Chapter 1), South Africa's overarching environmental law. In addition, Section 24 (5), Regulation 56 of GN R385 under the National Environmental Management Act, guides the public participation process that is required for an Environmental Impact Assessment (EIA).

The public participation process for the proposed loop-in and loop-out overhead power lines has been designed to satisfy the requirements laid down in the above legislation and guidelines. Figure 3 provides an overview of the EIA technical and public participation processes, and illustrates how issues and concerns raised by the public are used to inform the technical investigations of the EIA at various milestones during the process. This section of the report highlights the key elements of the public participation process followed.

<u>Objectives of Public Participation in an EIA</u>

The objectives of public participation in an EIA are to provide sufficient and accessible information to I&APs in an objective manner to assist them to:

During Scoping:

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

During Impact Assessment:

- Verify that their issues have been considered either by the EIA Specialist Studies, or elsewhere.
- Comment on the findings of the EIA, including the measures that have been proposed to enhance positive impacts and reduce or avoid negative ones.

Identification of interested and affected parties

The identification of stakeholders is an ongoing process, refined throughout the process as on-the-ground understanding of affected stakeholders improves through interaction with various stakeholders in the area. The identification of key stakeholders and community representatives (land owners and occupiers) for this project is important and was done in collaboration with the local municipalities and other organisations in the study area.

Stakeholders' details are captured on Maximiser 9, an electronic database management software programme that automatically categorises every mail to stakeholders, thus providing an ongoing record of communications - an important requirement by the authorities for public participation. In addition, comments and contributions received from stakeholders are recorded, linking each comment to the name of the person who made it.

According to the new EIA Regulations under Section 24(5) of NEMA, a register of I&APs must be kept by the public participation practitioner. Such a register has been compiled and is being kept updated with the details of involved I&APs throughout the process (See Appendix F).

Announcement of opportunity to become involved

The opportunity to participate in the EIA was announced in April 2008 as follows:

- Distribution of a letter of invitation to become involved, addressed to individuals and organisations by name, accompanied by a Background Information Document containing details of the proposed project, including maps of the project area and the alternative routes, and a registration sheet (Appendix G);
- Advertisements were placed in the following newspapers (Appendix I):

TABLE 2: ADVERTISEMENTS PLACED DURING THE ANNOUNCEMENT PHASE.

NEWSPAPER	DATE
City Press	27 April 2008
Pretoria News	22 April 2008
Beeld	23 April 2008
The Star	24 April 2008
Citizen	25 April 2008
Pretoria Record Central	25 April 2008
Tshwane Sun West	30 April 2008
Tembisan	25 April 2008
Middelburg Herald	25 April 2008
Witbank News	25 April 2008
Springs Advertiser	23 April 2008
Streeknuus	23 April 2008
Ekasi News	25 April 2008
Ridge Times	25 April 2008
The Echo	25 April 2008

- Notice boards were placed at prominent localities at each alternative route during May and June 2008 at conspicuous places at various public places and on route (Appendix H). Site notices were placed prominently to invite stakeholder participation.

3.1.6 Draft Scoping Report

The purpose of the DSR was to enable I&APs to verify that their contributions have been captured, understood and correctly interpreted, and to raise further issues. At the end of Scoping, the issues identified by the I&APs and by the environmental technical specialists, were used to define the Terms of Reference for the Specialist Studies that will be conducted during this Impact Assessment Phase of the EIA. A period of four weeks was available for public review of the DSR (from Monday 21 July to Thursday, 21 August 2008).

In addition to media advertisements and site notices that announced the opportunity to participate in the EIA, the opportunity for public review was announced as follows:

- In the Background Information Document (April 2008).
- In advertisements published (see table above and Appendix I) to advertise the public review period;
- In a letter sent out on 7 July 2008, and addressed personally to all individuals and organisations on the stakeholder database.

The Draft Scoping Report, including the Issues and Response Report Version 1, was distributed for comment as follows:

- Left in public places in the project area. The public places where documents were available are listed in the table below:
- Mailed to key stakeholders.
- Mailed to I&APs who requested the report.

- Copies were made available at the public meetings (see table 3 above) where stakeholders had the opportunity to comment on the Scoping Report.

TABLE 3: LIST OF STAKEHOLDER MEETINGS THAT WERE ADVERTISED AND HELD AS PART OF THE PUBLIC REVIEW PERIOD OF THE DRAFT SCOPING REPORT.

DATE	VENUE
Monday, 28 July 2008 at 18:00	Midrand
Tuesday, 29 July 2008 at 18:00	Bronkhorstspruit
Wednesday, 30 July 2008 at 18:00	Kendal
Thursday, 31 July 2008 at 18:00	Leandra

The minutes of the public meetings are attached as Appendix L.

I&APs could comment on the report in various ways, such as completing the comment sheet accompanying the report, and submitting individual comments in writing or by email.

TABLE 4: LIST OF PUBLIC PLACES WHERE THE DRAFT SCOPING REPORT WAS AVAILABLE

PLACE	CONTACT PERSON	TELEPHONE
Blue Valley Golf and Country Estate, HALFWAY HOUSE	Bothma, Lise	(011) 512 0538
City of Johannesburg: Human Development, HALFWAY HOUSE	Kubheka, Kaiser	(011) 203 3419
Delmas Public Library, DELMAS	Mehlape, Lydia	(013) 665 2425
Kungwini Public Library, BRONKHORSTSPRUIT	Smith, Brenda	(013) 665 2425
Leandra Public Library, LEANDRA	Potgieter, A M	(017) 683 0055
Lebogang Public Library, LESLIE	Mosako, Rosina	(017) 683 3000
Midfield Homeowners Association, MIDSTREAM ESTATES	Du Preez, Tarynlee	(012) 661 0456
Midlands Homeowners Association, MIDSTREAM ESTATES	De Wet, Lizette	087 805 3610
Midstream Homeowners Association, MIDSTREAM ESTATES	van der Westhuizen, Durette	(012) 661 0915

Olievenhoutbosch Library, OLIVENHOUTBOSCH	Nkonki, Bongi	(012) 652 1001
Phola Public Library, OGIES	Mabena, Agnes	(013) 645 0094
Secunda Public Library, SECUNDA	Griesel, Tertia	(017) 620 6183

3.1.7 Final Scoping Report

The Final Scoping Report was updated with additional issues raised by I&APs and contained new information that was generated as a result of this process. The FSR was distributed to the Authorities (DEAT) and key I&APs, and to those individuals who specifically requested a copy. I&APs were notified of the availability of the report.

3.1.8 Public participation during the Impact Assessment

The purpose of the public participation process during the Impact Assessment Phase is to ensure that the Draft Environmental Impact Assessment Report is made available to the public for comments. I&APs will be requested to comment on the findings of the EIA, including the measures that have been proposed to enhance positive impacts and reduce or avoid negative ones. Once the review is completed, the authority may decide to request additional information on matters that may not be clear from the report, authorise the application with certain conditions to be complied with by the applicant or reject the application. An Environmental Authorisation reflecting the decision of the authority as well as any conditions that may apply will be issued to the applicant.

Public participation during the impact assessment phase of the EIA mainly involves a review of the findings of the EIA, presented in this Draft Environmental Impact Report and the volume of Specialist Studies.

I&APs were advised of the availability of these reports, how to obtain them, and the dates and venues of public review places where the reports will be for review.

3.2 Draft Environmental Impact Assessment Report and Environmental Management Plan

Findings of the environmental investigations were integrated by the environmental consultants and captured in a Draft Environmental Impact Assessment Report. The report includes the Issues/Response Report (Version 2), which listed every issue raised with an indication of where the issue was dealt with in the technical evaluations, and the relevant findings. It also includes a full description of the EIA process, including the necessary appendices.

3.3 Announcement of opportunity to comment on findings

The availability of the Draft Environmental Impact Assessment Report and Environmental Management Plan as well as the comment period and the deadline for comment, was announced by the following methods:

- Personalised letters to all individuals and organisations on the mailing list (see notification as part of Appendix J)
- Posters at the public places to announce the opportunity to comment (Table 4 – the same public places were used throughout the project to ensure consistency)
- Paid advertisements in the local and regional media (See below)

TABLE 5: ADVERTISEMENTS AND ANNOUNCEMENTS TO ANNOUNCE THE AVAILABILITY OF THE DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT AND THE OPPORTUNITY TO COMMENT ON THE FINDINGS OF THE EIA

NEWSPAPER	DATE
City Press	25 February 2009
Pretoria News	25 February 2009
Beeld	25 February 2009
The Star	25 February 2009
Citizen	25 February 2009
Pretoria Record Central	25 February 2009
Tshwane Sun West	25 February 2009
Tembisan	25 February 2009
Middelburg Herald	25 February 2009
Witbank News	25 February 2009
Springs Advertiser	25 February 2009
Streeknuus	25 February 2009
Ekasi News	25 February 2009
Ridge Times	25 February 2009
The Echo	25 February 2009

3.4 Distribution

The full Draft Environmental Impact Assessment Report and Environmental Management Plan, Issues and Response Report and the volume of Specialist Studies, were left in public places (see Table 4 – same as the public places used for the Draft Scoping Report) in the study areas where the broader public had access to it, and was on display at meetings with stakeholders. The Draft Environmental Impact Assessment Report and Environmental Management plans are on public review from 16 February 2009 to 16 March 2009.

In special cases, such as the decision-making and commenting authorities, the full sets of reports were distributed. The Draft Environmental Impact Assessment Report alone, and individual Specialist Studies were, however, distributed to stakeholders that specifically request them.

3.5 Methods of public review and obtaining comments

Public review of the Draft Environmental Impact Assessment Report and Environmental Management Plan was done by the following methods:

- Written comment, including email – a comment sheet asking I&APs to respond to particular questions accompanied the report; while further written submissions are encouraged
- Verbal comment during public meetings
- One-on-one discussions with the EIA team members subsequent to the public meetings.

I&APs were asked to keep the following in mind when reviewing the findings of the EIA:

- Verify that the issue(s) they have raised during the Scoping Phase have been considered in the report
- If the issue was not specifically considered in the report, verify that an indication has been provided of where and when it will be addressed
- Indicate which of the findings they agree with, and which not
- For those of the findings that they do not agree with, they have been asked to provide reasons and supporting information, or at least the sources where such information can be obtained. They were also welcome not to agree because of personal preference.

3.5.1 Public meetings

Four public meetings (Table 6) are to be convened to assist stakeholders to comment on the findings of the investigations. The details of the meetings are as follows:

TABLE 6: PUBLIC MEETINGS TO COMMENT ON THE DRAFT SCOPING REPORT

DATE	VENUE
Monday, 2 March 2009 at 18:00	Midrand
Tuesday, 3 March 2009 at 18:00	Bronkhorstspruit
Wednesday, 4 March 2009 at 18:00	Kendal
Thursday, 5 March 2009 at 18:00	Leandra

3.6 Issues and Response Report and acknowledgements

Issues raised thus far, are captured in an Issues and Response Report Version 2, appended to this Draft Environmental Impact Report (Appendix J: Personalised letters to all individuals and organisations on the mailing list

Appendix K). This report will be updated to include any additional I&AP contributions that may be received as the EIA process proceeds. Issues and comments raised during the public review period of the Final Scoping Report were added to the report as Version 2 of the Issues and Response Report.

The contributions made by I&APs are acknowledged in writing.

3.6.1 Environmental Impact Assessment

The EIA culminates in the compilation of this Environmental Impact Report (EIR). The EIR contain an evaluation of feasible alternatives including a comparative assessment of the environmental impacts associated with these alternatives, determination of the significance of identified impacts, as well as proposed mitigation measures to reduce, avoid or prevent the negative impacts and enhance the positive aspects of the activity. This report also contains a summary of specialist investigations undertaken as well as an interpretation of the relevance of the results to the study.

Like the Scoping Report, the EIR has been made available for public review. Stakeholders have an opportunity to comment on the findings of any specialist studies completed and to review the evaluation of impacts and determination of significance. Once the final EIR (including all stakeholder feedback) is submitted to the Regulator, the EIR will be assessed to determine if the impact assessment is adequate for decision-making, whether all the key issues raised during scoping have been investigated and whether the procedures followed comply with the EIA Regulations. The Regulator may either request additional information or clarification, or proceed with decision-making based on the contents of the EIR. The application to undertake the proposed activity could either be authorised with or without conditions, or the application could be rejected. An Environmental Authorisation reflecting the decision of the authority, as well as any conditions that may apply, will then be issued to the Applicant.

3.6.2 Notice of Environmental Authorisation

Within 7 days of the Environmental Authorisation being received, all stakeholders registered on the database will be notified of the outcome of the authority decision-making process. Stakeholders will also be informed of their rights to appeal.

3.6.3 Appeal

An appeal on the Environmental Authorisation can be lodged with the National Minister of Environmental Affairs by either the Proponent or a stakeholder within 30 days following issue of the Environmental Authorisation. The appeal should describe the grounds for appeal and must be substantiated with evidence.

4 ISSUES AND CONCERNS RAISED

Issues and concerns raised during the EIA have been documented in the Issues and Response Report for the Construction of a new 400 kV power line from Bravo power station to Lulamisa substation attached in Appendix J: Personalised letters to all individuals and organisations on the mailing list

Appendix K.

4.1 Authorities

To date the following Authorities have raised issues and concerns regarding the proposed routes:

- Gauteng Provincial Department; and
- Kungwini Local Municipality (Bravo 3).

4.2 Stakeholders

The issues and concerns documented to date have been tabulated in the Issues and Response Report (Appendix J: Personalised letters to all individuals and organisations on the mailing list

Appendix K) and have been summarised into the following board categories:

- Socio-economic;
- Noise;
- Air quality
- Information requirements;
- Alternatives / corridor selection / proposed route of transmission lines
- Construction and servitude related comments;
- Construction time frames
- Land capability (chicken farms).

5 DESCRIPTION OF DEVELOPMENT ACTIVITIES

5.1 Activity to be undertaken

Eskom propose to construct a new 400 kV overhead power line, located half way between Bronkhorstspruit and Witbank just east of the Bravo Power Station. The purpose of this line is to integrate the new Bravo power station into the Eskom grid to supply addition electricity to the Diepsloot and the Johannesburg north area. The study area will include three route alternatives each route is approximately 100 kms in length.

5.2 Location

The proposed Bravo-Lulamisa power line will be located half way between Bronkhorstspruit and Witbank.

The proposed routes are located between Bravo and Lulamisa. A list of the farms that the alternative routes intersect are attached to this report as Appendix C. For the location of proposed routes refer to Figure 4.

5.3 Description of the Development Activities

5.3.1 The Pre-Construction Phase

Appointment of Contractor

After a tendering process, Eskom will appoint the construction contractor. The anticipated appointment date is mid-2009.

Construction Schedule

The primary milestones for the construction of the Bravo-Lulamisa power line are described in Table 7 below.

TABLE 7: CONSTRUCTION SCHEDULE FOR THE BRAVO-LULAMISA 400 KV OVERHEAD POWER LINE.

MILESTONES	DATE
Appointment of Construction Contractor	August 2009
Pegging of bend tower by a Transmission surveyor	March 2009
Site preparation and clearance for contractor's camp	September 2009
Erection of camp sites for the Contractors' workforce	October 2009
Vegetation clearing to facilitate access, construction and the safe operation of the lines	November 2009
Establishing of access roads on the servitude where required as per design parameters in TRMSCAAC1 rev 3	January 2010
Pegging of tower positions for construction by the contractor	February 2010

MILESTONES	DATE
Transportation of equipment, materials and personnel to site and stores	March 2010
Installation of foundations for the towers	March – April 2010
Tower assembly and erection	May – June 2010
Conductor stringing and regulation	July 2010
Taking over the line from the contractor for commissioning	November 2010

5.3.2 The Construction Phase

If a positive Environmental Authorisation is obtained, the construction of the power line will be undertaken over a period of XX months. The construction phase of the development will involve the following aspects:

- Pegging of bend tower by a Transmission surveyor;
- Site preparation and clearance for contractor's camp;
- Erection of camp sites for the Contractors' workforce;
- Servitude gate installation to facilitate access to the servitude;
- Vegetation clearing to facilitate access, construction and the safe operation of the lines;
- Establishing of access roads on the servitude where required as per design parameters in TRMSCAAC1 rev 3;
- Pegging of tower positions for construction by the contractor;
- Transportation of equipment, materials and personnel to site and stores;
- Installation of foundations for the towers;
- Tower assembly and erection;
- Conductor stringing and regulation; and
- Taking over the line from the contractor for commissioning.

<u>Pegging of bend tower by a Transmission surveyor</u>

A transmission surveyor will be required to pin-point all the bend tower positions with the aid of a Geographical Positioning System (GPS). This may take place during site clearance or prior to site clearance.

Site preparation and clearance for contractor’s camp

An area will be cleared for the siting of a contractor’s camp. This area will be chosen to have the least environmental impacts which are easily mitigated and will be rehabilitated as per the Environmental Maangement Plan (EMP) requirements post construction.

Erection of camp sites for the Contractors’ workforce

The contractor’s camp will be fenced and the contractor will maintain in good order all fencing for the duration of the construction activities. Site establishment shall take place in an orderly manner and all amenities shall be installed at Camp sites before the main workforce move onto site.

Servitude gate installation to facilitate access to the servitude

A servitude gate will be installed to ensure secure access to the site. This gate must be maintained throughout the construction phase in a working order in accordance with the EMP by the contractor.

Vegetation clearing to facilitate access, construction and the safe operation of the line

Vegetation must be cleared to facilitate access, construction and safe operation of the line. Where indigenous vegetation has been removed it must be replanted so as to minimise impacts to the environment. Search and rescue activities may be required for any endangered species if found on site during clearing.

Establishing of access roads on the servitude where required as per design parameters in TRMSCAAC1 rev 3

All access roads on the servitude must be in accordance to Transmission Specifications – Transmission Line and Towers and Line Construction (TRMSCAA1).

Pegging of tower positions for construction by the contractor

All in-line towers must be pin-pointed with the aid of a Geographical Positioning System (GPS). This may take place during the pegging of the bend tower either by the contractor or the transmission surveyor.

Transportation of equipment, materials and personnel to site and stores

All transportation must be in accordance with the EMP (see Section 11).

Installation of foundations for the towers

Foundations will be approximately 1.5 m x 1.5 m each. The number of foundations will be dependent on the type of tower chosen. The installation of the foundations must take place under supervised conditions.

Tower assembly and erection

All towers will be assembled simultaneously in stages, that is bottom structures will be assembled for all towers in the first phase1, middle structures for all towers will be assembled simultaneously in the second phase 2 and so on.

Conductor stringing and regulation

Stringing will be undertaken in accordance with Eskom's stringing procedure.

Taking over the line from the contractor for commissioning

Transmission engineers will take over the line from the contractor on the completion of construction.

5.3.3 Rehabilitation Phase

The rehabilitation phase of the development will involve the following aspects:

- Rehabilitation of disturbed areas; and
- Signing off of all Landowners upon completion of the construction and rehabilitation.

Rehabilitation of disturbed areas

Once construction of the powerline is completed rehabilitation of affected areas will be undertaken to obtain the following objectives:

1.) A sustainable topographic profile, tied into the adjacent vegetation in such a manner that erosion is controlled.

2.) A sustainable vegetation layer, free of alien invasive species.

3.) A litter free environment where all construction waste has been suitably removed to a licensed facility.

4.) All powerlines will be constructed to the highest standards such that residual impacts are controlled to their maximum extent.

Signing off of all Landowners upon completion of the construction and rehabilitation

Once rehabilitation has been completed sign off will be obtained from all landowners affected.

5.3.4 The Decommissioning and Operational Phase

The decommissioning and operational phase of the development will involve the following aspects:

- Final inspection of the line, commissioning and hand over to the Grid Line and Servitude Manager for operation.
- Handing over and taking over of the servitude by the Grid Environmental Manager.
- Operation and maintenance of the line by the Grid.

Final inspection of the line, commissioning and hand over to the Grid Line and Servitude Manager for operation.

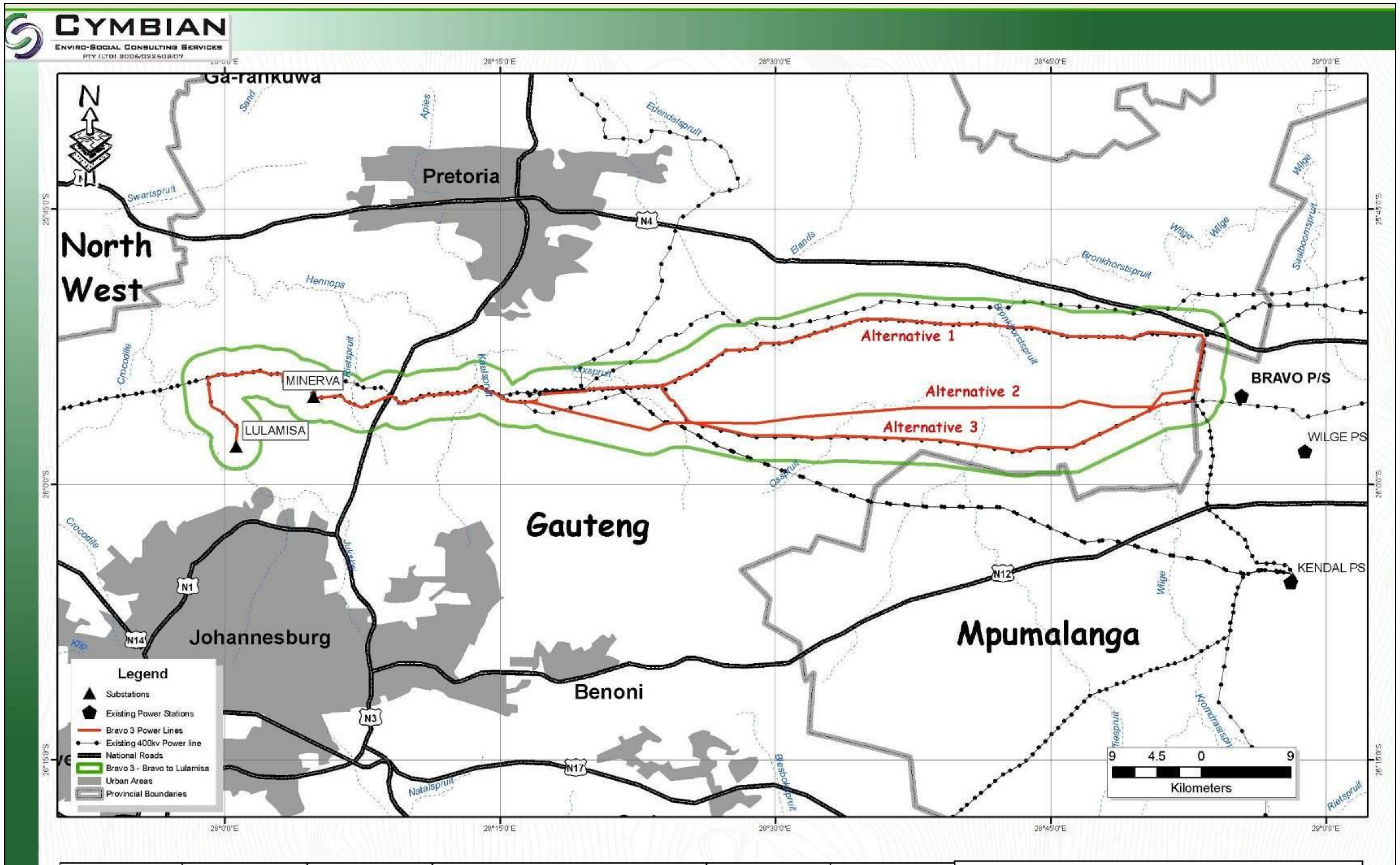
Final inspection of the line will be carried out by the Grid line and servitude manager.

Handing over and taking over of the servitude by the Grid Environmental Manager.

The site file will be handed over by the servitude manager to grid environmental manager

Operation and maintenance of the line by the Grid.

Bi-annual maintenance checks will be undertaken by Transmission by means of helicopter and on land to ensure that the lines are fully operational. In the event that a problem is identified Transmission will be instructed undertake maintenance on the power lines, however depending on the severity of the problem Transmission may appoint a contractor.



CLIENT CODE:	PROJ CODE:	REF NO:	DATE DRAWN: 2008/11/10	PROJECTION:	SCALE:	DATA SOURCES:
ZIT001	228	01	AUTHOR: K. Kruger	WGS 84 Hartebeesthoek	1:350,000	Surveyor General's Office Eskom

FIGURE 4: PROPOSED ALTERNATIVE ROUTES FOR THE BRAVO-LULAMISA POWER LINES.

6 TECHNOLOGY REVIEW / ALTERNATIVES INVESTIGATED

The IEM Guidelines on Scoping (Department of Environment Affairs and Tourism) state that information on reasonable alternatives should be given during the Scoping Phase. The following alternatives have been considered and are discussed in more detail below:

- Project alternatives;
- Site alternatives;
- Design alternatives; and
- “No-go” alternative.

The ‘no-go’ alternative is the option of not establishing the new Bravo-Lulamisa power line. As described in detail in the Scoping Report, the electricity demand in South Africa is placing increasing demand on the country’s existing power generation capacity. South Africa is expected to require additional baseload generating capacity by 2010 and beyond. The ‘no-go’ alternative is likely to result in these electricity requirements not being met, with concomitant potentially significant impacts from an economic and social perspective for South Africa. This alternative will not be explicitly assessed in this EIR, but it represents the baseline against which all of the potential impacts are assessed.

6.1 Project Alternatives

Several strategic alternatives were considered at the conceptual phase of the Bravo Power Station EIA. This strategic information was again revisited during the planning phase of the Bravo Integration Project. The following project alternatives were excluded during the planning phase due to the significant cost implications:

1) Two new power lines from Bravo Power Station to Kendal substation and from Bravo to Apollo were replaced with:

    a) A loop in line from Apollo substation to Bravo substation;

    b) A loop in line to Kendal Power Station;

    c) Two new lines from Kendal Power Station to Apollo Substation.

These alternatives were selected as they represent a total cost saving of R30 million.

6.2 Route Alternatives

The various route alternatives were analysed between Bravo power station and Lulamisa substation. The following criteria were used to determine appropriate route alternatives: regional environmental information; engineering feasibilities; as well as economic implications. The following three alternatives were identified:

Three alternative routes for the proposed power line have been selected considering existing environmental information, engineering feasibilities as well as existing Eskom power lines.

6.2.1 Alternative Route 1

Alternative 1 is to construct the proposed 400 kV power line approximately 106.8 km along a north alignment. Alternative 1 will run furthest to the north. This alternative is the longest alternative, and follows and existing servitude.

6.2.2 Alternative Route 2 (The Preferred Route)

Alternative 2 is to construct the proposed 400 kV power line approximately 102.3 km along a central alignment. The alternative will lead to the shortest power line length, which runs primarily outside Eskom's property. Alternative 2 is currently the preferred alternative by Eskom.

6.2.3 Alternative Route 3

Alternative 3 is to construct the proposed 400 kV power line approximately 102.7 km along a southern alignment. Alternative 3 will be shorter than Alternative 1 but longer than Alternative 2. This route follows an existing servitude partially and to place the route primarily on Eskom property. This route is less favourable than Alternative 2 but more favourable than Alternative 1.

For the locality of the alternative sites refer to Figure 4.

6.2.4 Route Evaluation

Alternative 2 is the shortest alternative and hence intersects the least sensitive environments such as wetlands, ridges etc. In conclusion Alternative 2 is the preferred rout alternative.

6.3 Design Alternatives

The primary motivating factors behind the selection below ground power lines include the following:

1) Areas prone to significant infrastructure damage due to extreme weather conditions, on an annual basis, usually consider underground power lines. The cost of power line replacement over the life of the infrastructure is usually more cost effective in such areas;

2) The visual impact of underground power lines is much less than those of overhead power lines, and are usually considered in highly sensitive visual landscapes, such as wide open wilderness spaces and tourism facilities e.g. game farms and nature reserves.

The primary motivating factors behind the selection overhead power lines include the following:

1) The cost of overhead lines is between 250% and 400% less. Eskom have a responsibility to provide cost effective and reliable energy resources;

2) Overhead circuits can often be worked on while they are still energized. Nearly all work on underground circuits is performed while things are de-energized and grounded.

3) Underground cables need a larger conductor to handle the same amperage as a smaller overhead conductor. This is due to the difficulty of dissipating heat to the earth. Larger conductors means higher cost.

4) Overhead distribution circuits are much easier to modify to serve customers or make other changes. A simple set of fuses on an overhead circuit might cost ~R2 000.00, yet the underground equivalent costs over ~R10 000,00.

5) An overhead line can generally span and not disturb sensitive features such as cultural resources sites, streams, most wetlands, isolated steep slopes, or a sensitive species location to mention a few. Underground lines however require the construction of a trench and results in a disturbed area of approximately 15m in width for the entire length of the line.

As none of the areas affected by the proposed Bravo Integration Project are annually affected by extremely damaging environmental events, or fall within highly sensitive visual environments it was decided to implement the more cost effective overhead power line alternative.

 **OVERHEAD POWER LINE**	 **UNDERGROUND POWER LINE**

FIGURE 5: OVERHEAD VERSUS UNDERGROUND POWER LINES.

6.3.1 Tower Designs

The following types of towers may be used on this project:

- Cross rope suspension tower;
- Compact cross rope suspension tower;

- Guyed-V suspension tower;
- Self-supporting suspension tower;
- Self-supporting strain tower.

The following will be taken into consideration during the tower selection process.

- Environmental Issues;
- Visual Impacts;
- Financial Implications;

6.4 The No-Go Alternative

The No-Go alternative was considered. If the new proposed 400 kV power line is not constructed, the new Bravo Power Station will not be able to be integrated into the existing Eskom infrastructure grid. The existing Eskom infrastructure grid will thus not benefit from the construction of the new Bravo Power Station

6.4.1 The Applicant

Should the construction and operation of the proposed project not take place it is definite that the electricity from the new Bravo Power Station will not be able to be integrated into the Eskom infrastructure grid.

6.4.2 The Community

Should the construction and operation of the proposed project not take place the community will not have sufficient electricity in the near future.

6.4.3 The Local Economy

Should the construction and operation of the proposed project not take place; the economy of the country at large will be negatively affected, resulting in the decrease of low-cost options for electricity. The capital investment and employment opportunities will also not be realised and the potential multiplier effect on the local economy will be lost.

6.4.4 The Environment

Should the construction and operation of the proposed project not take place; the local environment will not be impacted upon. The Bravo power station has however impacted upon a large section of the local environment, and these impacts will persist.

7 BASELINE RECEIVING ENVIRONMENT

Zitholele Consulting (Pty) Ltd appointed Cymbian Enviro-Social Consulting Services to undertake the Biophysical Specialist Studies for this project, including:

- Vegetation Assessment;
- Soil and Land Capability Assessment;
- Wetland Delineation;
- Geology;
- Visual; and
- Avifauna.

The Heritage Impact Assessment was conducted by Julius Pistorius and the Social Assessment was undertaken by Master Q Research (Pty) Ltd.

7.1 Bio-Physical Environment

This section details the bio-physical receiving environment at the project location. Although the aim of this section is to detail the vegetation, wetlands, soil and land capability, certain factors have been included as they provide perspective to the soil and vegetation sections.

For more information on this section please refer to Appendix R.

7.1.1 Geology

Data Collection

The geological analysis was undertaken through the desktop evaluation using a Geographic Information System (GIS) and the relevant data sources. The geological data was taken from the Environmental Potential Atlas Data from the Department of Environmental Affairs and Tourism (DEAT) as well as the Geological Desk Study Report for the EIA for the proposed alternative routes and infrastructure[2].

Regional Description

The results from the assessment are graphically represented in Figure 6 below.

The geology towards the western section of the proposed power lines, incorporating Minerva and Lulamisa substations, is dominated by Archean granite, Meinhardskraal granite, Sand River gneiss and gneiss of the Halfway House granite.

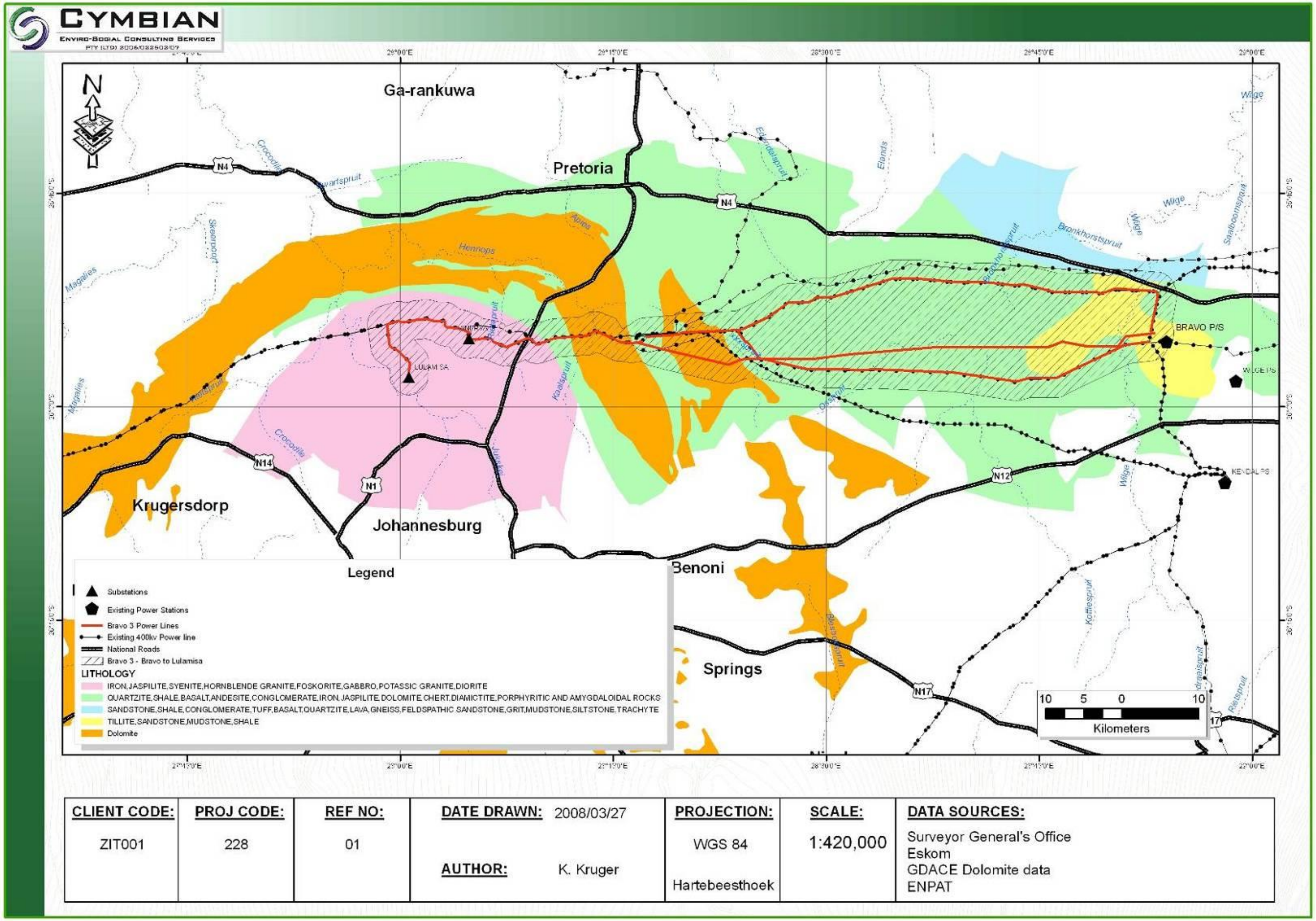


FIGURE 6: GEOLOGICAL LITHOLOGY OF THE STUDY AREA

The central part of the route overlies large sections of dolomite just south of Pretoria. These sections should be seen as sensitive as the dolomite provides a risk of sinkhole formation. The geology of the central section of the proposed power lines includes formations of the Transvaal, Rooiberg and Griqualand-West super groups, while the eastern section of the of the proposed power lines is dominated by formations of the Dwyka group

7.1.2 Climate

Data Collection

Climate information was attained using the climate of South Africa database, Land Types of the Maps 2526 Rustenburg, 2528 Pretoria (Land Type Survey Staff 1987)[3], as well as from The Vegetation of South Africa, Lesotho and Swaziland (Mucina and Rutherford 2006).

Regional Description

The region experiences strongly seasonal summer-rainfall with very dry winters. Mean Annual Precipitation (MAP) varies between 570 mm and 730 mm. The area has a warm temperate climate, with mean monthly minimum temperature of 11.7°C and a mean monthly maximum temperature of 24.0°C. A mean annual temperature (MAT) of 15.8°C is recorded.

Incidences of frosts are frequent, however it is higher in the west (30-40 days), than in the east (10-35 days). The mean annual potential evaporation (MAPE) is approximately 2 184 mm.

Site Description

The MAP for Funda Muni Training Centre, the nearest official recording station to the study site is approximately 678 mm. Maximum and minimum temperatures recorded at the station are 35.0°C and -2.5°C respectively. The rainfall and temperature data for the Funda Muni Training Centre weather station are discussed below.

Ambient Temperature

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers.

[3] Land Type Survey Staff (1987). Land Types of the Maps 2526 Rustenburg, 2528 Pretoria. Memoirs of the Agricultural Natural Resources of South Africa No. 8

TABLE 8: RAINFALL AND TEMPERATURE DATA FOR THE FUNDA MUNI TRAINING CENTRE WEATHER STATION

Month	Average Rainfall	Max Rainfall 24hrs	Mean Monthly Temperature	Ave Daily Temp (°C)	
	(mm)	(mm)	(°C)	Max	Min
Jan	**75**	**44**	**21.7**	**27.4**	**16.0**
Feb	**98**	**71**	**21.3**	**26.9**	**15.8**
Mar	**60**	**41**	**20.5**	**26.3**	**14.7**
Apr	**73**	**158**	**17.8**	**23.7**	**11.9**
May	**6**	**17**	**15.2**	**21.8**	**8.6**
Jun	**11**	**26**	**12.2**	**18.7**	**5.7**
Jul	**3**	**8**	**12.4**	**19.2**	**5.6**
Aug	**8**	**18**	**15.2**	**22.0**	**8.4**
Sep	**44**	**73**	**16.9**	**23.8**	**10.4**
Oct	**72**	**51**	**19.0**	**25.5**	**12.5**
Nov	**101**	**37**	**20.5**	**26.1**	**14.9**
Dec	**127**	**67**	**20.9**	**26.5**	**15.4**
Annual	678	158	17.8	24.0	11.7

7.1.3 Surface Water

<u>Data Collection</u>

Surface water data was taken from the WR90 Data supplied by the Department of Water Affairs and Forestry (DWAF) as well as data supplied by the Gauteng Department of Agriculture, Conservation and Environment (GDACE).

Regional Description

The area covered by the three alternative power line corridors run over several main drainage networks (Figure 8), but majority of the water drains in two major directions. The first is found in the central to western parts of the site and all the drainage flows northwest towards the Hartbeesport Dam and the Crocodile River. The second drainage network drains towards the northeast and culminates in the Olifants River.

Site Description

Three maps were generated to provide clarity because of the scale of the area that needed to be covered. From Figure 9, Figure 10 and Figure 11, there are several rivers and dams that all three alternative routes cross over. The Bronkhorstspruit River intersects all three alternatives and Bronkhorstspruit Dam intersects Alternative 2. Other rivers and streams that are intersected by the three alternative routes are the Wilge, Osspruit, Kaalspruit, Rietspruit and other small streams that follow drainage lines as indicated in Figure 9, Figure 10 and Figure 11. Figure 7 below clearly indicates existing river crossings along the route. The aim of the crossings is to always remain outside the flood line

FIGURE 7: EXISTING POWER LINE RIVER CROSSINGS

All water bodies including drainage lines that occur in the area have particular fauna and flora that are adapted to survive in these particular conditions. All these areas are earmarked as sensitive areas and should be avoided as far as possible by placing a buffer zone around each sensitive area

Particular attention needs to be focused on Alternative 2 because of the locality and the difficulty that will arise in the construction phase of the power line. This alternative runs straight across the Bronkhorstspruit Dam which will be a large problem to overcome in the future both from a construction and environmental scope.

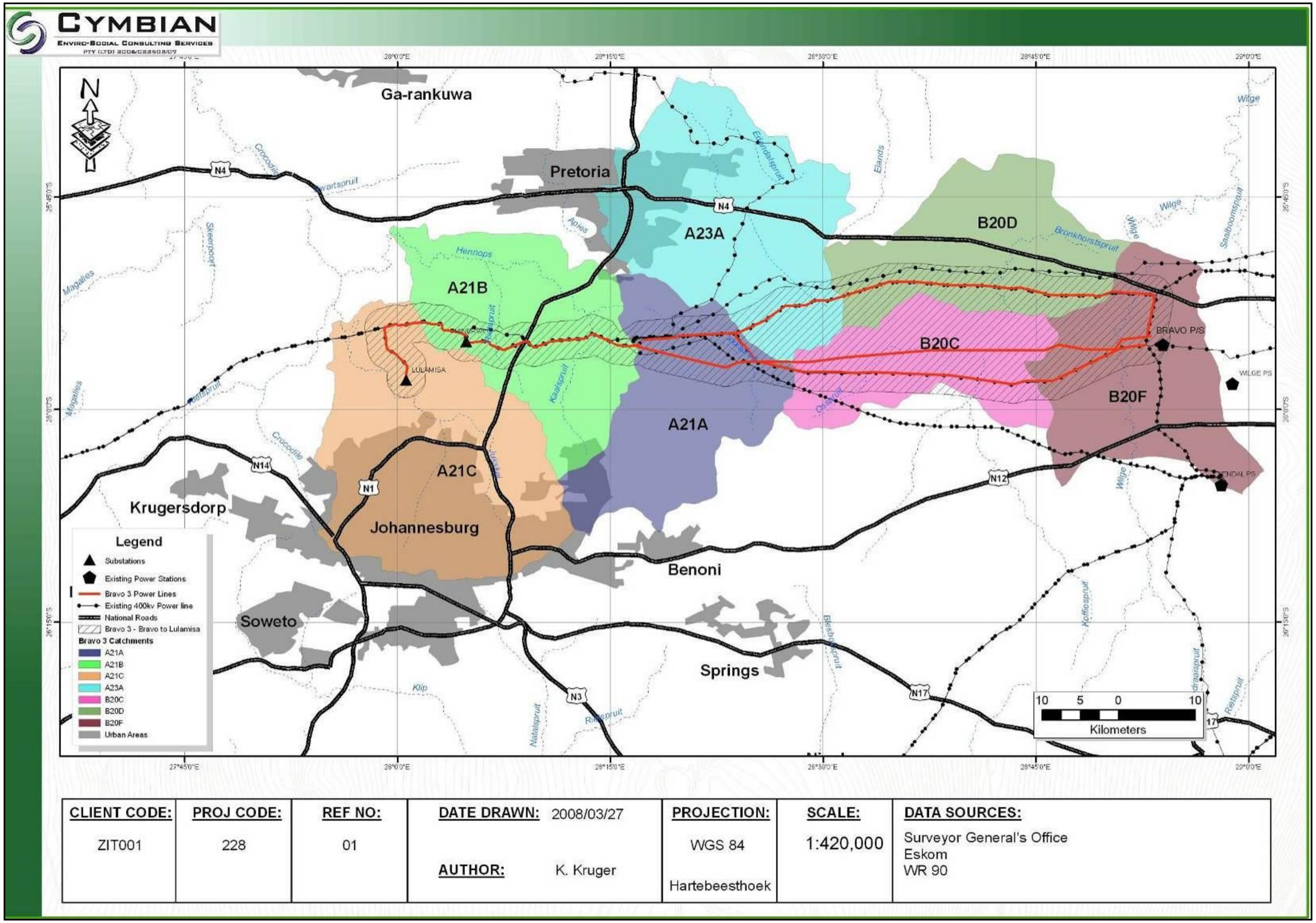
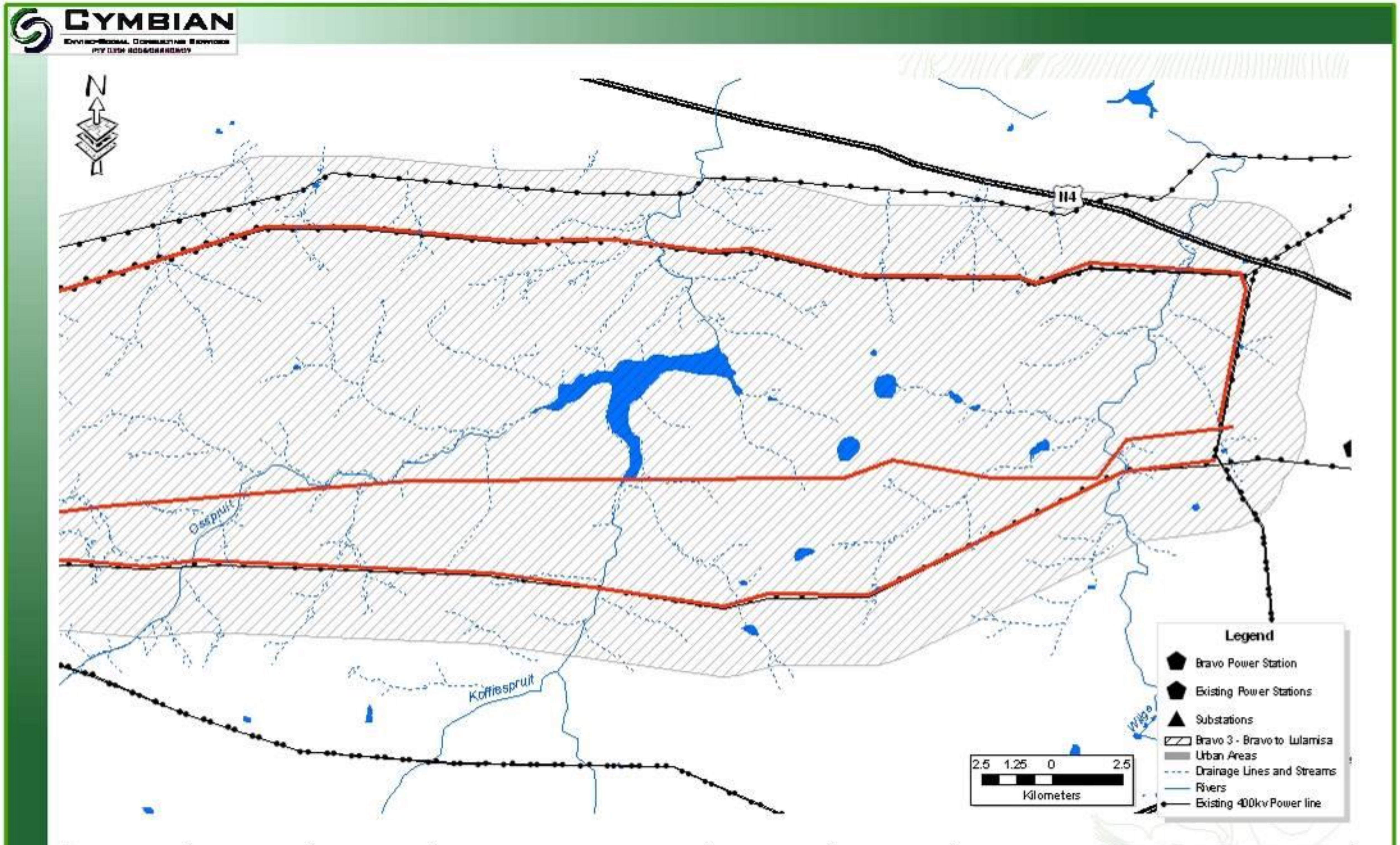


FIGURE 8: SURFACE WATER AND CATCHMENTS



CLIENT CODE:	PROJ CODE:	REF NO:	DATE DRAWN:	PROJECTION:	SCALE:	DATA SOURCES:
ZIT001	228	01	2008/11/25 AUTHOR: B.Coutts	WGS 84 Hartebeesthoek	1:170,983	Surveyor General's Office Eskom Department of Agriculture Land Capability Data

FIGURE 9: SURFACE WATER AND DRAINAGE FEATURES OF THE EASTERN SECTION OF THE SITE

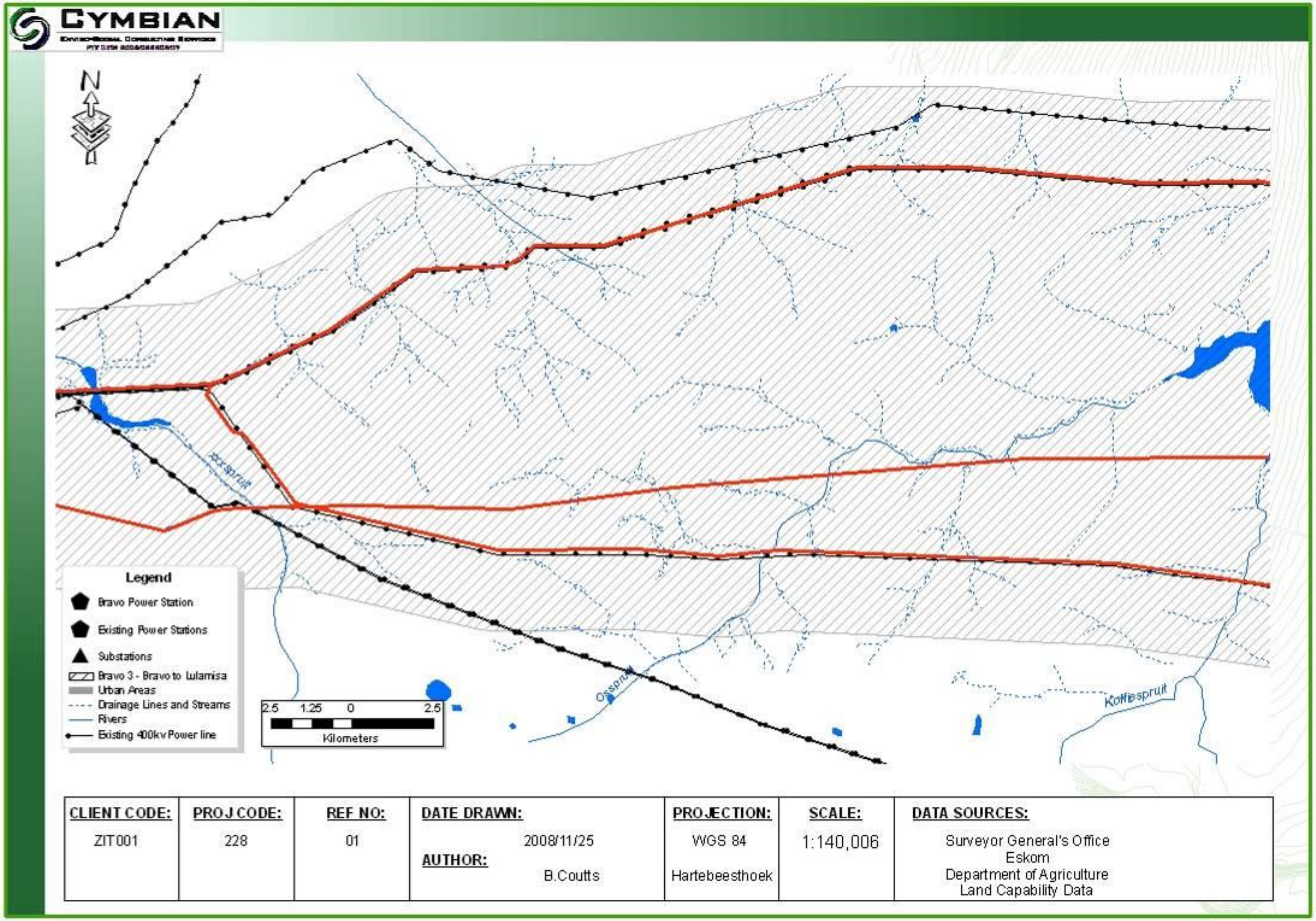


FIGURE 10: SURFACE WATER AND DRAINAGE FEATURES OF THE CENTRAL PART OF THE SITE

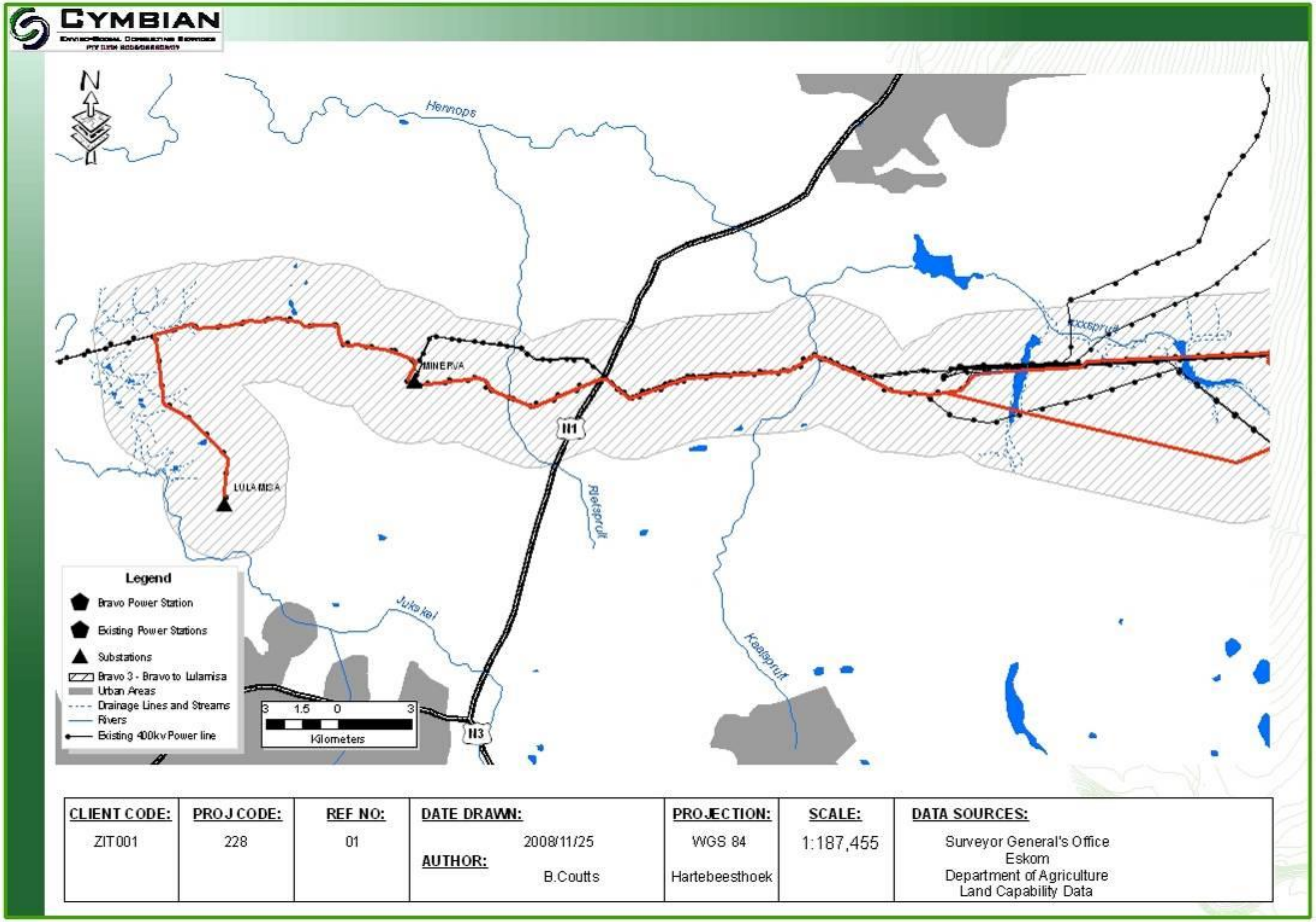


FIGURE 11: SURFACE WATER AND DRAINAGE FEATURES OF THE WESTERN PART OF THE SITE

7.1.4 Topography

Data Collection

The topography of the area was taken from the Surveyor General 1:50 000 topocadastral map sheets of the area, namely 2528 CC, CD, DD, DC, and 2527 DD.

Using the Arcview GIS software the contour information was used to develop a digital elevation model of the region as shown in Figure 13, Figure 14 and Figure 15 below.

Regional Description

The topography of the area exhibits a highly variable landscape with extensive sloping plains and ridges elevated over undulating surrounding plains. The undulating plains include some low hills and pan depressions.

A TIN model of the contours on site is represented in Figure 13, Figure 14 and Figure 15, illustrating the elevations found on site. The elevation ranges from 1 180 to 1 660 mamsl on site with the western sections of the route located in the lower lying areas that drain towards the Hartbeespoort Dam. The central part of the corridors traverse several ridges and high-lying areas, while the eastern section traverses relatively flat areas with east-west running ridges prominent.

Site Description

A number of ridges occur in the area as indicated in Figure 16 below. In several places the proposed corridors traverse along ridges, especially in the Bronkhorstspruit area. The ridges are the only land in the area that is not suitable for agriculture and therefore the power line servitudes have been placed along the ridges. This has had the added bonus that the ridges have remained relatively undisturbed, barring the power line pylon footings. The vegetation along the ridges is in good condition as the servitudes are not open for grazing. Refer to Figure 12 for photographs of the power lines on ridges.

FIGURE 12: POWER LINES LOCATED ON A RIDGE

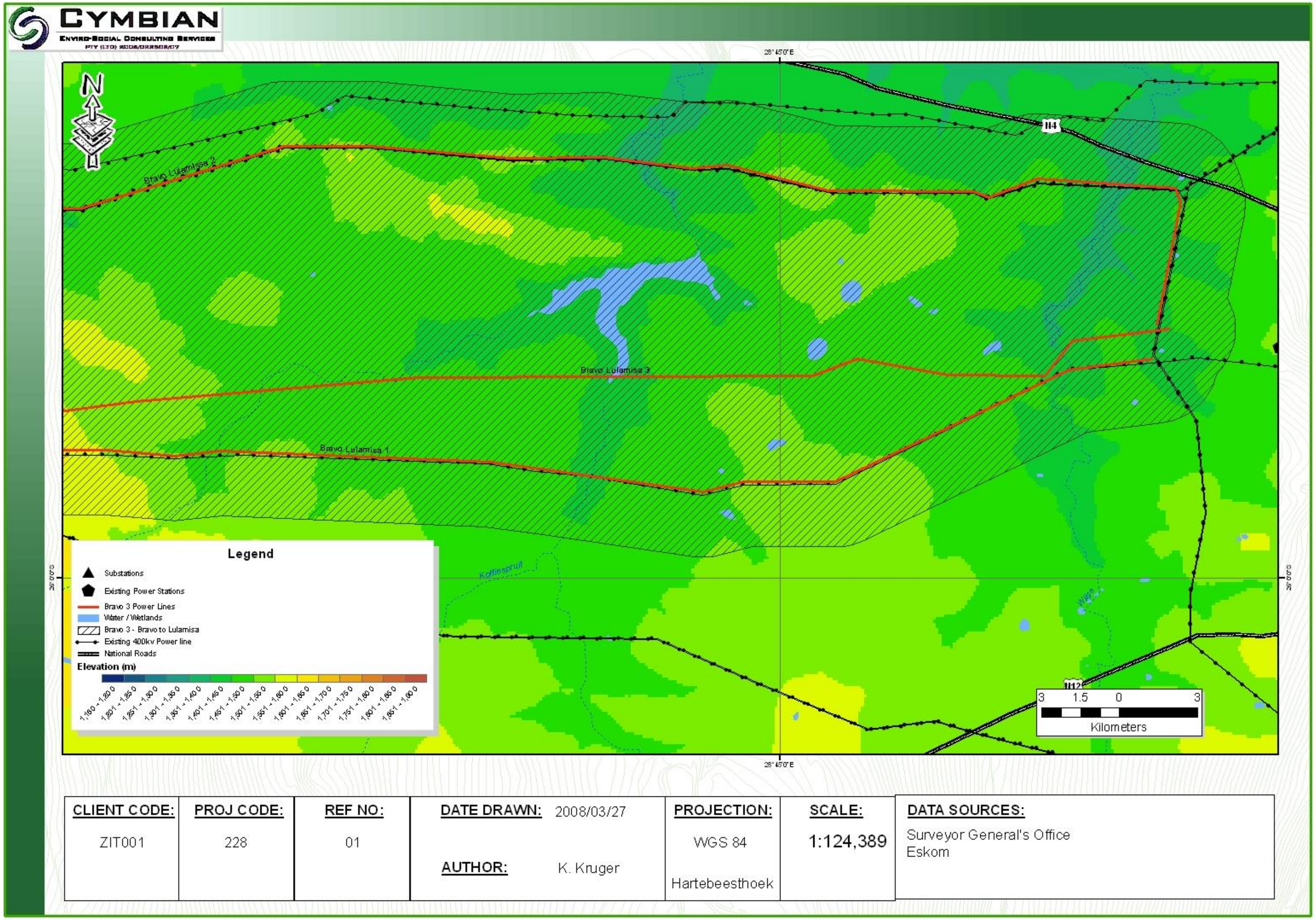


FIGURE 13: EASTERN TOPOGRAPHY OF SITE

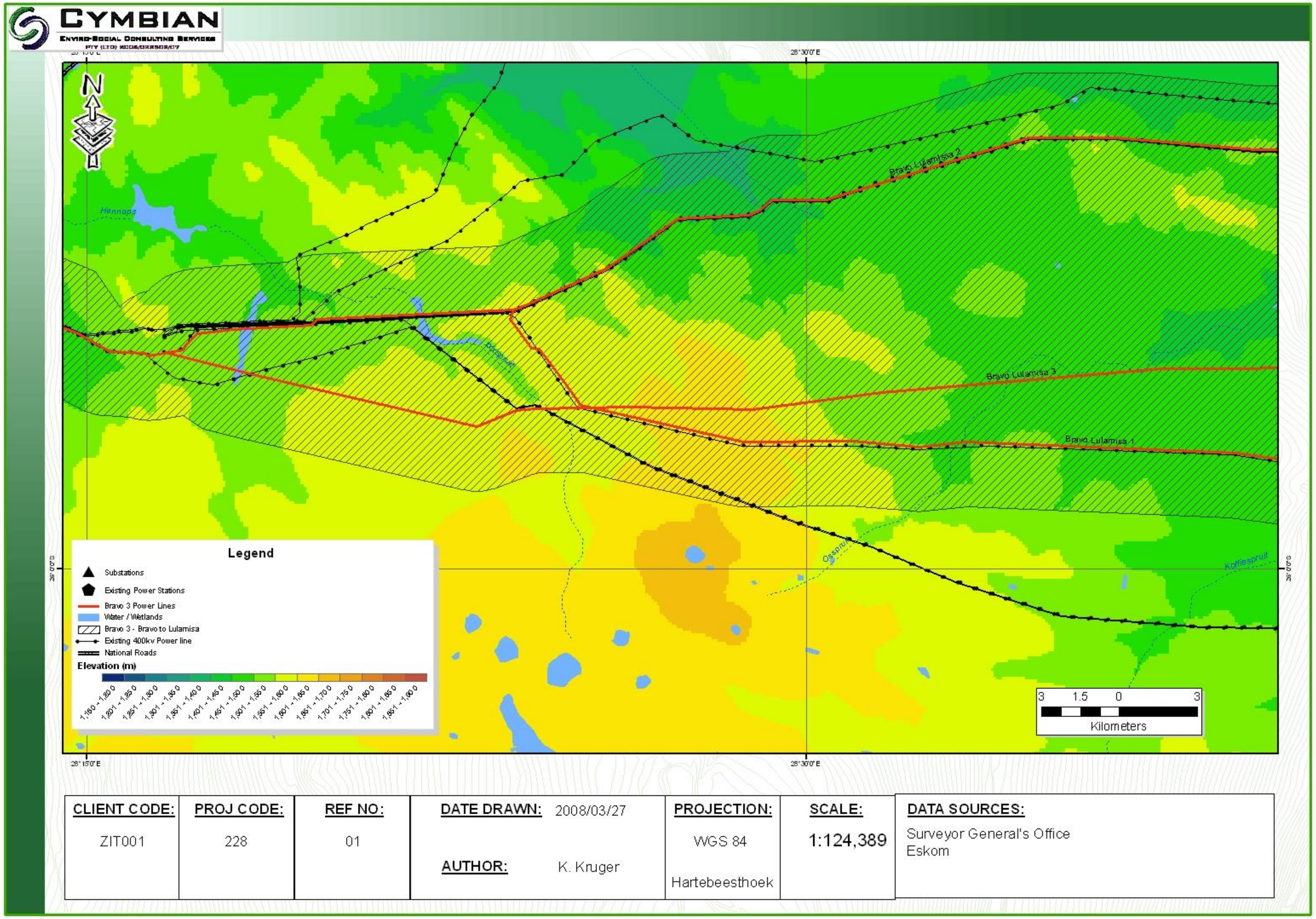


FIGURE 14: CENTRAL TOPOGRAPHY OF SITE

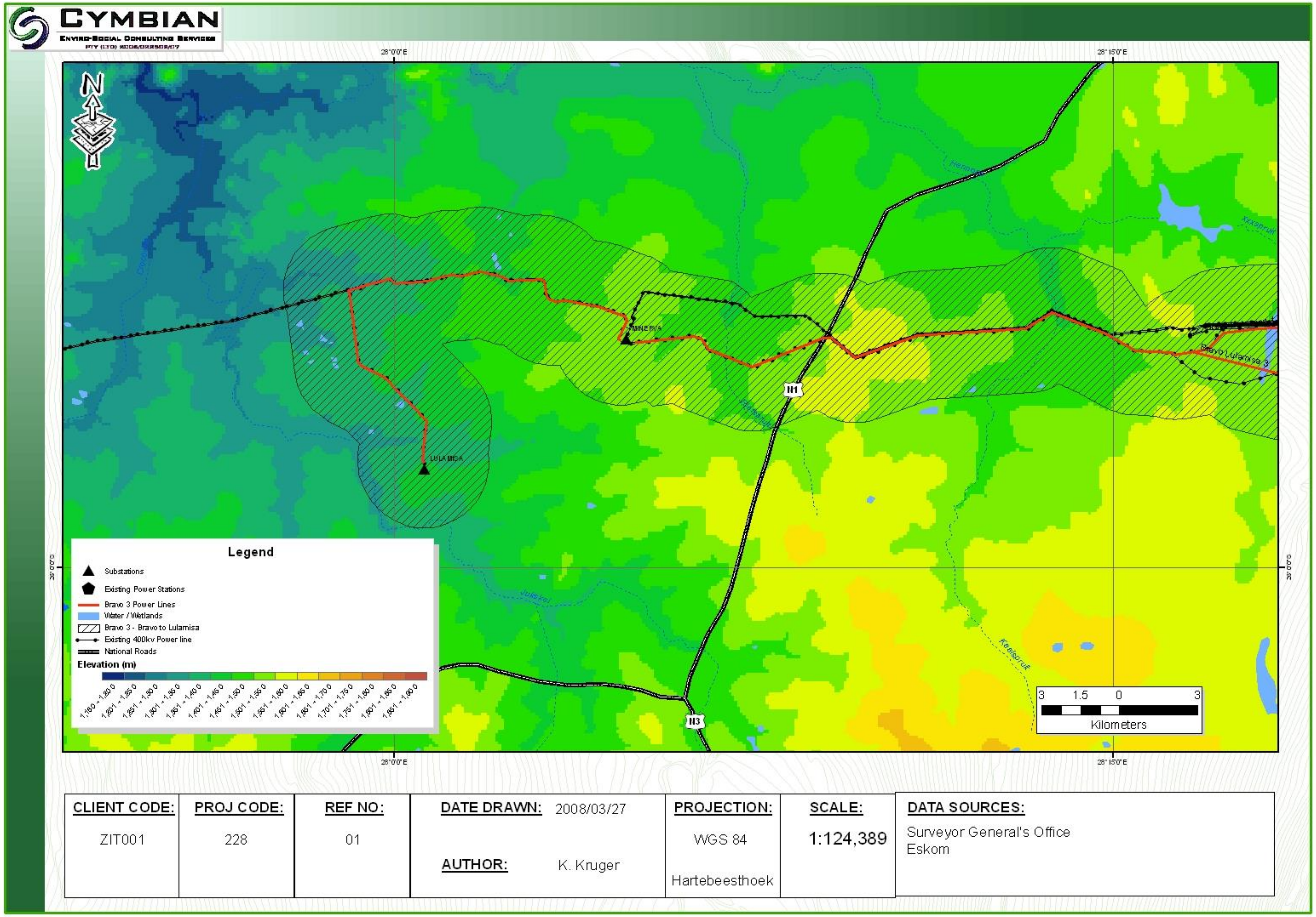


Figure 15: Western Topography of Site

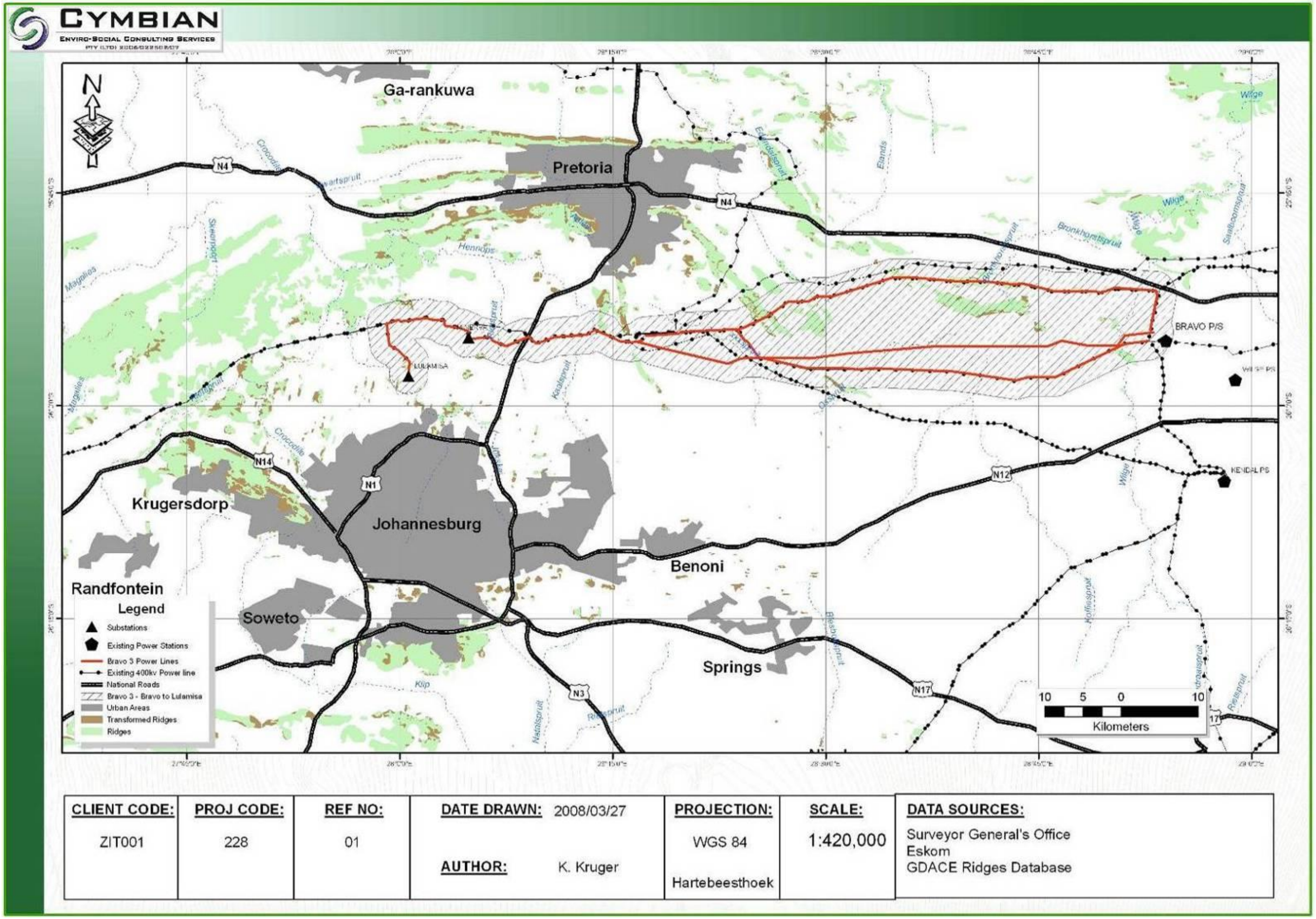


FIGURE 16: RIDGES MAP

7.1.5 Soils

Data Collection

The site visit was conducted on the 10th, 14th and 18th-20th of November 2008. Soils were augered at random intervals along the porposed powerline routes. Soils were augered using a 150 mm bucket auger, up to refusal or 1.5 m. Soils were identified according to Soil Classification; a taxonomic system for South Africa (Memoirs on the Natural Resources of South Africa, no. 15, 1991). The following soil characteristics were documented:

- Soil colour;
- Soil depth;
- Soil texture (Field determination);
- Wetness;
- Occurrence of concretions or rocks; and
- Underlying material (if possible).

Information was also obtained from the Land Type Maps 2526 Rustenburg, 2528 Pretoria (Land Type Survey Staff 1987)[3], as well as GIS data sources. Data were obtained from the National Department of Agriculture's Land Capability Classification System for South Africa (Schoeman et al 2002)[4] as well as the Land Type survey map.

Regional Description

The land types occurring in the region included Ab1, Ab2, Ab5, Ba2, Ba3, Ba5, Ba6, Ba9, Bb1, Bb12, Bb2 and Ib7. Figure 7 below lists the terrain units of each land type identified and the soil form/s associated with the terrain unit. Please note that the terrain is broken into crest, scarp, midslope, footslope and valley bottom.

TABLE 9: TERRAIN UNITS AND ASSOCIATED SOIL FORMS

Terrain Unit	Soil Forms
1 (=Crest)	Rock, Mispah, Hutton, Avalon, Glencoe, Kroonstad, Westleigh, Wasbank, Glenrosa, Clovelly, Cartref

[4] Schoeman, J.L., van der Walt, M., Monnik, K.A., Thackrah, A., Malherbe, J., and Le Roux, R.E. 2002. Development and Application of a Land Capability Classification System for South Africa. ARC-Institute for Soil, Climate and Water, Pretoria.

3 (=Midslope)	Rock, Mispah, Hutton, Valsrivier, Avalon, Glencoe, Kroonstad, Westleigh, Wasbank, Longlands, Pans, Swartland, Cartref
4 (=Footslope)	Hutton, Valsrivier, Avalon, Bonheim, Shortlands, Swartland, Glencoe, Kroonstad, Westleigh, Wasbank, Mispah, Longlands, Estcourt, Clovelly, Bainsvlei, Cartref
5 (=Valley bottom)	Hutton, Valsrivier, Oakleaf, Willowbrook, Bonheim, Rensburg, Arcadia, Streambeds, Kroonstad, Katspruit, Westleigh, Rensburg, Longlands, Dundee, Champagne,

From the soil information above the Department of Agriculture's data provides an indication as to the land capability of these soils, as indicated in Figure 17, Figure 18 and Figure 19. The route traverses areas with mostly arable soils (green and light green) that is used for growing of mainly maize.

Site Description

During the site visit large quantity of soil forms were identified. The soils forms were grouped into management units and are described in detail in the sections below and Figure 17, Figure 18 and Figure 19 illustrates the location of the management units. The land capability (agricultural potential) of the abovementioned soil form is described in more detail in Section 7.1.6.

The management units are broken up into:

- Agricultural Soils;
- Clay Soils;
- Rocky Soils;
- Transitional Soils; and
- Disturbed Soils.

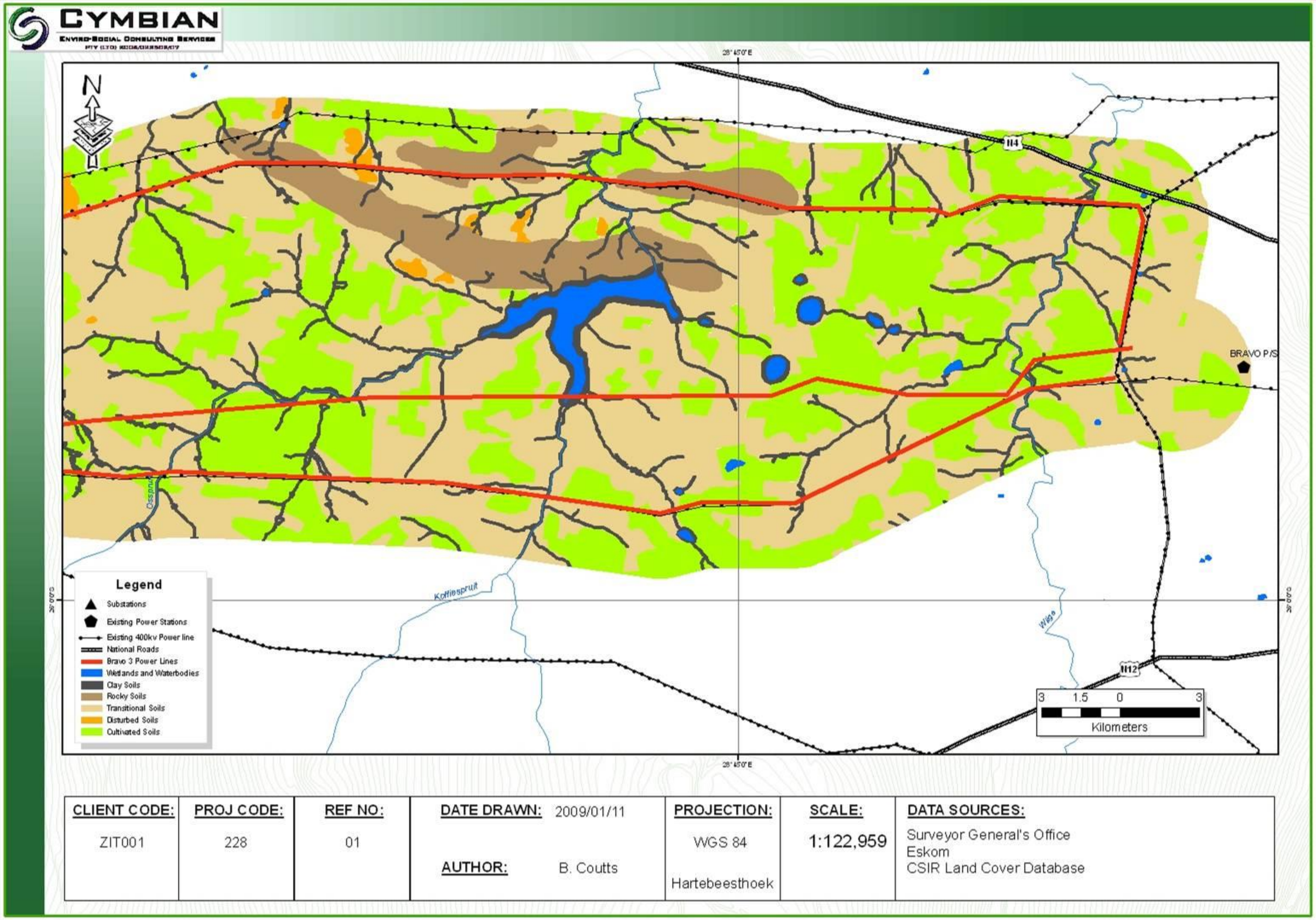


FIGURE 17: SOIL TYPE MAP FOR THE EASTERN PART OF THE SITE

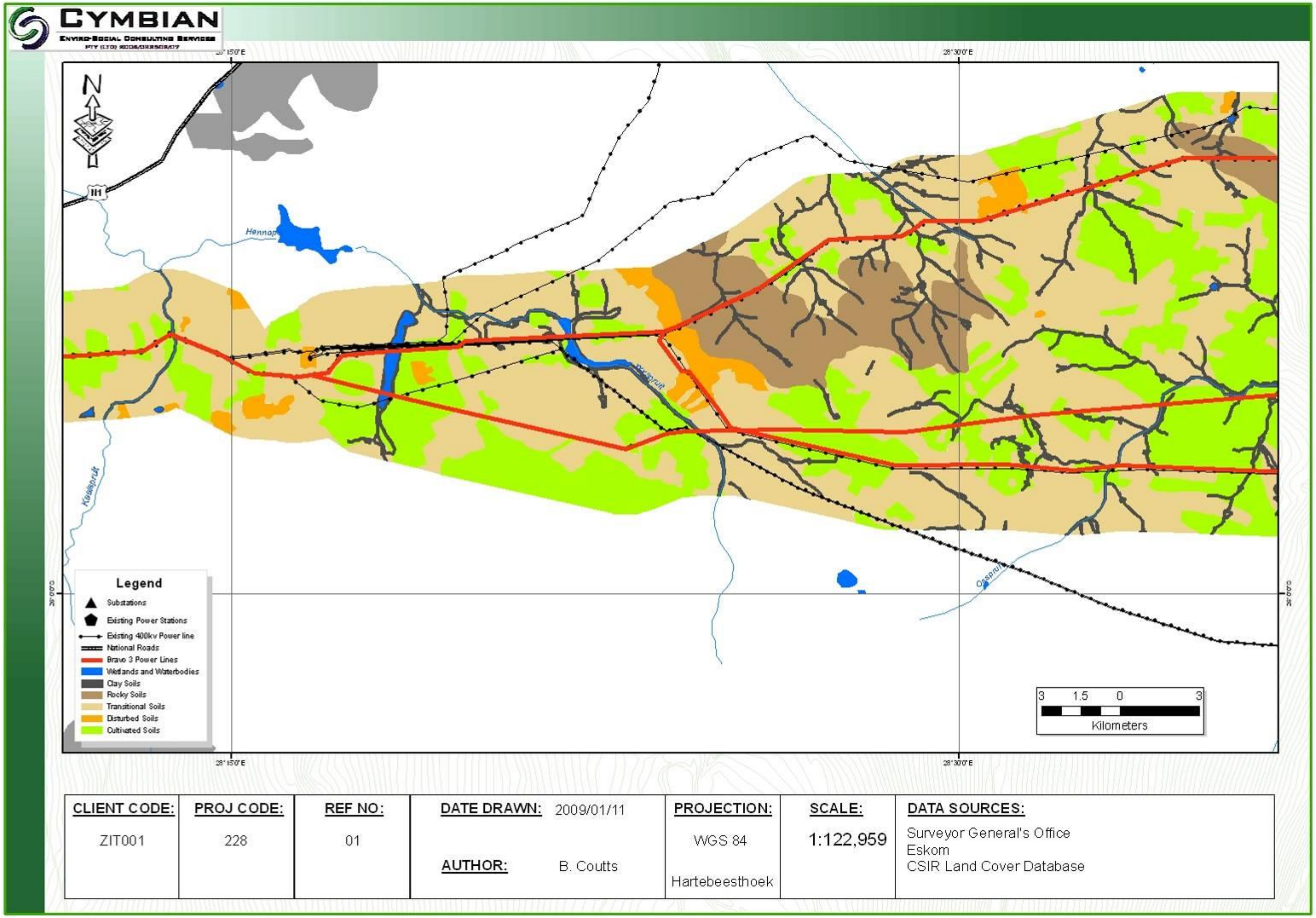


FIGURE 18: SOIL TYPE MAP FOR THE CENTRAL PART OF THE SITE

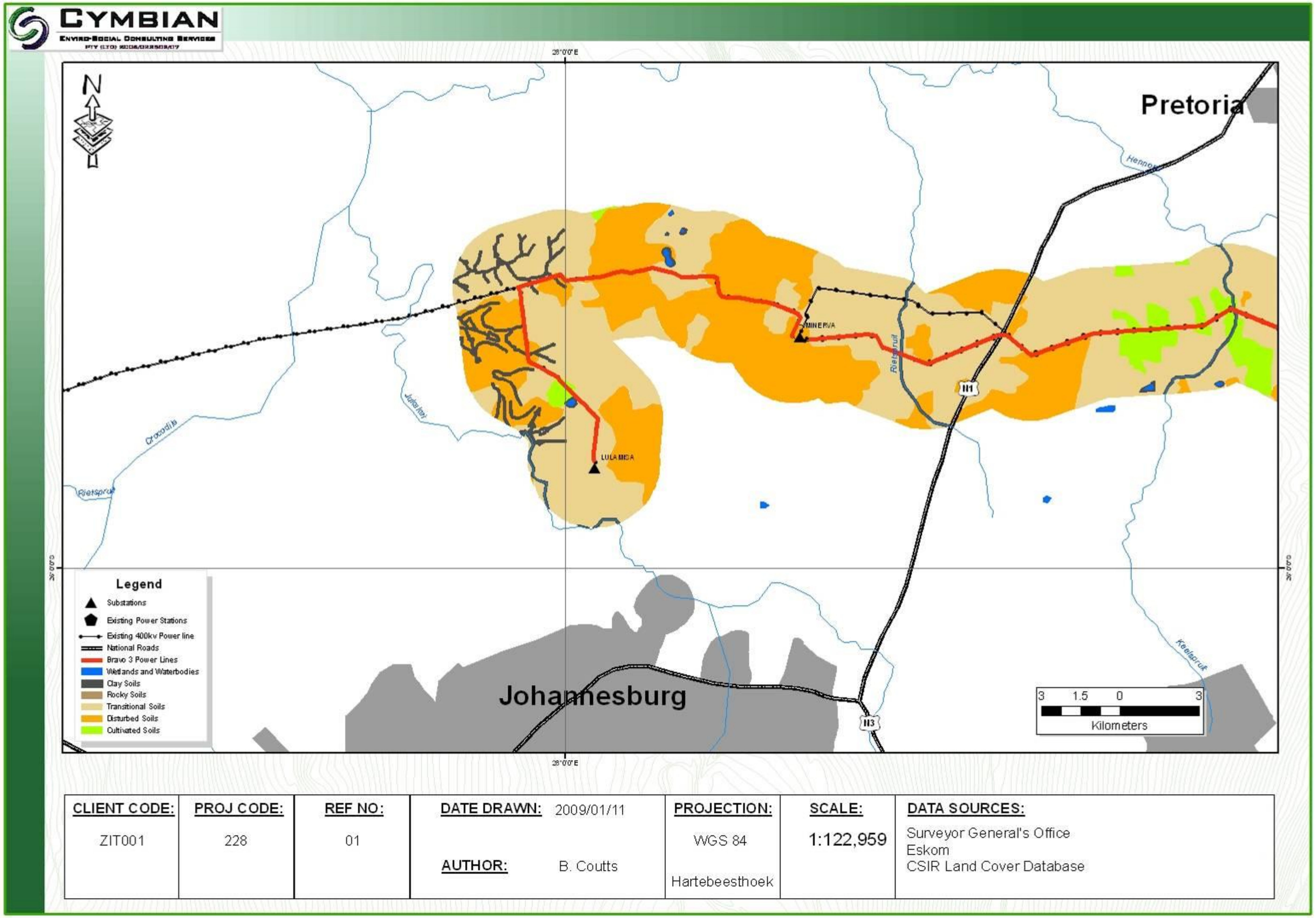


FIGURE 19: SOIL TYPE MAP OF THE WESTERN PART OF THE SITE

Agricultural Soils

The agricultural soils found on site support an industry of commercial maize production. These soils include Hutton, Clovelly, Avalon, Bainsvlei, Glencoe and Shortlands. These soils have deep red or yellow-brown B-horizons with minimal structure, but in the case of Shortlands soils the B-horizon has some degree of structure. These soils drain well and provide excellent to moderate cultivation opportunities. Each of the soils is described in detail below.

Hutton Soil Form

Hutton's are identified on the basis of the presence of an apedal (structureless) "red" B-horizon as indicated in Figure 20 below. These soils are the main agricultural soil found in South Africa, due to the deep, well-drained nature of these soils. The Hutton soils found on the site are restricted to the midslopes of the site.

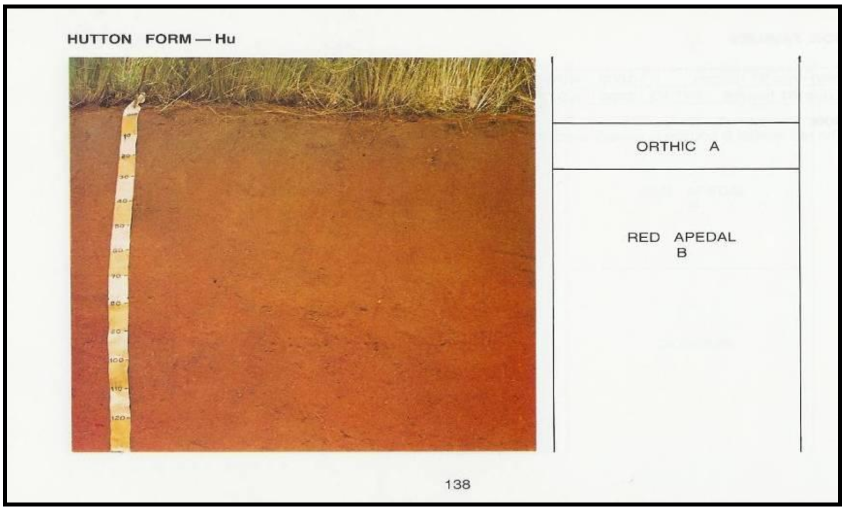


FIGURE 20 : HUTTON SOIL FORM (SOIL CLASSIFICATION, 1991)

Clovelly Soil Form

Clovelly soils can be identified as an apedal "yellow" B-horizon as indicated in Figure 21 below. These soils along with Hutton soils are the main agricultural soil found within South Africa, due to the deep, well-drained nature of these soils.

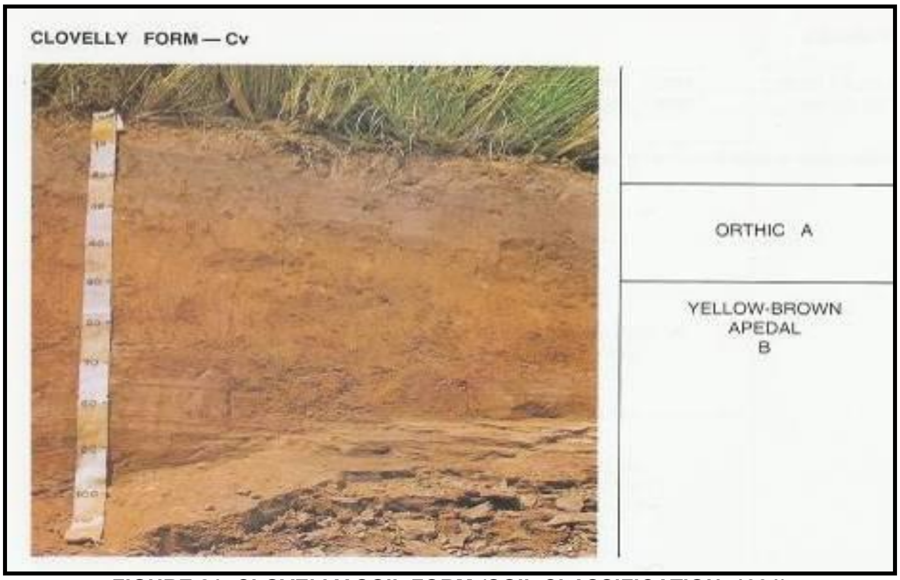


FIGURE 21: CLOVELLY SOIL FORM (SOIL CLASSIFICATION, 1991)

Avalon Soil Form

The Avalon soil form is characterised by the occurrence of a yellow-brown apedal B-horizon over a soft plinthic B – horizon (Figure 22). The yellow-brown apedal horizon is the same as described for the Clovelly soil form and the plinthic horizon has the following characteristics:

- Has undergone localised accumulation of iron and manganese oxides under conditions of a fluctuating water table with clear red-brown, yellow-brown or black strains in more than 10% of the horizon;
- Has grey colours of gleying in or directly underneath the horizon; and
- Does not qualify as a diagnostic soft carbonate horizon.

These soils are found between lower down the slopes than the Clovelly soils and indicate the start of the soils with clay accumulation.

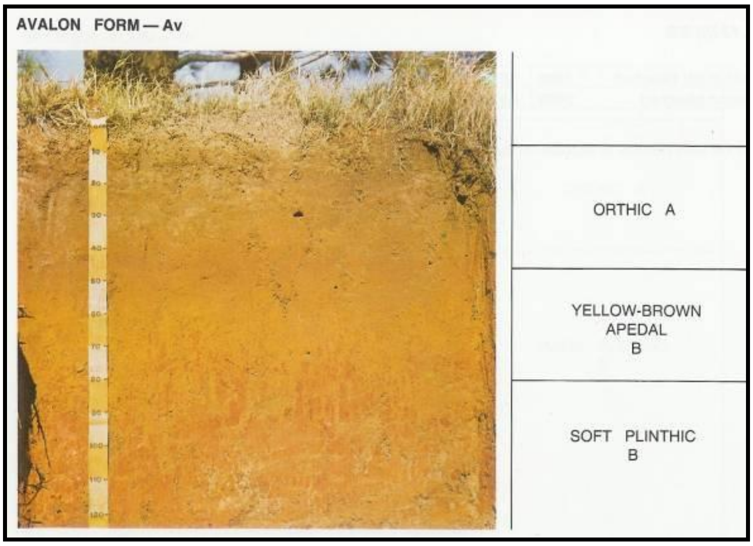


Figure 22: Avalon Soil Form (Soil Classification, 1991)

Griffin Soil Form

Griffin soils are characterised by a yellow-brown apedal B-horizon over a red apedal B-horizon as described in the Hutton and Clovelly soils above. These soils form part of agricultural soils and are suitable for cultivation.

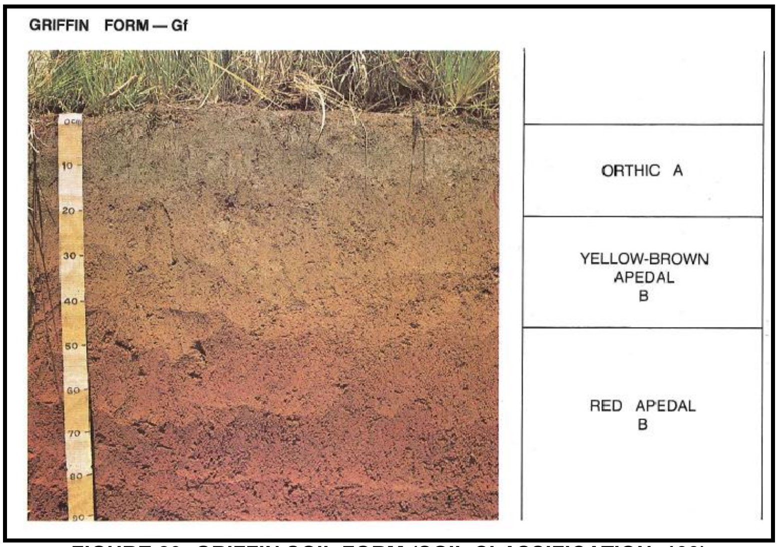


FIGURE 23: GRIFFIN SOIL FORM (SOIL CLASSIFICATION, 199)

Bainsvlei Soil Forms

Bainsvlei soils are characterised by a red apedal B-horizon over a soft plinthic B-horizon, as described in the Avalon soil form.

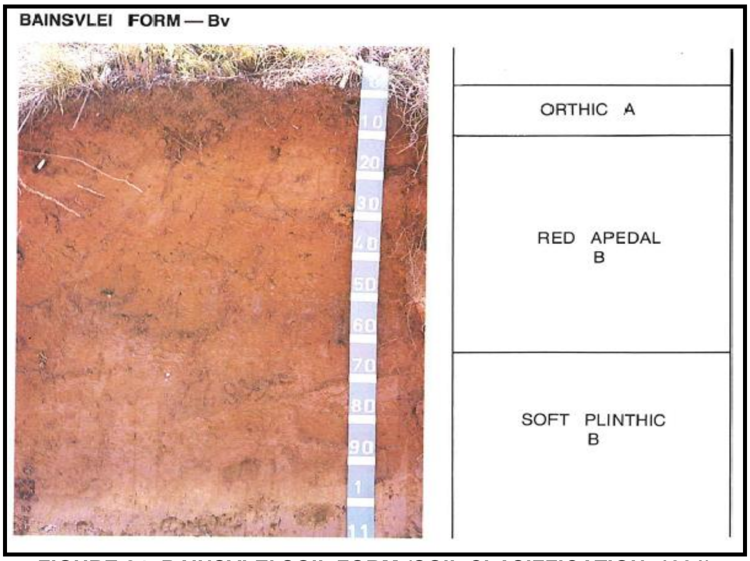


FIGURE 24: BAINSVLEI SOIL FORM (SOIL CLASIFFICATION, 1991)

Shortlands Soil Form

Shortlands soils are characterised by on orthic A-horizon over a red structured B-horizon. This soil is very similar to Hutton soils, but it characterised with a bit more structure in the B-horizon.

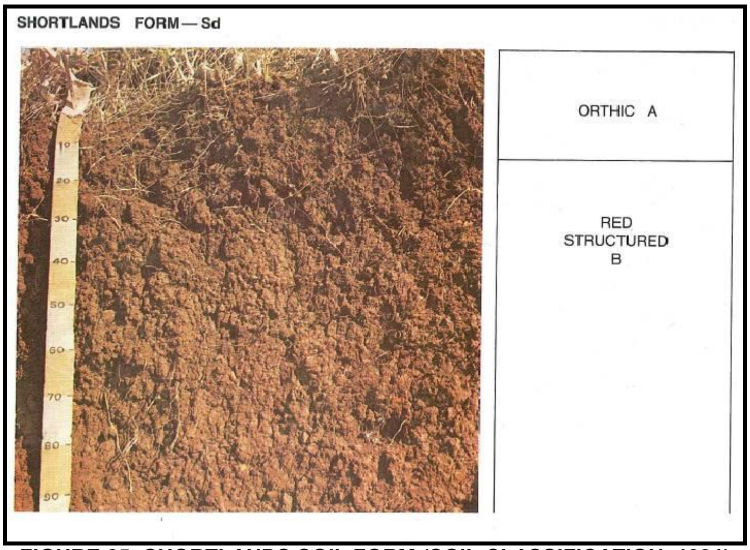


FIGURE 25: SHORTLANDS SOIL FORM (SOIL CLASSIFICATION, 1991)

Rocky Soils

The rocky soil management unit is made up of soils that are generally shallow and that overlie an impeding layer such as hard rock. These soils are not suitable for cultivation and in most cases are only usable as light grazing. The main soil forms found in rocky soils were Mispah and Glenrosa, each form is described below.

Mispah Soil Form

The Mispah soil form is characterised by an Orthic A – horizon overlying hard rock. Refer to Figure 26 for an illustration of a typical Mispah soil form.

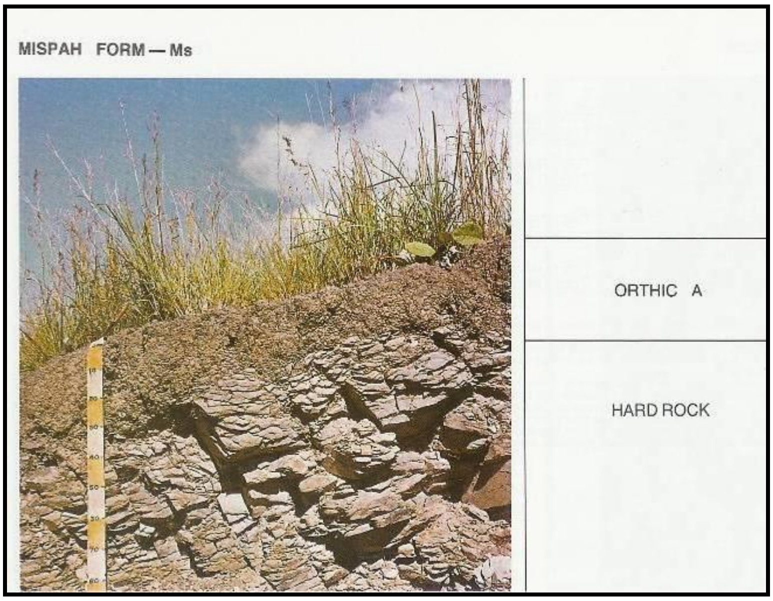


FIGURE 26: MISPAH SOIL FORM (MEMOIRS ON THE NATURAL RESOURCES OF SOUTH AFRICA, NO. 15, 1991).

Glenrosa Soil Form

The Glenrosa soil form is a combination of an Orthic A horizon overlying a lithocutanic B horizon as indicated in Figure 27 below. A lithocutanic B has several characteristics that separate it from other horizons, namely:

- It merges into the underlying weathering rock;
- Has a general organisation in respect of colour, structure or consistency that has distinct affinities with the underlying parent rock;
- Has cutanic character expressed usually as tongues or prominent colour variations caused by residual soil formation and illuviation resulting in localization of one or more of clay, iron and manganese oxides;
- Lacks a laterally continues horizon which would qualify as either a diagnostic podzol B, neocarbonate B, pedocutanic B, pedocutanic B, hardpan carbonate or dorbank; and
- If the horizon shows signs of wetness, then more than 25% by volume has saprolite character.

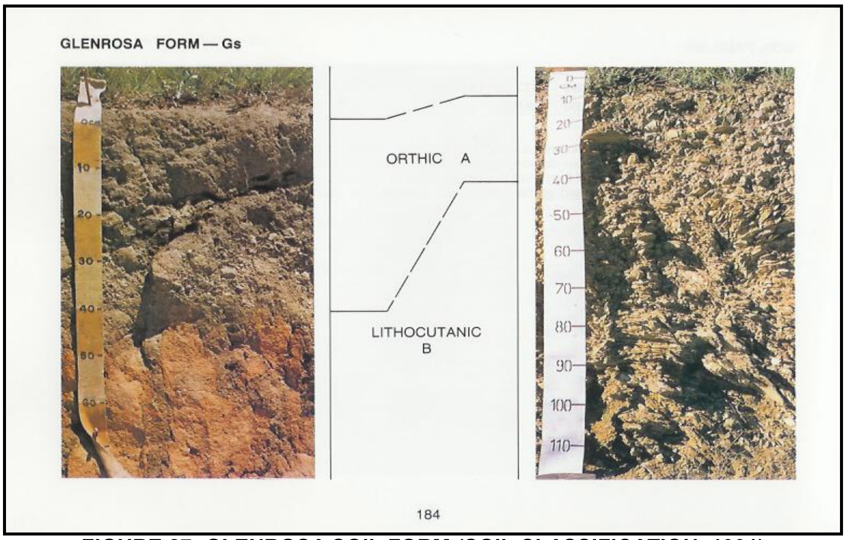


FIGURE 27: GLENROSA SOIL FORM (SOIL CLASSIFICATION, 1991)

Disturbed Soils

The main soil form found in disturbed soils is Witbank and, is described below.

Witbank

The Witbank soil form is most commonly found in areas of man made activities and is a man made soil. The thickness of the orthic A horizon plus man made soil deposits must be more than 500 mm if these overlie a classifiable buried soil.

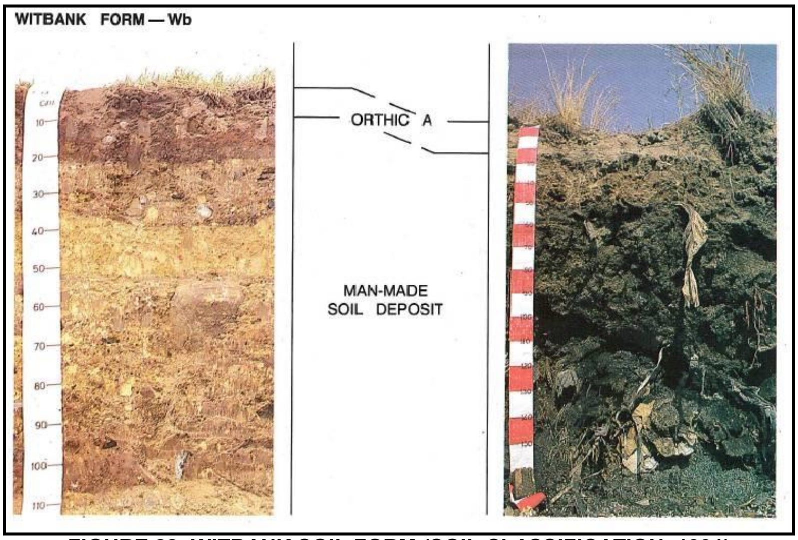


FIGURE 28: WITBANK SOIL FORM (SOIL CLASSIFICATION, 1991)

Transitional Soils

The transitional soil management unit comprises the soils found between clay soils and the agricultural soils. These soils often have signs of clay accumulation or water movement in the lower horizons. These soils are usually indicative of seasonal or temporary wetland conditions. The main soil forms found in transitional soils were Kroonstad, Wasbank, Longlands and Westleigh, each form is described below.

Kroonstad Soil Form

The Kroonstad soil form is most commonly found in areas of semi-permanent wetness. The soil is made up of an Orthic A horizon over a diagnostic E-horizon over a G-horizon, as indicated in Figure 29 below. The G-horizon has several unique diagnostic criteria as a horizon, namely:

- It is saturated with water for long periods unless drained;
- Is dominated by grey, low chroma matrix colours, often with blue or green tints, with or without mottling;
- Has not undergone marked removal of colloid matter, usually accumulation of colloid matter has taken place in the horizon;
- Has a consistency at least one grade firmer than that of the overlying horizon;
- Lacks saprolitic character; and
- Lacks plinthic character.

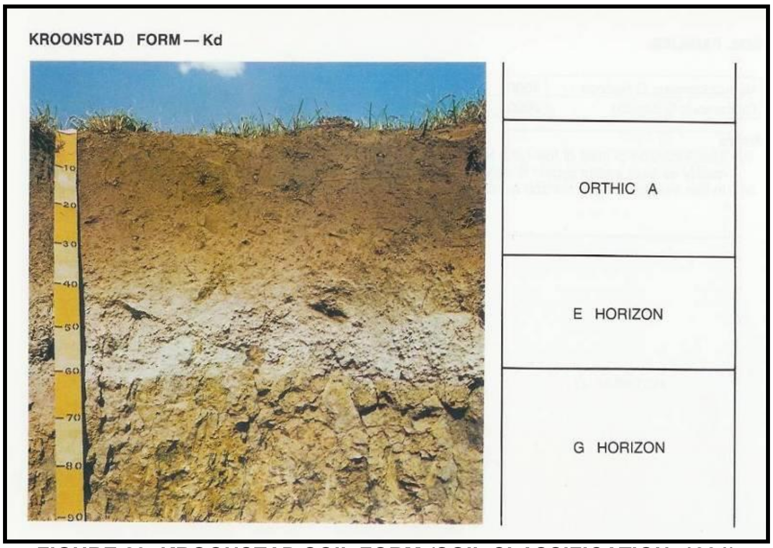


FIGURE 29: KROONSTAD SOIL FORM (SOIL CLASSIFICATION, 1991)

Wasbank Soil Form

The Wasbank soil form is found in close proximity to the Longlands soil form and is typified by an Orthic A-horizon over an E-horizon (as described above) over a Hard Plinthic B-horizon. The Hard Plinthic B-horizon develops when a Soft Plinthic horizon is subjected to a prolonged dry period and the accumulated colloidal matter hardens, almost irreversibly. The Wasbank soil form is illustrated in Figure 30 below.

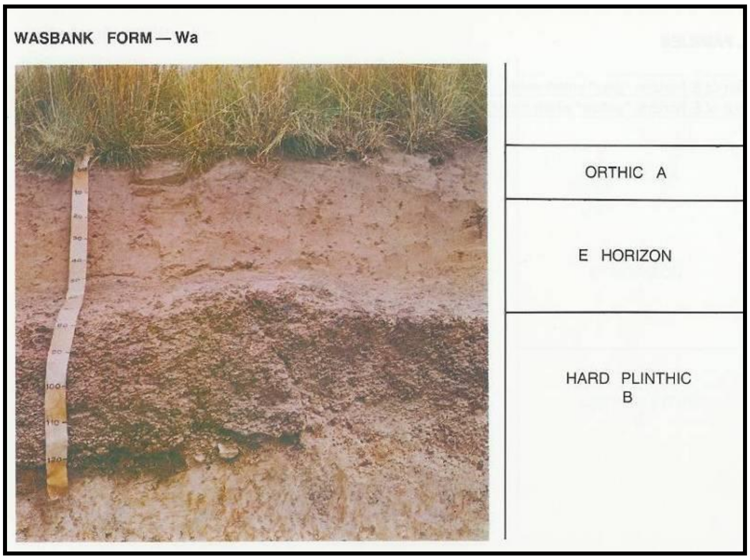


FIGURE 30: WASBANK SOIL FORM (SOIL CLASSIFICATION, 1991)

Longlands Soil Form

The Longlands soil forms are all typified by an eluvial (E) horizon over a soft plinthic horizon (as described above). The E-horizon is a horizon that has been washed clean by excessive water movement through the horizon and the plinthic horizon as undergone local accumulation of colloidal matter. Refer to Figure 31 and Figure 32 for an illustration of the soil form.

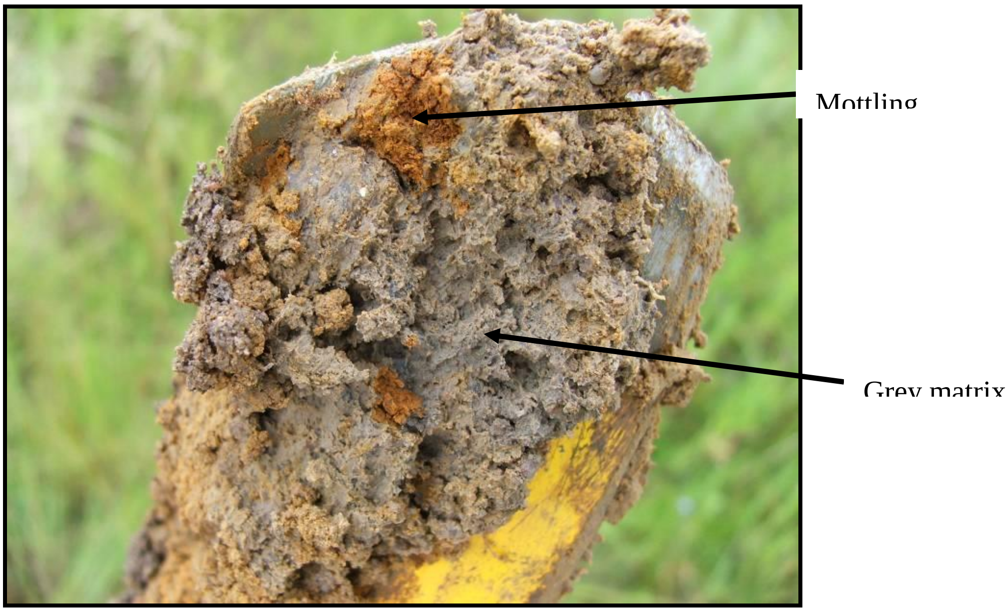


FIGURE 31: SOFT PLINTHIC B-HORIZON.

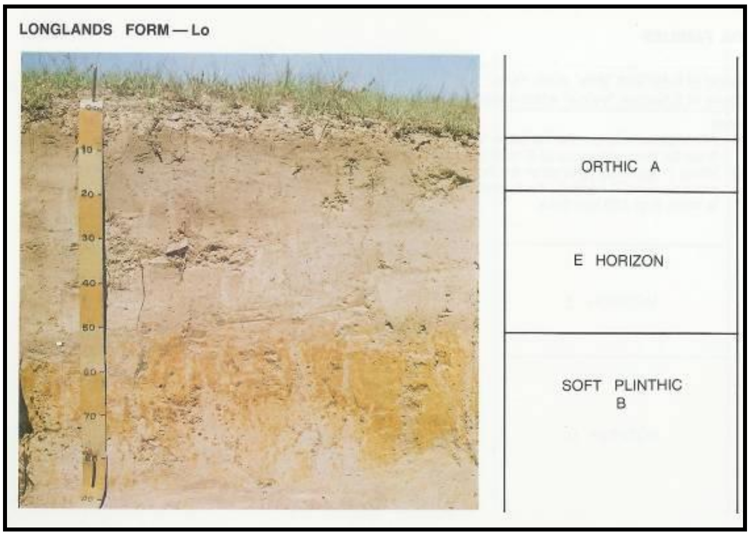


FIGURE 32: LONGLANDS SOIL FORM (SOIL CLASSIFICATION, 1991)

Westleigh Soil Forms

Westleigh soils are characterised by an orthic A-horizon over a soft plinthic B-horizon and is found in areas between good agricultural soils and clay soils and the movement of water determines the characteristics of the soil.

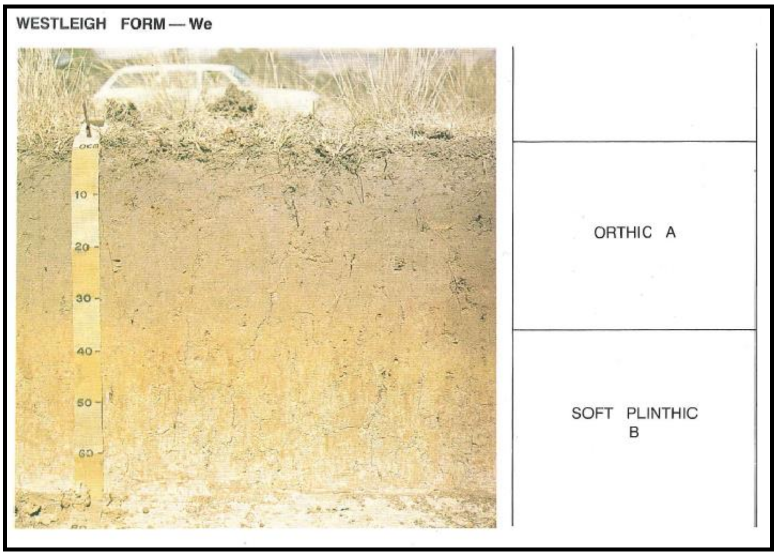


FIGURE 33: WESTLEIGH SOIL FORM (SOIL CLASSIFICATION 1991)

Clay Soils

The clay soil management unit is found in areas where clays have accumulated to such an extent that the majority of the soil matrix is clays. These soils are usually indicative of seasonal or permanent wetland conditions. The main soil forms found in clay soils were Katspruit and Rensburg, Arcadia and Willowbrook, each form is described below. These soils are saturated with water and must be noted to be unstable for construction and are sensitive.

Katspruit Soil Form

The Katspruit soil form is most commonly found in areas of semi-permanent wetness. The soil is made up of an Orthic A-horizon over a diagnostic G-horizon and is indicated in Figure 34 below. The G-horizon has several unique diagnostic criteria as a horizon, namely:

- It is saturated with water for long periods unless drained;
- Is dominated by grey, low chroma matrix colours, often with blue or green tints, with or without mottling;
- Has not undergone marked removal of colloid matter, usually accumulation of colloid matter has taken place in the horizon;
- Has a consistency at least one grade firmer than that of the overlying horizon;
- Lacks saprolitic character; and
- Lacks plinthic character.

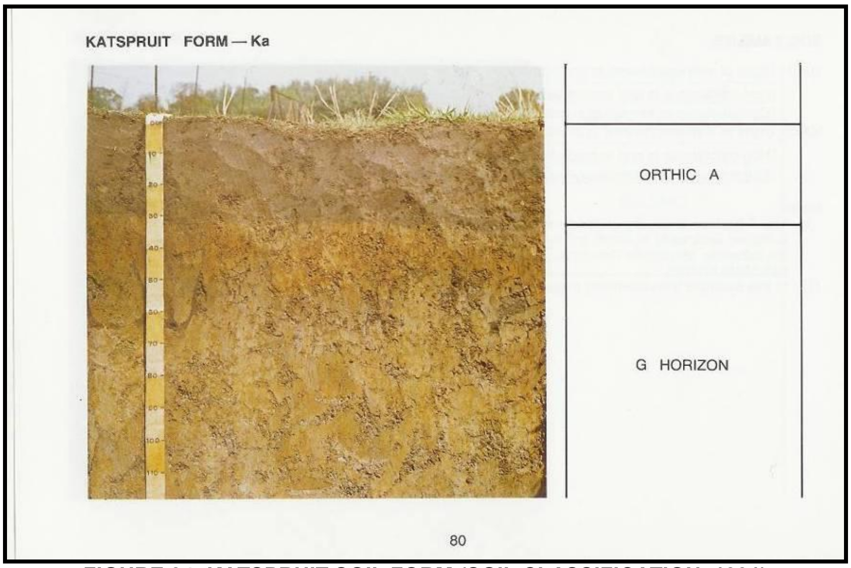


FIGURE 34: KATSPRUIT SOIL FORM (SOIL CLASSIFICATION, 1991)

Arcadia Soil Form

Arcadia soils are characterised by a vertic A-horizon, which frequently overlies weathering rock or yellowish brown block clay. The Vertic horizon has several unique diagnostic criteria as a horizon, namely:

- Has strong developed structure
- Has at least one of the following:
- Clearly visible, regularly occurring slicken sides in some part of the horizon or in the transition to an underlying layer; and

- A plasticity index greater than 32 (using the SA Standard Casagrande cup to determine liquid limit), or greater than 36 (using the British Standard cone to determine liquid limit).

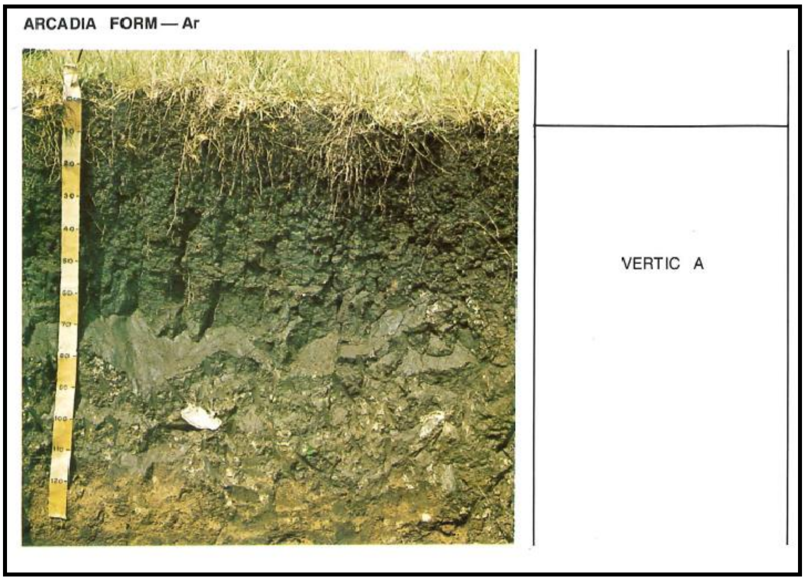


FIGURE 35: ARCADIA SOIL FORM (SOIL CLASSIFICATION, 1991)

Rensburg Soil Form

Rensburg soils are characterised by a vertic A-horizon over a G horizon. The vertic A-horizon is characterised by shrinking and swelling of the soils and the G-horizon has characteristics described above.

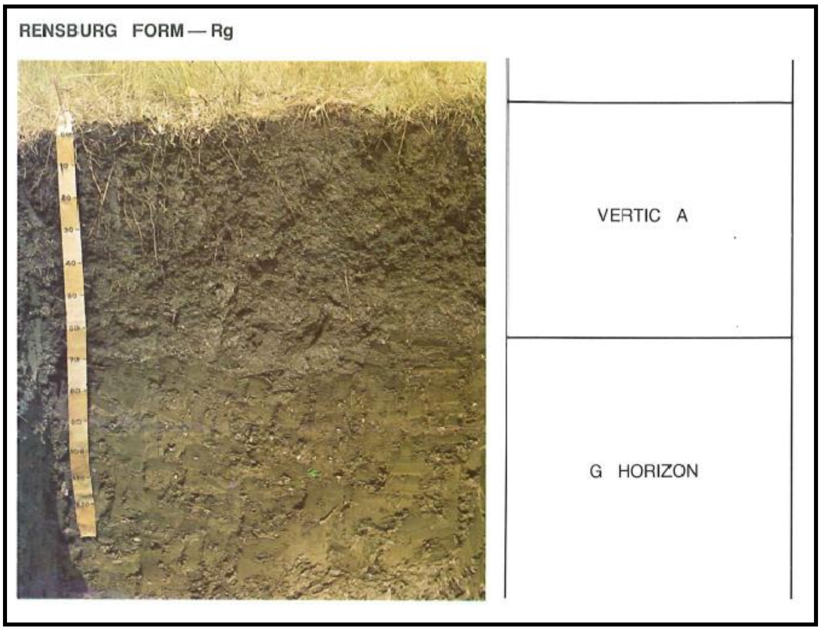


FIGURE 36: RENSBURG SOIL FORM (SOIL CLASSIFICATION, 1991)

Willowbrook Soil Form

Willowbrook soils are characterised by Melanic A-horizon over a G-horizon. The G-horizon is invariably firm or very firm and it's characteristics are described above. The Melanic horizon has several unique diagnostic criteria as a horizon, namely:

- Has dark colours in the dry state.
- Lack slickensides that are diagnostic of vertic horizons.
- Has les organic carbon than required for diagnostic organic O horizon.
- Has structure that is strong enough so that the major part of the horizon is not both massive and hard or very hard when dry.

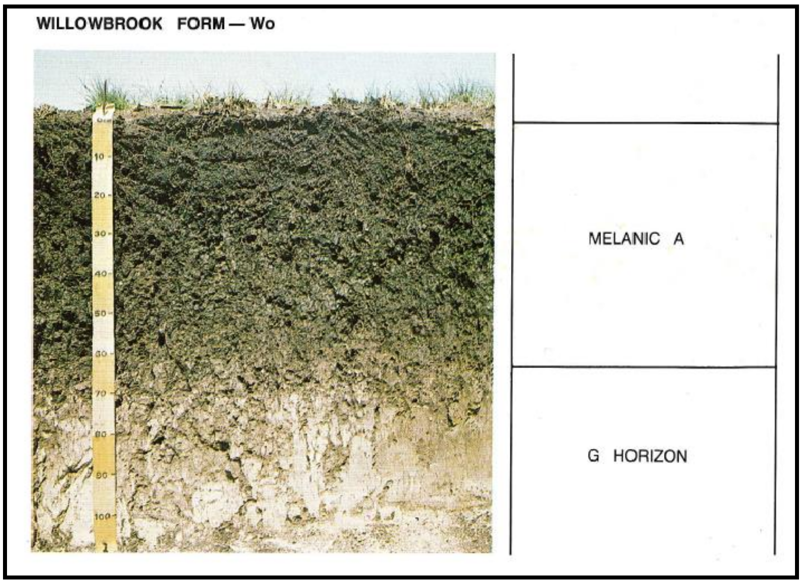


FIGURE 37: WILLOWBROOK SOIL FORM (SOIL CLASSIFICATION 1991)

7.1.6 Land Capability

Data Collection

A literature review was conducted in order to obtain any relevant information concerning the area, including information from the Environmental Potential Atlas (ENPAT), Weather Bureau and Department of Agriculture. Results from the soil study were taken into account when determining the land capability of the site.

The land capability assessment methodology as outlined by the National Department of Agriculture was used to assess the soil's capability on site.

Regional Description

The region has historically been used for cultivation of crops and grazing of livestock, because of the arable soils present. Some of the areas have been used for mining, industrial areas and urban zones and therefore the land capability in those areas have been changed permanently.

Site Description

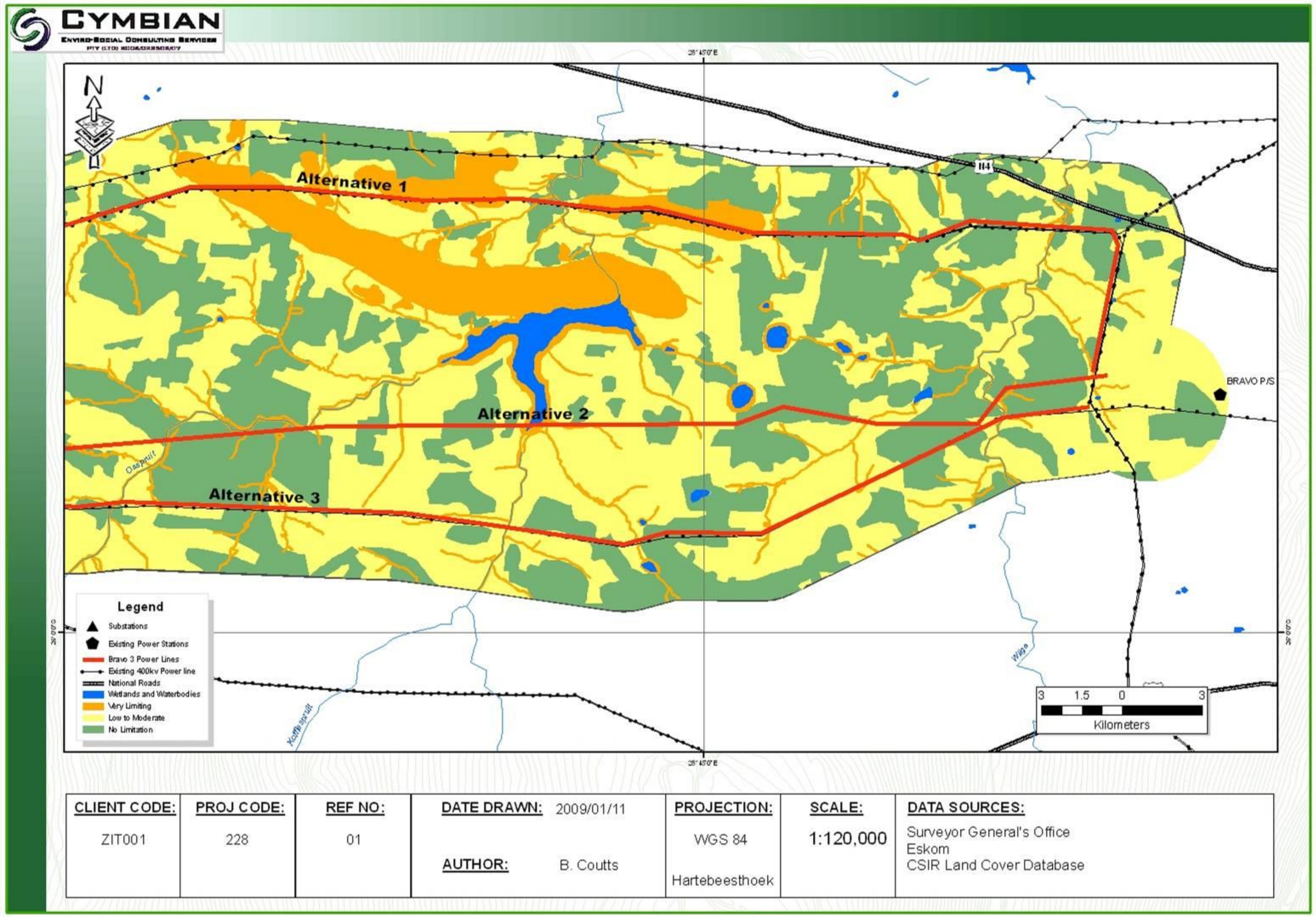
The soils identified on site were classified according to the methodology proposed by the Agricultural Research Council – Institute for Soil, Climate and Water (2002). Factors evaluated are tabled below.

The soils on site were identified to have a land capability of being good arable soils. From Figure 38, Figure 39 and Figure 40 below it is clear that large sections of the site are made up of good arable soils. This indicates that these soils are good to cultivate a variety of crops such as maize. Approximately 30% of the area is used for agricultural purposes; such crops as maize are grown in these areas because of the good quality of the soils. Approximately 50% of the Transitional soils are used for mixed land use; such as grazing for livestock and other crops besides maize.

TABLE 10: LAND CAPABILITY OF THE SOILS ON SITE FOR AGRICULTURAL USE

Soil	Cultivated	Transitional	Rocky	Clay	Disturbed
% on Site	26	53	6	8	7
Rock Complex			X		X
Flooding Risk	F1	F1	F1	F4	F4
Erosion Risk	E2	E5	E5	E1	E4
Slope %	3.9	3.7	4.0	0.5	10-30
Texture	T2	T2	T2	T1	T3
Depth	D1	D2	D4	D4	D4
Drainage	W2	W4	W2	W4	W2
Mech Limitations	MBO	MBO	MB3	MBO	MB3
pH	P2	P1	P1	P1	P1
Soil Capability	II	III	VI	V	VII
Climate Class	C2	C2	C2	C2	C2
Land Capability	II	III	VI	V	VII

No limitation	Low to Moderate	Moderate	High	Very Limiting



CLIENT CODE:	PROJ CODE:	REF NO:	DATE DRAWN: 2009/01/11	PROJECTION:	SCALE:	DATA SOURCES:
ZIT001	228	01	AUTHOR: B. Coutts	WGS 84 Hartebeesthoek	1:120,000	Surveyor General's Office Eskom CSIR Land Cover Database

FIGURE 38: EASTERN LAND CAPABILITY MAP

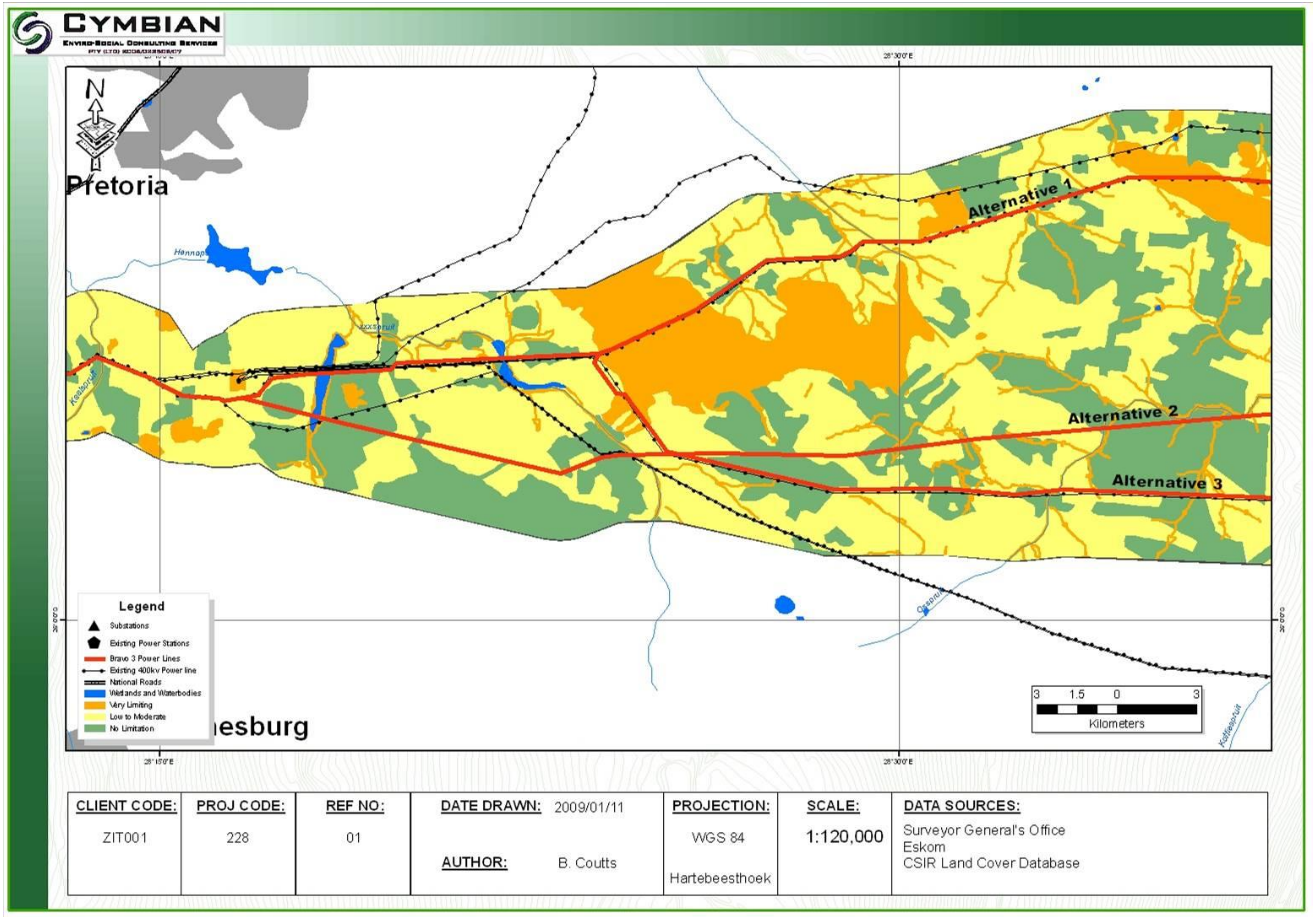
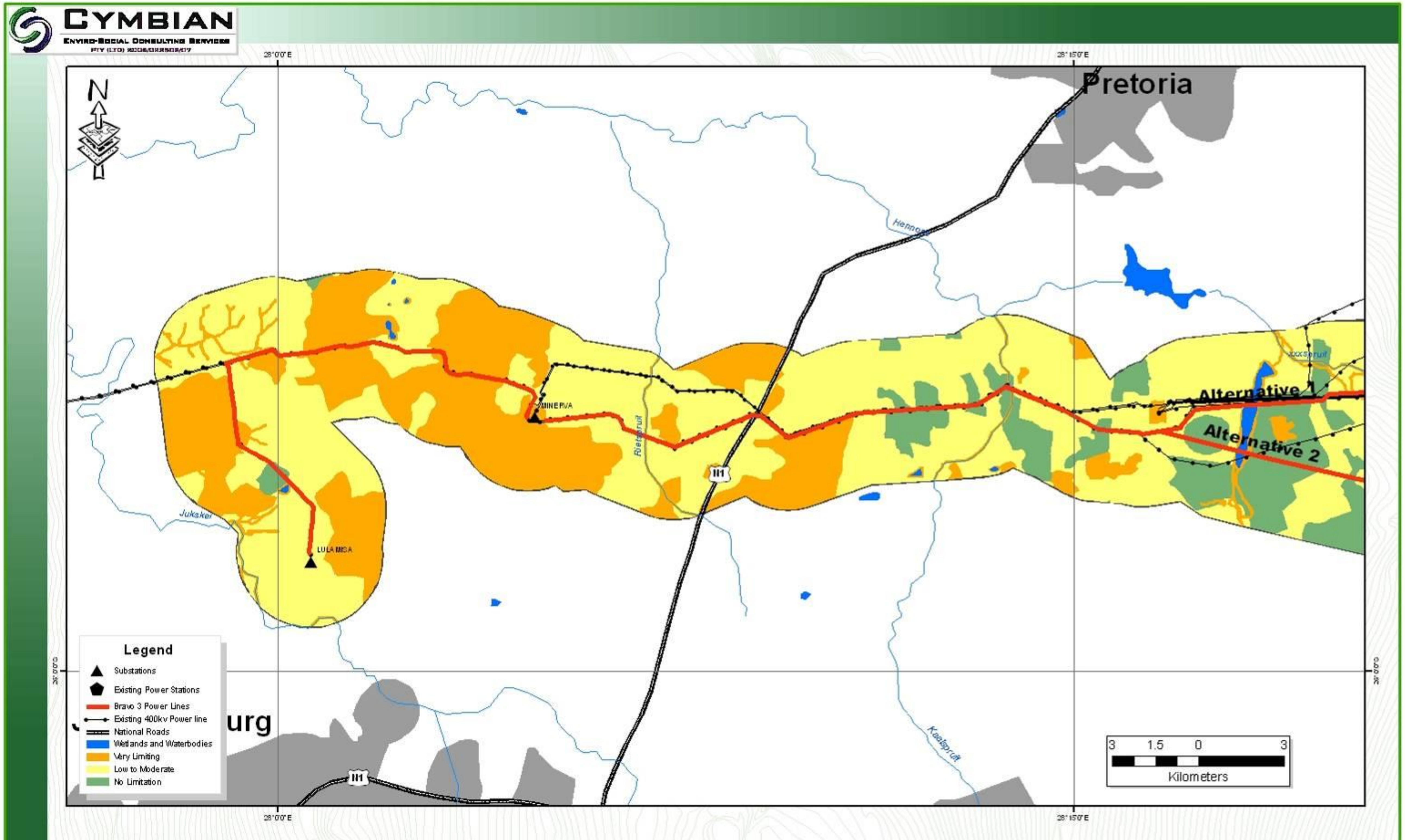


FIGURE 39: CENTRAL LAND CAPABILITY MAP



CLIENT CODE:	PROJ CODE:	REF NO:	DATE DRAWN: 2009/01/11	PROJECTION:	SCALE:	DATA SOURCES:
ZIT001	228	01	AUTHOR: B. Coutts	WGS 84 Hartebeesthoek	1:120,000	Surveyor General's Office Eskom CSIR Land Cover Database

FIGURE 40: WESTERN LAND CAPABILITY MAP

7.1.7 Land Use

Data Collection

Land Use was determined utilizing a GIS desktop study and confirmed during the site investigations conducted on the 28th-29th February 2008. The site investigation involved ground truthing the Land Use according to the maps produced using the desktop analysis. The data was obtained from the Council for Scientific Investigation and Research (CSIR). Their Land Cover database was used create the desktop maps.

Regional Description

The land use for the region is illustrated in Figure 41 below and the land used have been grouped into urban, cultivation, grassland/plantations, mines/erosion and water bodies/wetlands. From the map it is clear that the Gauteng area is dominated by urban developments, and upon moving to the east the dominance moves towards farming (grazing and cultivation) and open grasslands. Almost 80 % of the power line corridors cover areas used for farming or grasslands while the section of the corridor west of the N1 Highway moves into the urban areas

Site Description

When focusing on site specific descriptions the potential sensitivities arise due to the land use along the power line corridor. These sensitivities originate from two areas. Firstly public perception of power lines is often negative, and hence the “sensitivity” to power lines is usually higher in areas of higher population densities. The main sensitivities in this regard are the informal settlements located in Diepsloot and Olivienhoutbosch, the residential estate of Midrand Estates and a couple of planned developments just south-east of Pretoria (Celtic Village and Blue Crane Country Estate).

Secondly sensitivity can arise from current land use, where the land use itself poses a threat to the new power lines. This is the case in areas of mining, quarrying and water bodies. Immediately Alternative 2 has to be highlighted here, as the proposed alignment traverses over the Bronkhorstspruit Dam. The area around Bronkhorstspruit dam needs to be avoided during the detailed route planning of the power line alignments in the corridors. Not only is this of financial concern, but of aesthetics. On the ridge location adjacent to Bronkhorstspruit Dam there are upmarket houses built. Having a power line running through this area is of financial concern and destroys the aesthetics of the area; due to upmarket residential houses around the dam. The sentiment from residents could be negative, especially if the relatively pristine view of the dam is compromised by the proposed power line.

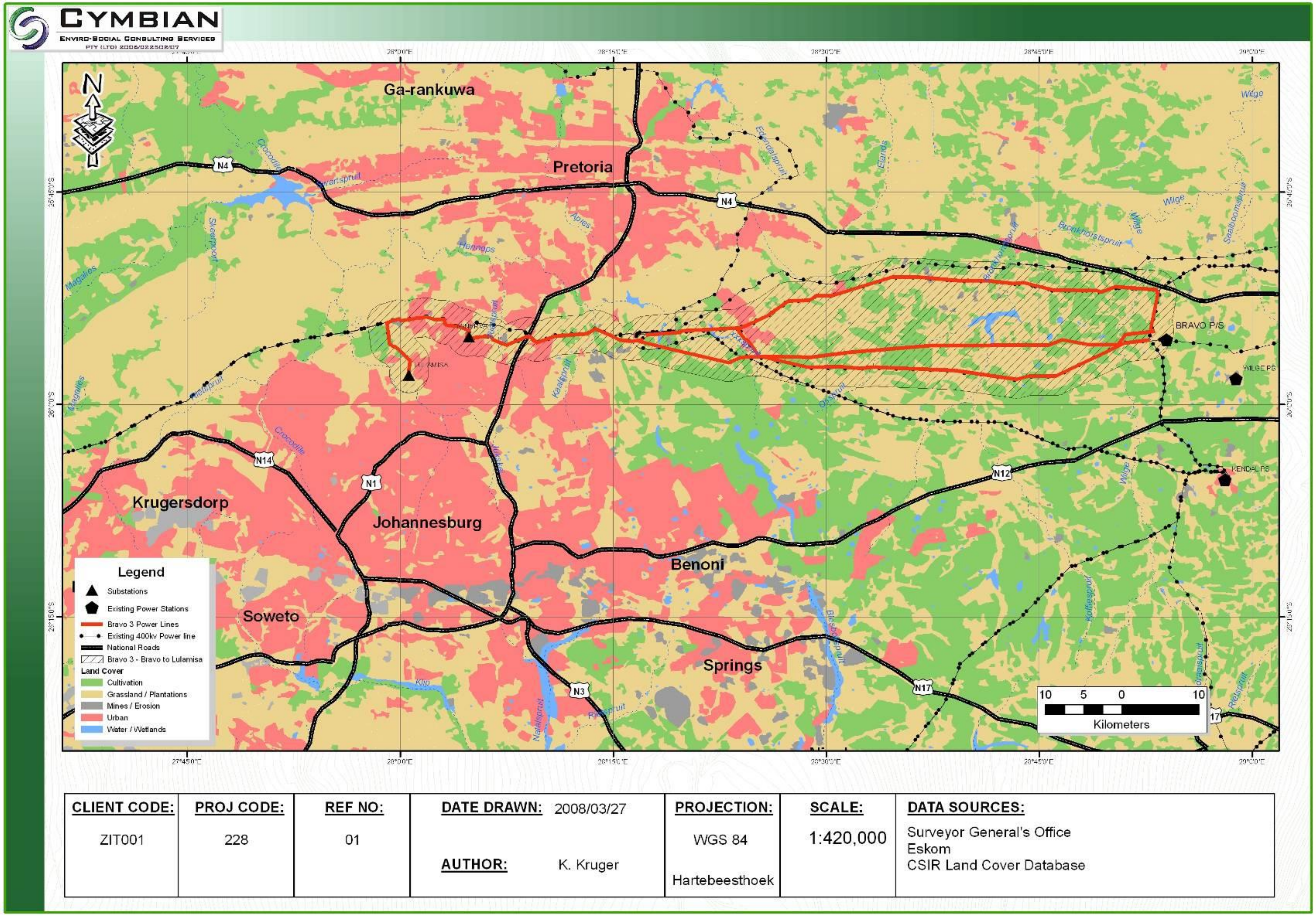


FIGURE 41: LAND USE MAP

In addition to the sensitivities noted above, it was observed during the site assessment that a number of the servitudes are located within an area of existing development, too such an extent that placing another power line along the existing lines might be impossible. This was particularly evident in the Midrand area between Olivienhoutbosch and Midstream estates. In addition the crossing of the N1 highway is already severely congested and will pose additional challenges. Further along the route to the west, adjacent to the N14 highway, the route traverse through Highveld Mushroom's property and thereafter crosses over the highway, onto land that is currently being mined for sand. In both these areas space is also limited. Lastly the informal settlements of Diepsloot and Olivienhoutbosch have a history of people trying to build houses in the existing servitudes and once again, space for additional lines is limited.

Even though these limitations exist, it does not influence the alternative selection, as this section of the route has only one alternative available. It is however, recommended that a detailed route analysis be undertaken by Eskom, as this report is part of an application for the entire corridor, more detailed work will be required.

7.1.8 Vegetation

Data Collection

The floral study involved extensive fieldwork, a literature review and a desktop study utilizing GIS. The site was investigated during two one week site visits, conducted from the 10th-14th March and from the 17th-20th of November 2008, in late summer and early spring respectively. The area within the servitude was sampled using transects placed at 300 m intervals. At random points along the transect an area of 20 m x 20 m were surveyed. All species within the 20 m x 20 m quadrant were identified, photographed and their occurrence noted. Sensitive features such as ridges or wetlands were sampled by walking randomly through the area concerned and identifying all species within the area.

The floral data below is taken from The Vegetation of South Africa, Lesotho and Swaziland (Mucina and Rutherford 2006). Also, while on site, the following field guides were used:

- Guide to Grasses of Southern Africa (Frits van Oudtshoorn, 1999);
- Field Guide to Trees of Southern Africa (Braam van Wyk and Piet van Wyk, 1997);
- Field Guide to the Wild Flowers of the Highveld (Braam van Wyk and Sasa Malan, 1998);
- Problem Plants of South Africa (Clive Bromilow, 2001);
- Medicinal Plants of South Africa (Ben-Erik van Wyk, Bosch van Oudtshoorn and Nigel Gericke, 2002)

The occurrence of the species was described as either:

- Very common (>50 % coverage);
- Common (10 – 50 % coverage);
- Sparse (5 – 10 % coverage); and

- Individuals (< 5 % coverage).

Regional Description

The area under investigation straddles two Biomes, namely the Savanna and the Grassland Biomes. Each biome comprises several bioregions which in turn has various vegetation types within the bioregion. The Grassland Biome is represented by Dry Highveld Grassland bioregion and Mesic Highveld Grassland bioregion, while the Savanna Biome is represented by Central Bushveld bioregion. Each of these bioregions is described below. These descriptions are adapted from Mucina and Rutherford, 2006.

Dry Highveld Grassland

Dry Highveld Grassland prevails in the western region of the Grassland Biome where the annual rainfall is below 600 mm per annum. These grasslands fall within the “sweet” grassland type with a predominance of chloridoid grasses.

In terms of conservation and disturbance, 44 % of the vegetation type is already transformed by cultivation, plantations, mines, and urbanisation. No serious alien invasion, but *Acacia mearnsii* can dominate in certain areas.

Eastern Highveld Grassland

Highveld grasslands are found on the extensive central plateau of South Africa with its flat to undulating topography. The major environmental factors controlling vegetation patterns and the recognition of different vegetation types is annual rainfall, which forms an east to west gradient of decreasing moisture across the Highveld.

Mesic Highveld Grassland

Mesic Highveld Grassland is found mainly in the eastern, high rainfall regions of the Highveld, extending all the way to the northern escarpment. These are considered to be “sour” grasslands and are dominated by primarily andropogonoid grasses. The different grassland types are distinguished on the basis of geology, elevation, topography and rainfall. Shrublands are found on outcrops of rock within the bioregion, where the surface topography creates habitat in which woody vegetation is favoured above grasses.

Central Bushveld

The savanna bioregions in South Africa are distinguished by location. The Central Bushveld extends from the northern sections of the Gauteng Province northwards into the Limpopo Province. The savanna is typified by an herbaceous layer dominated by grasses and a discontinuous to open tree layer.

As mentioned above the corridors were visited for a lengthy period of time and the following vegetation types were identified along the route:

- Egoli Granite Grassland
- Rand Highveld Grassland

- Eastern Highveld Grassland
- Cartonville Dolomite Grassland
- Gold Reef Mountain Bushveld
- Andesite Mountain Bushveld
- Marikana Thornveld and
- Eastern Temperate Freshwater Wetlands

Although the above mentioned vegetation types occur, the vegetation within the corridors were often severely transformed with few remaining patches of natural vegetation. The routes are also heavily invaded by species such as *Eucalyptus* and black wattle (*Acacia mearnsii*), the latter forming dense stands throughout the site. The vegetation types identified on site are indicated in Figure 42, Figure 43 and Figure 44 below and described in detail in the site description taking into account areas that had been transformed.

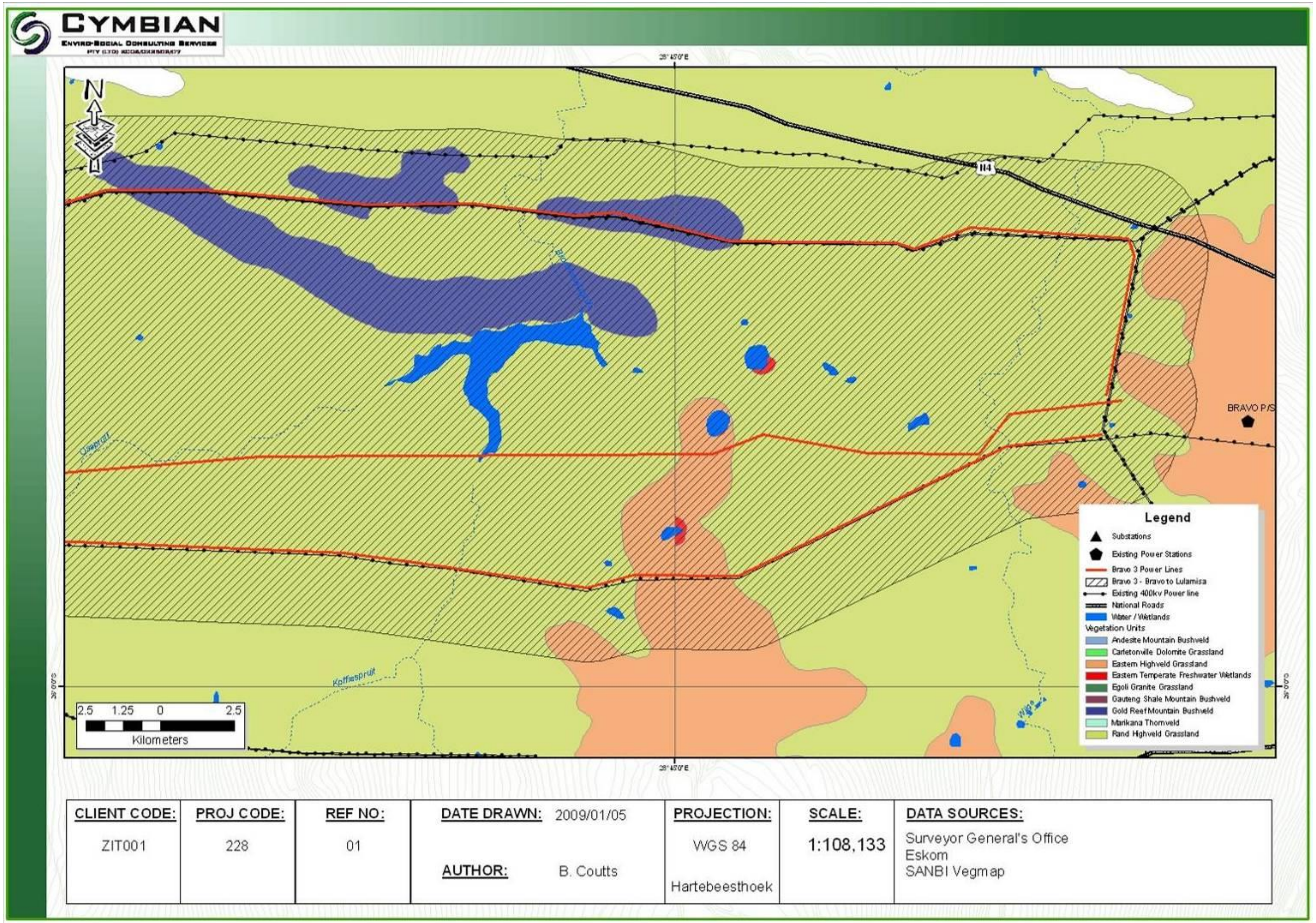


FIGURE 42: VEGETATION UNIT MAP

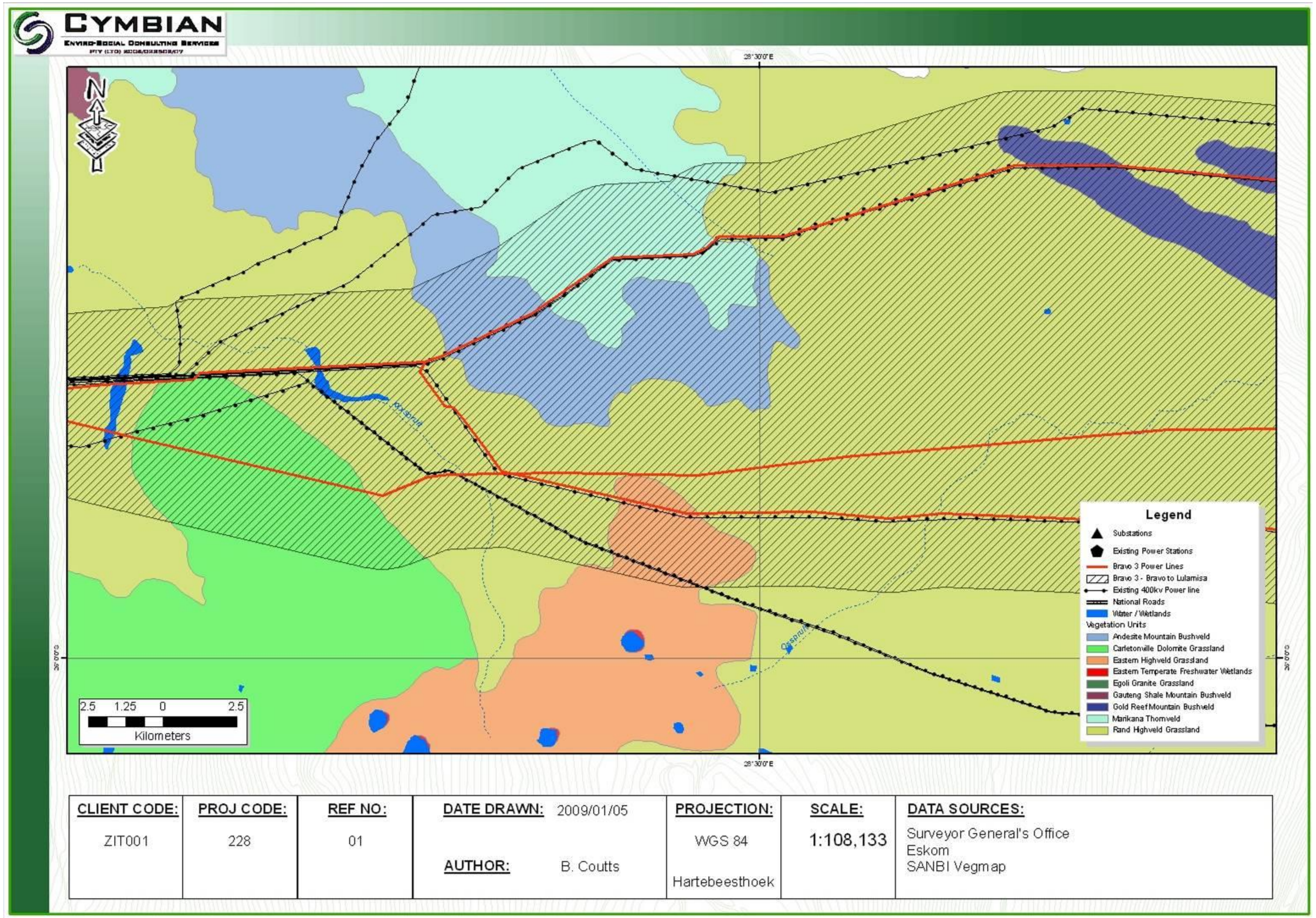


FIGURE 43: VEGETATION UNIT MAP

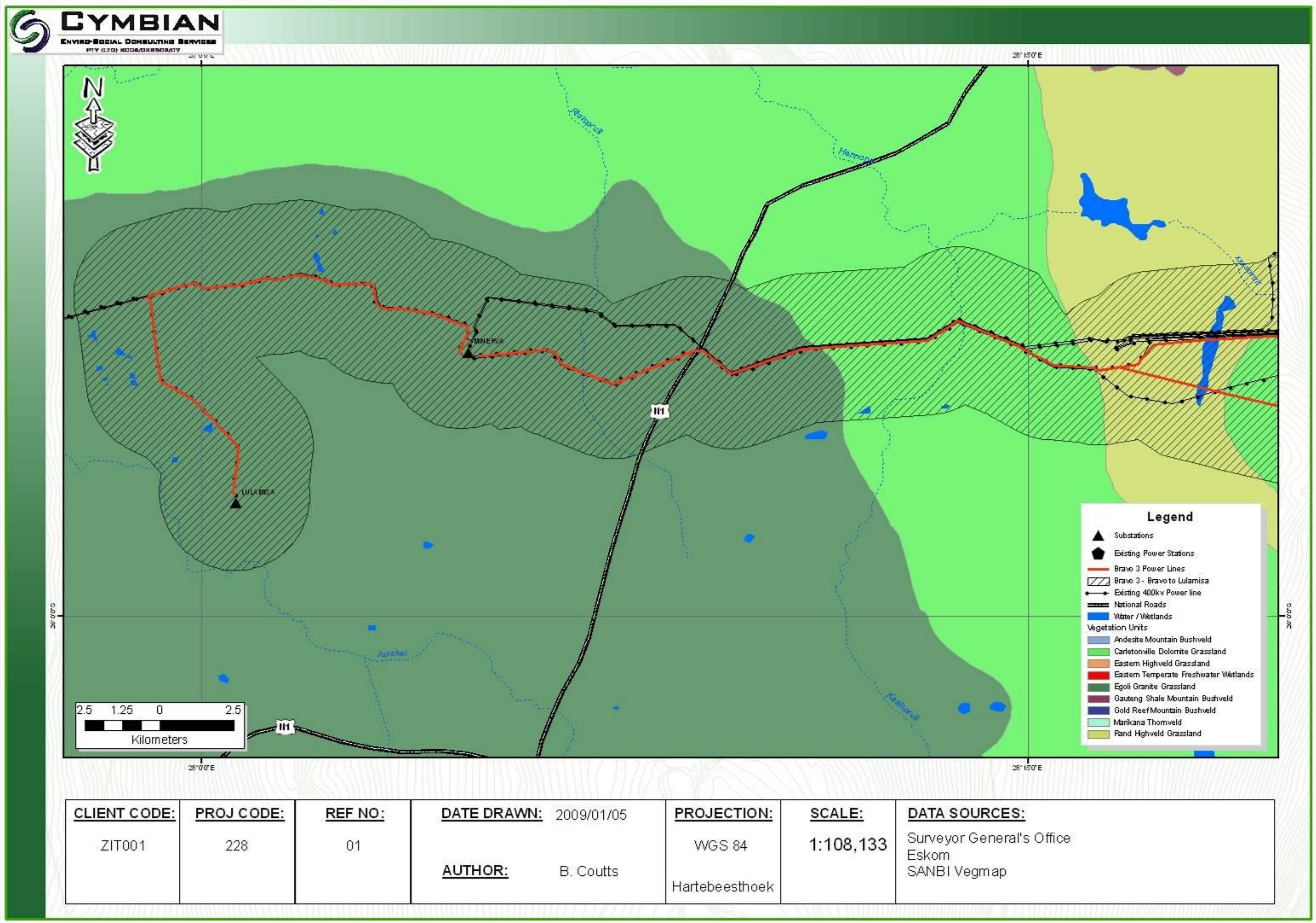


FIGURE 44: VEGETATION UNIT MAP

Site Description

At the time of the site visit it was found that large sections of the area were being used for cultivation of crops, livestock and grazing lands, which can be seen from Figure 49, Figure 50 and Figure 51. Portions of the site were located on ridges where natural vegetation had very little disturbance in terms of grazing from livestock.

Three additional vegetation management units were identified; namely, cultivated fields/grazed pastures wetland/riparian zones, and disturbed areas. Each of these vegetation units are described in more detail below and illustrated in Figures below. The species list for the site is attached in Appendix Q. The species that could occur in the quarter degree grid was obtained from the Plants of Southern Africa (POSA) online database upheld by the South African National Botanical Institute (SANBI) and supplemented with field notes

Egoli Granite Grassland

The Egoli Granite Grassland vegetation type is found the Gauteng Province in the region between Johannesburg in the south, Muldersdrift in the west, Centurion in the north and Tembisa in the east. The moderately undulating plains and low hills support tall grassland, usually dominated by *Hyparrhenia hirta* with some woody species on rocky outcrops.

The vegetation type is listed as endangered as the vegetation type has a conservation target of 24 % conserved, while only 3 % is currently conserved. More than two thirds of the unit has already undergone transformation mostly by urbanisation, cultivation or by building of roads. Current rates of transformation threaten most of the remaining unconserved areas. There is no serious alien infestation in this unit, although species such as *Eucalyptus grandis*, *E. camaldulensis* and *E. sideroxylon* are commonly found. A species list with all the species identified for each vegetation type is attached in Appendix Q and photos are given Figure 45 below. Approximately 25 % of the corridors fall within this vegetation unit.

FIGURE 45 PHOTOS OF EGOLI GRANITE GRASSLAND VEGETATION ALONG THE CORRIDORS

Rand Highveld Grassland

Rand Highveld Grassland is found in the highly variable landscape with extensive sloping plains and ridges in the Gauteng, North-West, Free State and Mpumalanga Provinces. The vegetation type is found in areas between rocky ridges from Pretoria to Witbank, extending onto ridges in the Stoffberg and Roossenekal regions as well as in the vicinity of Derby and Potchefstroom, extending southwards and northeastwards from there. The vegetation is species rich, sour grassland alternating with low shrubland on rocky outcrops. The most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon and Elionurus*. High numbers of herbs, especially *Asteraceae* are also found. In rocky areas shrubs and trees also prevail and are mostly *Protea caffra, Acacia caffra, Celtis africana and Rhus spp.*

This vegetation type is poorly conserved (approx 1 %) and has a target of 24 % of the vegetation type to be conserved. Due to the low conservation status this vegetation type is classified as endangered. Almost half of the vegetation type has been transformed by cultivation, plantations, urbanisation or dam-building. Scattered aliens (most prominently *Acacia mearnsii*) are present in the unit. Approximately 60 % of the corridors traverse Rand Highveld Grassland, thus the largest section of the route comprises this vegetation type. Photos are provided in Figure 46 below.

FIGURE 46:PHOTOS OF RAND HIGHVELD GRASSLAND

Eastern Highveld Grassland

The Eastern Highveld Grassland is found in the Mpumalanga and Gauteng Provinces on the plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. The landscape is dominated by undulating plains and low hills with short dense grassland dominating belong to the genera *Themeda*, *Aristida*, *Digitaria*, *Eragrostis*, *Tristachya etc*. Once again woody species are prevalent on the rocky outcrops.

In terms of conservation and disturbance, 44 % of the vegetation type is already transformed by cultivation, plantations, mines, and urbanisation. No serious alien invasion, but *Acacia mearnsii* can dominate in certain areas. For a complete species list, please refer to Appendix Q. Approximately 1.5 % of the route is covered by Eastern Highveld Grassland.

Carletonville Dolomitic Grassland

The Carletonville Dolomitic Grassland, as indicated by the name, is limited to the dolomitic regions of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in the Gauteng Province. This vegetation type is found on slightly undulating plains dissected by prominent ridges. Species rich grasslands forming a complex mosaic patterns dominate the vegetation type.

This vegetation type is poorly conserved (1.8 % and rated as vulnerable) and almost a quarter of the vegetation type is already transformed by cultivation, urban sprawl or by mining activities

Marikana Thornveld

The Marikana Thornveld vegetation type occurs on plains from the Rustenburg area in the west, through Marikana and Brits to the Pretoria area in the east. The vegetation type is typified by open *Acacia karroo* woodland occurring in the valleys and undulating plains. Shrubs are denser along drainage lines and it is common for the drainage lines to be infested with aliens. Refer to Figure 47 for photos of the Marikana Thornveld encountered along the route.

Marikana Thornveld is considerably impacted, with 48 % of the vegetation type being transformed, mainly due to cultivated and urban or built-up areas. Most agricultural development of this unit is in the western regions towards Rustenburg, while in the east (near Pretoria) industrial development is a greater threat of land transformation. This vegetation type is rated as endangered as only 0.7 % of the unit is conserved. Approximately 2.5 % of the route is covered by Marikana Thornveld.

FIGURE 47: MARIKANA THORNVELD ENCOUNTERED ALONG THE ROUTE

Gold Reef Mountain Bushveld

Occurs along rocky quartzite ridges of the Magaliesberg and the parallel ridge to the south, from around Boshoek and Koster in the west to near Bronkhorstspruit in the east. The west-east-trending ridge of the Witwatersrand from around Krugersdorp in the west, through Roodepoort and Johannesburg to Bedfordview (Germiston District). Inner ridges (e.g. Dwarsberg and Witkop) of the Vredefort Dome on the Vaal River northwest of Parys and part of the Suikerbosrand and some other hills around Heidelberg.

The unit is typical mountain vegetation that is woodier than the surrounding plains, often with more dense woody vegetation on the south-facing slopes with distinct floristic differences. About 15 % of the unit is transformed by cultivation and urban built-up areas. Some areas have dense stands of the alien *Melia azedarach* which is often associated with drainage lines. Some 22 % of the unit is conserved and therefore the unit is rated as least threatened. Approximately 2.5 % of the route is covered by Gold Reef Mountain Bushveld.

Andesite Mountain Bushveld

The Andesite Mountain Bushveld vegetation unit is found in several separate occurrences of which the main are: the Bronberg Ridge in eastern Pretoria extending to Welbekend; from Hartebeesthoek in the west along the valley between the two parallel ranges of hills to Atteridgeville; hills in southern Johannesburg; several hills encompassing Nigel, Willemsdal, Coalbrook and Suikerbosrand (in part); and the outer ring of ridges of the Vredefort Dome and some hills to the northwest around Potchefstroom. The unit is typified by dense, medium-tall thorny bushveld with a well developed grass layer.

The unit is rated as least threatened due to the conservation of 6.8 % of the unit. The main sources of transformation are cultivation and urban development. Approximately 2.5 % of the route is covered by Andesite Mountain Bushveld.

Eastern Temperate Freshwater Wetlands

This vegetation unit is found throughout the Northern Cape, Eastern Cape, Free State, North-West, Gauteng, Mpumalanga and KwaZulu-Natal Provinces as well as in neighbouring Lesotho and Swaziland. It is based around water bodies with stagnant water (lakes, pans, periodically flooded vleis, and edges of calmly flowing rivers) and embedded within the Grassland Biome. These water bodies support zoned systems of aquatic and hygrophillous vegetation of temporary flooded grasslands and ephemeral herblands.

Due to the recent efforts of organisations such as Ramsar, this vegetation unit is now 4.6 % conserved and rated as least threatened. The following aliens are encountered in this type of wetland: *Bidens bidentata, Cirsium vulgare, Conyza bonariensis, Oenothera rosea, Physalis viscosa, Plantago lanceolata, Rumex crispus, Sesbania punicea, Schkuhria pinnata, Stenotaphrum secundatum* (native on South African coast, alien on Highveld*), Trifolium pratense, Verbena bonariensis, V. brasiliensis, and Xanthium strumarium*. Approximately 1 % of the route traverses through areas that could be classified as Wetlands (Refer Figure 48 below for photographs).

Areas around drainage lines/seepage areas were also added to this unit because of the similar vegetation that may occur in these areas. Seepage areas are seasonally wet areas that occur in sandy areas where water seeps into lowlying drainage lines after rains. These areas are usually covered by hygrophytes such as sedges and reeds. The dominant sedge in the study area is Juncus rigidus. Sometimes bulrush (Typha capensis) and reeds (Phragmites australis) also occurs.

Wetlands are of a more permanent nature and occur in low-lying areas such as tributaries of streams and rivers. Here hydrophytes can be found. Typical plants are the Orange River Lily (*Crinum bulbispermum*), bulrush (*Typha capensis*) and reeds (*Phragmites australis*), sedges of the *Cyperus, Fuirena and Scirpus* genera also occur. The site had many drainage and seepage lines running into large streams and into dams. Many of the site drainage and seepage lines had associated wetland and riparian flora. This made these areas have a high species diversity in terms of both plants and animals and makes them have a high conservation level.

FIGURE 48:WETLANDS FOUND ALONG THE POWER LINE CORRIDORS

Cultivated Fields

This was the main vegetation type found upon the site visit, were 80% of the site was cultivated land.

Majority of the crops were maize and were being prepared for plantation of seeds. Very little to no natural occurring vegetation was located within the cultivated fields, besides invasive species such as *Tagetes minuta* (Langkakiebos).

Disturbed areas/vegetation

This area was located in areas that were highly disturbed from anthropogenic causes, such as overgrazing and bad land use management. Some of the species that exist in these plantations are *Acacia decurrens* (Sliver wattle) and *Acaia mearnsii* (Black wattle). These two species were originally used in the commercial field to produce tannins (Bromilow 2001). Like these species and other invasive trees that have became invaders of veld and indigenous bush, these plants are hard to remove and are fast growing. Invasive trees use a lot of water, which is already a valuable resource. Around these areas very little indigenous vegetation grew because of the dense forest these invaders can form. Other areas that were included are urban and industrial areas.

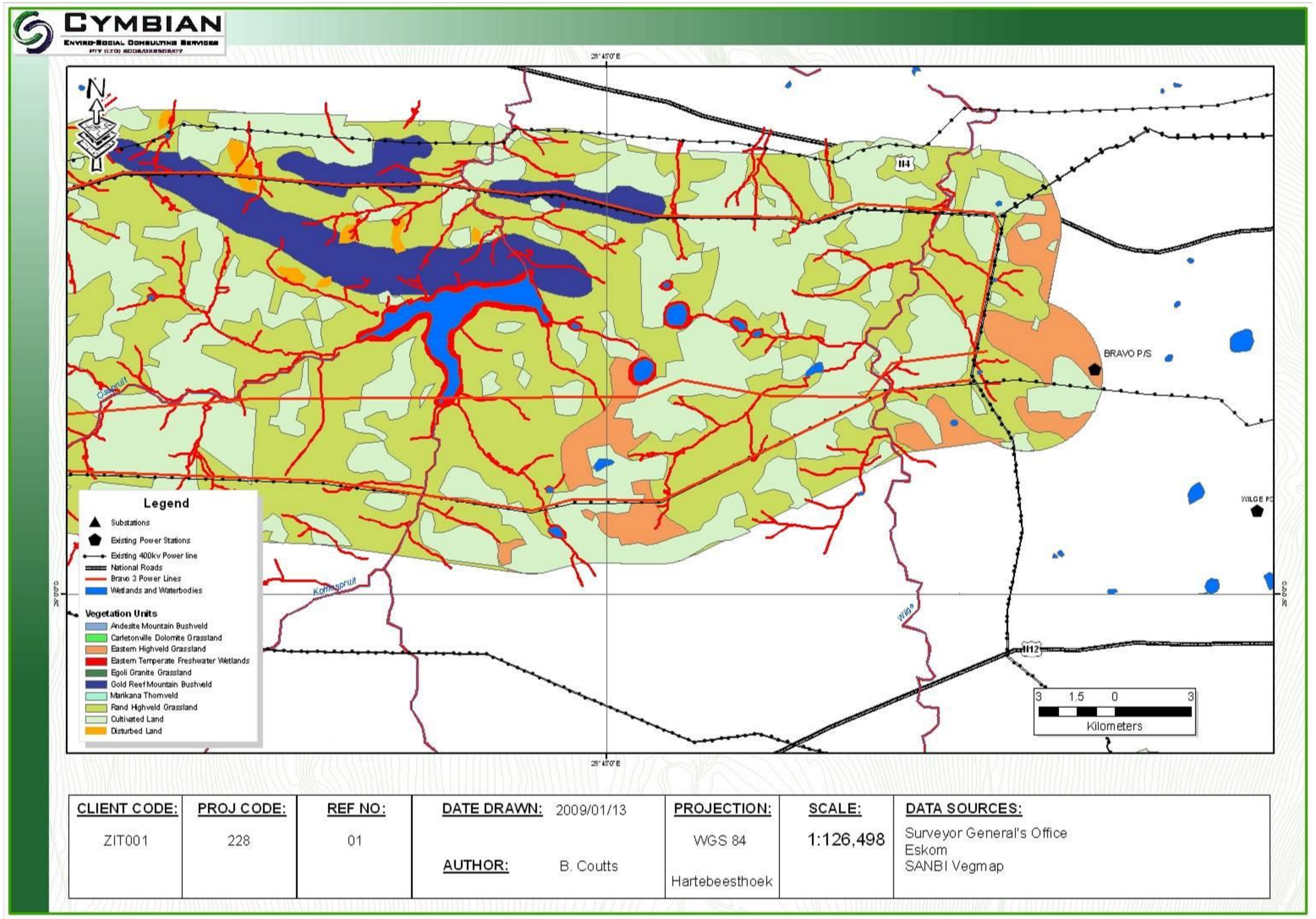


FIGURE 49: WESTERN VEGETATION

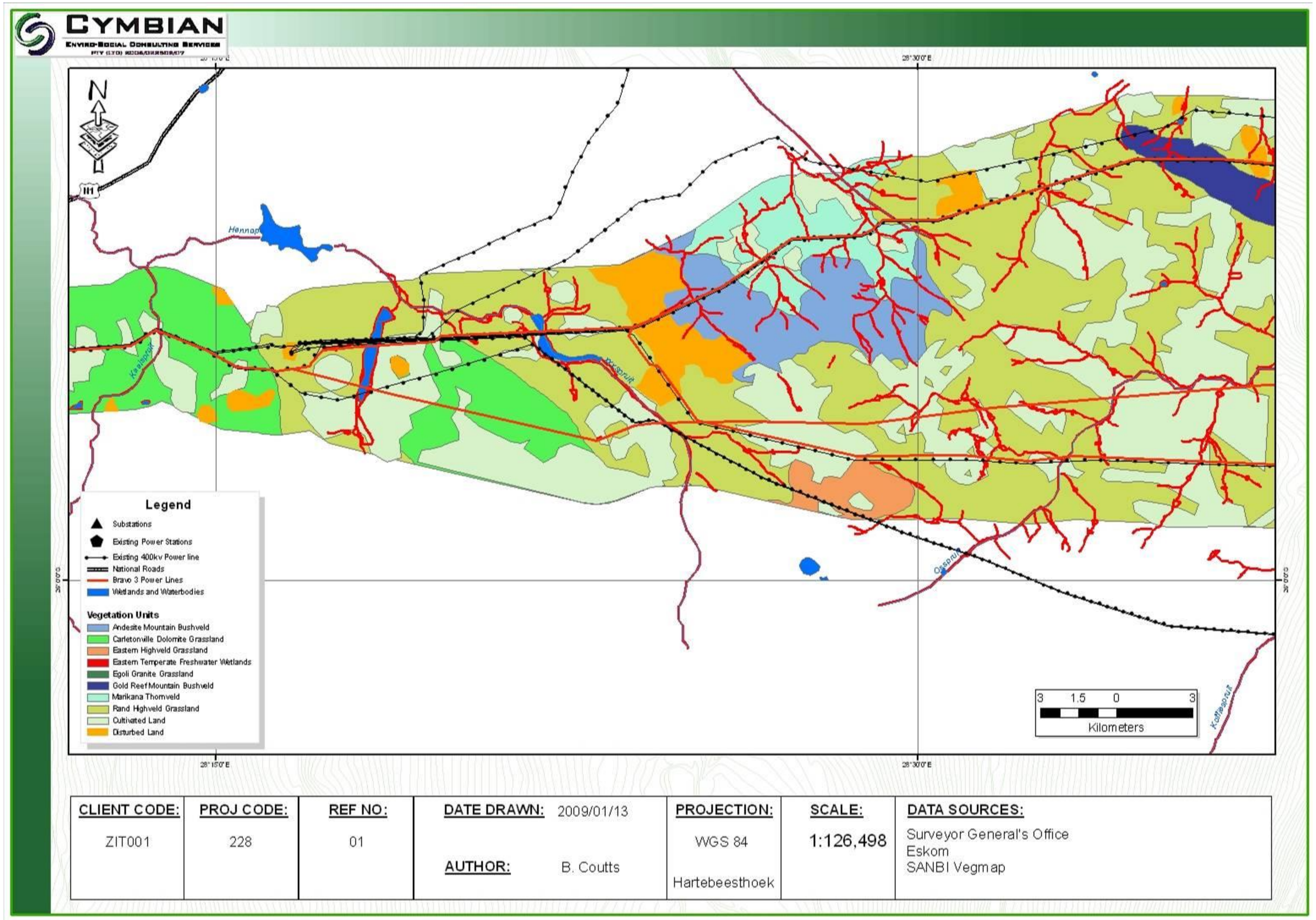


FIGURE 50: CENTRAL VEGETATION

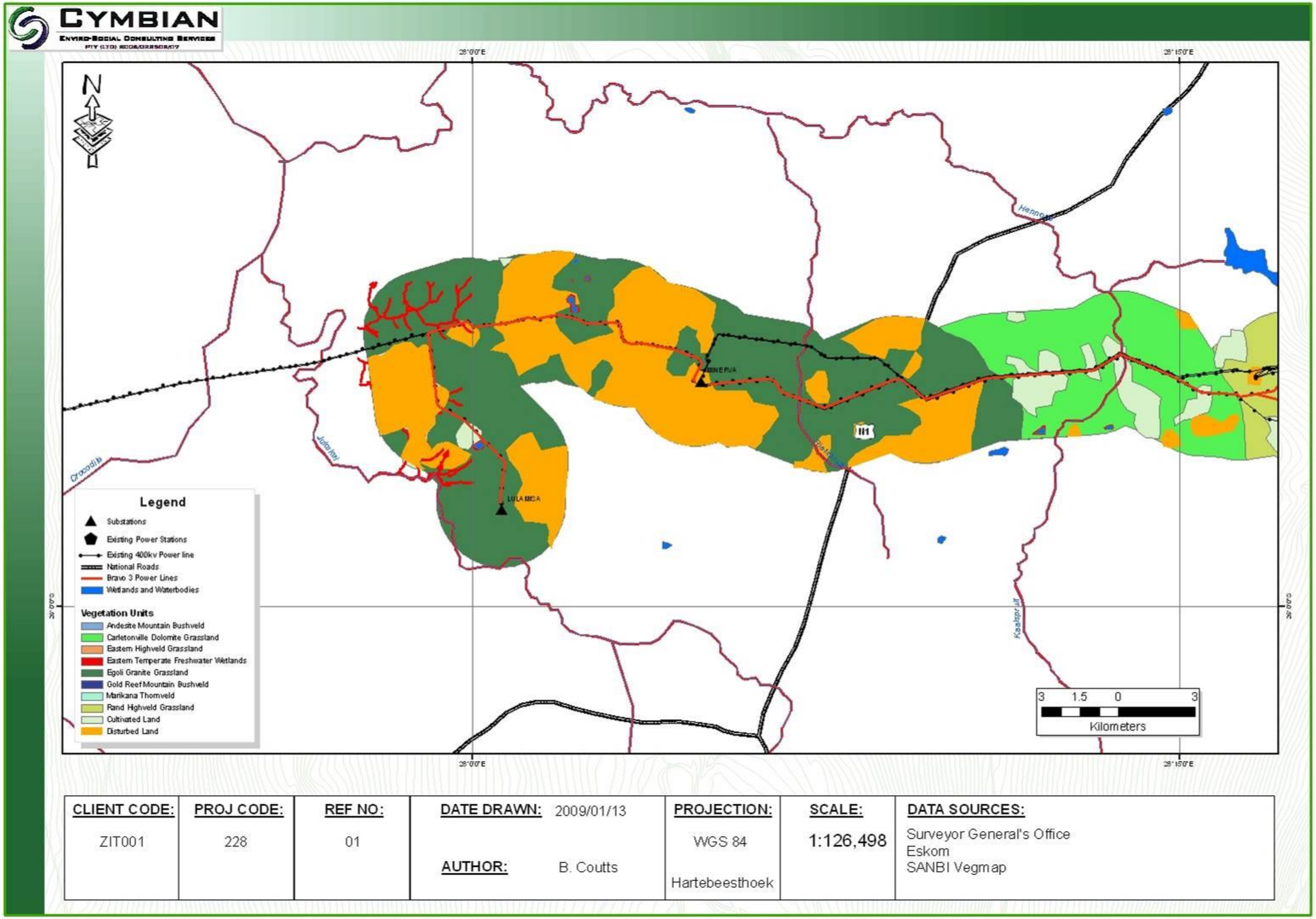


FIGURE 51: WESTERN VEGETATION

Sensitivities

The ratings mentioned above in the site description are derived from the level of conservation of that specific vegetation type. This is useful for an overview perspective, but for detailed sensitivities the focus moves to red/orange data species. Due to the endangered status of the plants, their specific occurrence is kept confidential by the GDACE. For guidance, the department has issued the Conservation Plan (CPlan) data which provides an indication as to the locality of red/orange data fauna or flora. Figure 52 illustrates the areas identified by CPlan as being sensitive. These areas have been investigated in detail for sensitive flora. It was found that the areas highlighted in Figure 52 are mostly wetlands, the Bronkhorstspruit Dam and ridges. All of these areas could provide habitat to sensitive species.

7.1.9 Fauna

Data Collection

A literature review of the faunal species that could occur in the area was conducted. C-Plan data provided from the Mpumalanga provincial department was used to conduct a desktop study of the area. This data consists of terrestrial and aquatic components, ratings provide an indication as to the importance of the area with respect to biodiversity. Additionally, all fauna were noted during the site visit conducted on the 10th-14th March and 18th – 20th November 2008.

Regional Description

As a consequence of mining and farming in the area, it appears that only small animals are to be found at the site. Small mammals known to occur in the area include hedgehog, rabbits, polecat, meerkat and the ubiquitous rats and mice. Given the habitat, it is likely that korhaans, larks, longclaws, species of Euplectes (bishops and widows), weavers, starlings and sparrows occur in the grassland.

The area surrounding the proposed power line does include areas of terrestrial and aquatic habitats. These areas should be treated as sensitive and should therefore be managed accordingly; if feasible they should be avoided.

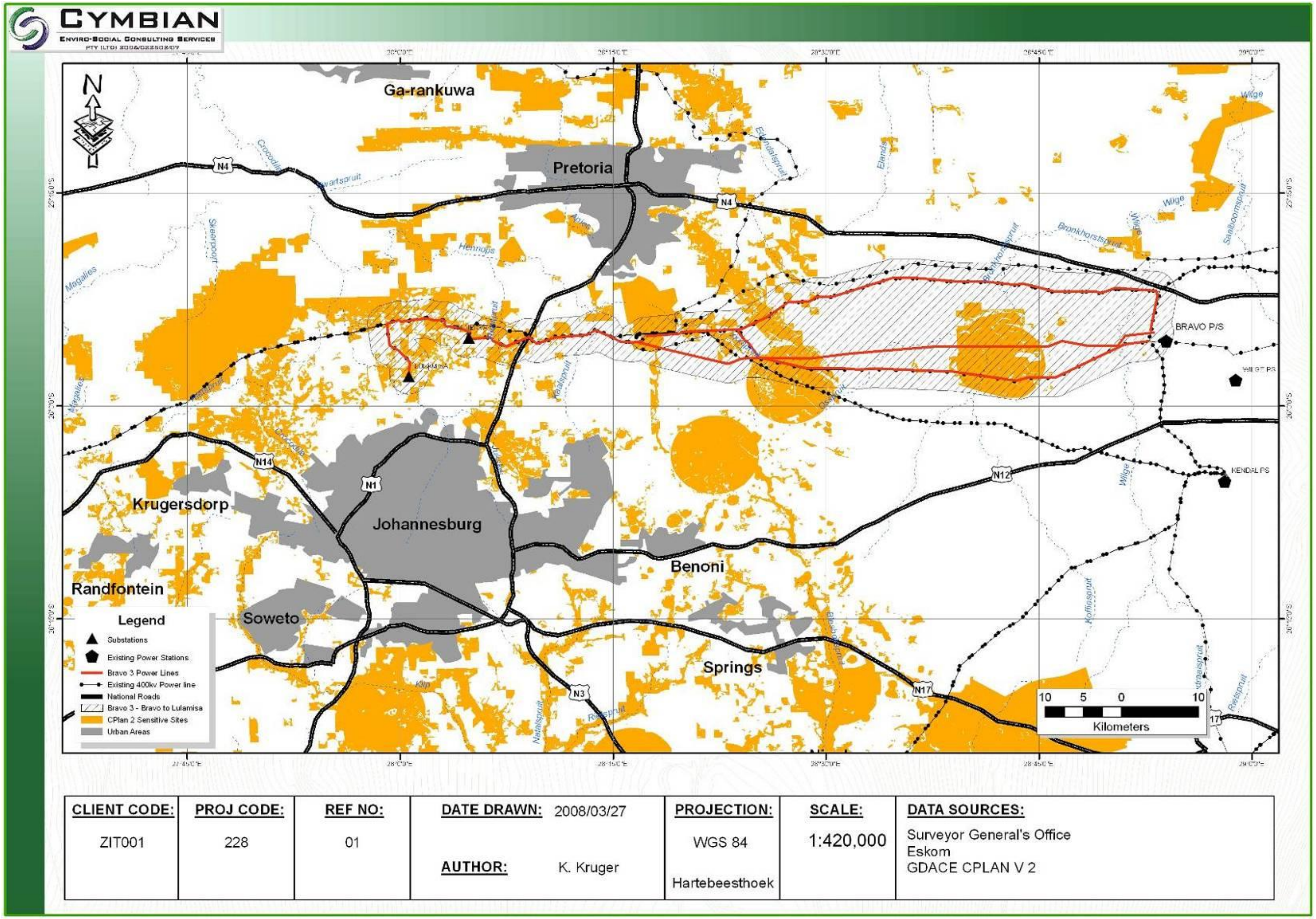


FIGURE 52: SENSITIVE VEGETATION UNITS FOUND ON SITE

Site Description

The scope of work indicated that an avifauna assessment was required. An avifaunal assessment will be undertaken and the report will be provided as part of the EIA. All herpetofauna and mammals observed on site were noted during the site visit.

Habitat

The habitat on site is described in the vegetation site description in Section 7.1.8 above. All of the vegetation types identified have been disturbed to a certain extent, as the main land use in the area is grazing of livestock. Disturbed Grasslands, Riparian and Wetland areas were found on site. All of these are suitable habitat to a number of protected species found in the region.

Species potentially occurring on site

A detailed list of the species potentially occurring on site is attached in Appendix Q.

Herpetofauna

Herptofauna could potentially occur in all the habitat types. The Riparian and Wetland zones could potentially support amphibians representative of the region, specifically *Pyxicephalus adspersus* (African Bullfrog) which is a species rated as "near threatened" and is a protected species in South Africa.

The area can potentially contain *Geochelone pardalis* (Leopard tortoise), *Aparallactus capensis* (Cape Centipede Eater), *Atractaspis bibronii* (Southern or Bibron's Burrowing Asp), *Causus rhombeatus* (Common Night Adder), *Crotaphopeltis hotamboeia* (Herald or Red-lipped Snake), *Dasypeltis scabra* (Common or Rhombic Egg Eater), *Hemachatus haemachatus* (Rinkhals), *Lycodonomorphus rufulus* (Common Brown Water Snake), *Naja annulifera annulifera* (Snouted Cobra), *Psammophylax tritaeniatus* (Striped Skaapsteker), *Agama atra (*Southern Rock Agama*), Bitens arietans* (Puff Adder), *Cordylus vittifer* (Transvaal Girdled Lizard), *Gerrhosaurus flavigularis* (Yellow Throated Plated Lizard), *Lygodactylus ocellatus* (Spotted Dwarf Gecko), *Pachydactylus affinis* (Transvaal Thick-toed Gecko), *Telescopus semiannulatus semiannulatus* (Eastern Tiger Snake), *Psammophis brevirostris brevirostris* (Leopard or Short-snouted Grass Snake) and *Varanus niloticus (*Water Monitor). *Hemachatus haemachatus* (Rinkhals), *Psammophis brevirostris brevirostris* (Leopard or Short-snouted Grass Snake) and *Cordylus vittifer* (Transvaal Girdled Lizard) are endemic to Southern Africa, while *Lygodactylus ocellatus* (Spotted Dwarf Gecko) and *Pachydactylus affinis* (Transvaal Thick-toed Gecko) are endemic to South Africa.

None of the above mentioned Herpetofauna were encountered on site during the site visit that took place from the 10^{th}-14^{th} March and 18^{th} to 20^{th} November 2008.

Avifauna

A number of power line sensitive, Red Data species could potentially occur along any of the corridors in small densities, mostly in the remaining natural grassland (Refer to Table 11). The biggest potential risk that the proposed power line will pose, unless mitigated, is bird collisions with the earth wire of the proposed line. Other potential risks are the destruction of sensitive habitat through the construction of access roads, and disturbance of breeding birds during construction operations. The proposed corridors run through very similar habitat, which means that the potential bird impacts are likely to be similar in nature (but not in extent) along all the proposed corridors. The preferred corridor would be one that strives to avoid natural grassland or wetlands, or alternatively, is situated within the zone of influence of factors that lessen the risk of interactions for example, close to existing transmission lines or within urban areas. There is reason to believe that the impact of existing power lines may have been a major contributory factor to the low density and/or absence of power line sensitive grassland species such as cranes in the study area.

TABLE 11: AVIFAUNA RED DATA SPECIES LIST

Species	Common Name	Conservation Status
Mycteria ibis	Yellow-Billed Stork	Near Threatened
Leptoptilos crumeniferus	Marabou Stork	Near Threatened
Gyps coprotheres	Cape Vulture	Vulnerable
Gyps africanus	White-Backed Vulture	Vulnerable
Aquila rapax	Tawny Eagle	Vulnerable
Aquila ayresii	Ayre’s Hawk-Eagle	Near Threatened
Polemaetus bellicosus	Martial Eagle	Vulnerable
Falco peregrinus	Peregrine Falcon	Near Threatened
Falco biarmicus	Lanner Falcon	Near Threatened
Bugeranus carunculatus	Wattled Crane	Critically Endangered
Crex crex	Corn Crake	Near Threatened
Podica senegalensis	African Finfoot	Vulnerable
Eupodotis caerulescens	Blue Korhaan	Near Threatened
Rostratula benghalensis	Greater Painted Snipe	Near Threatened
Glareola nordmanni	Black-Winged Pratincole	Near Threatened
Alcedo semitorquata	Half-Collared Kingfisher	Near Threatened
Mirafra cheniana	Melodious Lark	Near Threatened
Ciconia nigra	Black Stork	Near Threatened
Sagittarius serpentarius	Secretarybird	Near Threatened
Eupodotis senegalensis	White-Bellied Korhaan	Vulnerable
Phoenicopterus minor	Lesser Flamingo	Near Threatened
Phoenicopterus ruber	Greater Flamingo	Near Threatened
Falco naumanni	Lesser Kestrel	Vulnerable
Tyto capensis	African Grass-Owl	Vulnerable

Anthropoides paradiseus	Blue Crane	Vulnerable
Sterna caspia	Caspian Tern	Near Threatened
Circus ranivorus	African Marsh-Harrier	Vulnerable

Mammals

Large mammals have to a large extent been removed from the area and the only indication of large mammal species that could have previously occurred in the area are re-introduced mammals found on a few game farms and lodges encountered during the site visit. Such game farms can be found around the Apollo sub station. These include Springbok (*Antidorcas marsupialis*), Blesbok (*Damaliscus dorcas phillipsi*), Blue Wildebeest (*Connochaetes taurinus*) and Burchell's Zebra (*Equus burchelli*). During the site visit, Yellow Mongoose (*Cynictis pencillata*) was spotted as well as signs of other small mammals such as droppings. Other small mammals known to occur in the area include Hedgehog (*Atelerix frontalis*), Striped Polecat (*Ictonyx striatus*), Suricate / Meerkat (*Suricata suricatta*), Aardvark / Antbear (*Orycteropus afer*) and the ubiquitous rats and mice. Sensitive mammal species that could occur in the quarter degree square 2529CD include *Genetta tigrina* (Large-spotted Genet), *Lepus saxatilis* (Scrub hare), Hyaena *brunnea* (Brown Hyaena), *Sylvicapra grimmia* (Common/Grey Duiker), Tragelaphus scriptus (Bushbuck), Vulpes chama (Cape Fox). None of these species were identified on site.

7.1.10 Wetland and Riparian Zone Delineation

Riparian Zones vs. Wetlands

Wetlands

The riparian zone and wetlands were delineated according to the Department of Water Affairs and Forestry (DWAF) guideline, 2003: A practical guideline procedure for the identification and delineation of wetlands and riparian zones. According to the DWAF guidelines *a wetland* is defined by the National Water Act as:

"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

In addition the guidelines indicate that wetlands must have one or more of the following attributes:

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

During the site investigation the following indicators of potential wetlands were identified:

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

Riparian Areas

According to the DWAF guidelines *a riparian area* is defined by the National Water Act as:

"Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas"

The difference between Riparian Areas and Wetlands

According to the DWAF guidelines the difference between a wetland and a riparian area is:

"Many riparian areas display wetland indicators and should be classified as wetlands. However, other riparian areas are not saturated long enough or often enough to develop wetland characteristics, but also perform a number of important functions, which need to be safeguarded... Riparian areas commonly reflect the high-energy conditions associated with the water flowing in a water channel, whereas wetlands display more diffuse flow and are lower energy environments."

Delineation

The site was investigated for the occurrence of wetlands and riparian areas, using the methodology described above and described in more detail in the DWAF guidelines.

Terrain Unit Indicator

The terrain on site varies from 1 520 mamsl to 1 420 mamsl as illustrated in Figure 13, Figure 14 and Figure 15. From the figures it can be seen that the site is located in an area of undulating hills with the dominant terrain units on site being the midslope, footslope and valley bottom units. According to the DWAF guidelines the valley bottom is the terrain unit where wetlands are most likely to occur, but they are not excluded from any of the other terrain units.

Soil Form Indicator

The majority of the site can be described as a typical Highveld plinthic catena. In the top parts of the slopes you find the rocky soils and then as the soil weathers and moves down the slope you start finding you agricultural soils. From here the action of water movement through the slope typifies the soils of the largest part of the site (eluvial and plinthic soils). Closer to the valley bottom terrain unit the soils gradually deepen due to the down-slope transport of soil (colluvium). In addition these soils have gradually higher percentages of clays that over time have been washed down-slope and accumulate at the valley bottom where the slope angle reduces.

During the site visit the soils on site were identified and mapped (Refer to Section 7.1.5). Of the soils identified on site the Katspruit, Willobrook, Arcadia and Rensburg soil form is indicative of the permanent wetland zone, while the Wasbank Longlands Kroonstad and Westleigh soil forms are indicative of the temporary wetland zone. There is also a possibility that the Avalon soil form can be indicative of the temporary zone.

Soil Wetness Indicator

The soils on site were subjected to a soil wetness assessment. If soils showed signs of wetness within 50 cm of the soil surface, it was classified as a hydromorphic soil and divided into the following groups:

Temporary Zone

- Minimal grey matrix (<10%);
- Few high chroma mottles; and
- Short periods of saturation.

Seasonal Zone

- Grey matrix (>10%);
- Many low chroma mottles present; and
- Significant periods of wetness (>3 months / annum).

Permanent Zone

- Prominent grey matrix;
- Few to no high chroma mottles;
- Wetness all year round; and
- Sulphuric odour.

The Katspruit, Wasbank, Willobrook, Arcadia; Rensburg and Longlands soil forms have signs of wetness in the soil profile. The Avalon soil form however did not have any signs of wetness. The Katspruit soil form was classified as the permanent zone, while the Wasbank and Longlands were classified as the temporary and seasonal zone. The soil forms are illustrated in Figure 17.

Vegetation Indicator

The vegetation units on site are described in Section 7.1.8 above and illustrated in. Figure 42, Figure 43 and Figure 44. The vegetation found in the moist grassland and the seepage zone vegetation units both have species present to indicate the presence of wetlands.

Wetlands and Buffer Zones

According to the methodology that was followed for delineation of wetlands by DWAF, there are wetlands present on site. It should however be noted that several of the so-called wetlands could also be classified as riparian zones as they follow the drainage path of the non-perennial streams on site. All the areas identified above perform critical ecosystem functions and also provide habitat for sensitive species. It is suggested that a 100m buffer be placed from the edge of the seasonal zone in order to sufficiently protect the wetlands and riparian zones. Alternative 2 is the best alignment, as it avoids most the sensitive wetlands as well as the buffer zones.

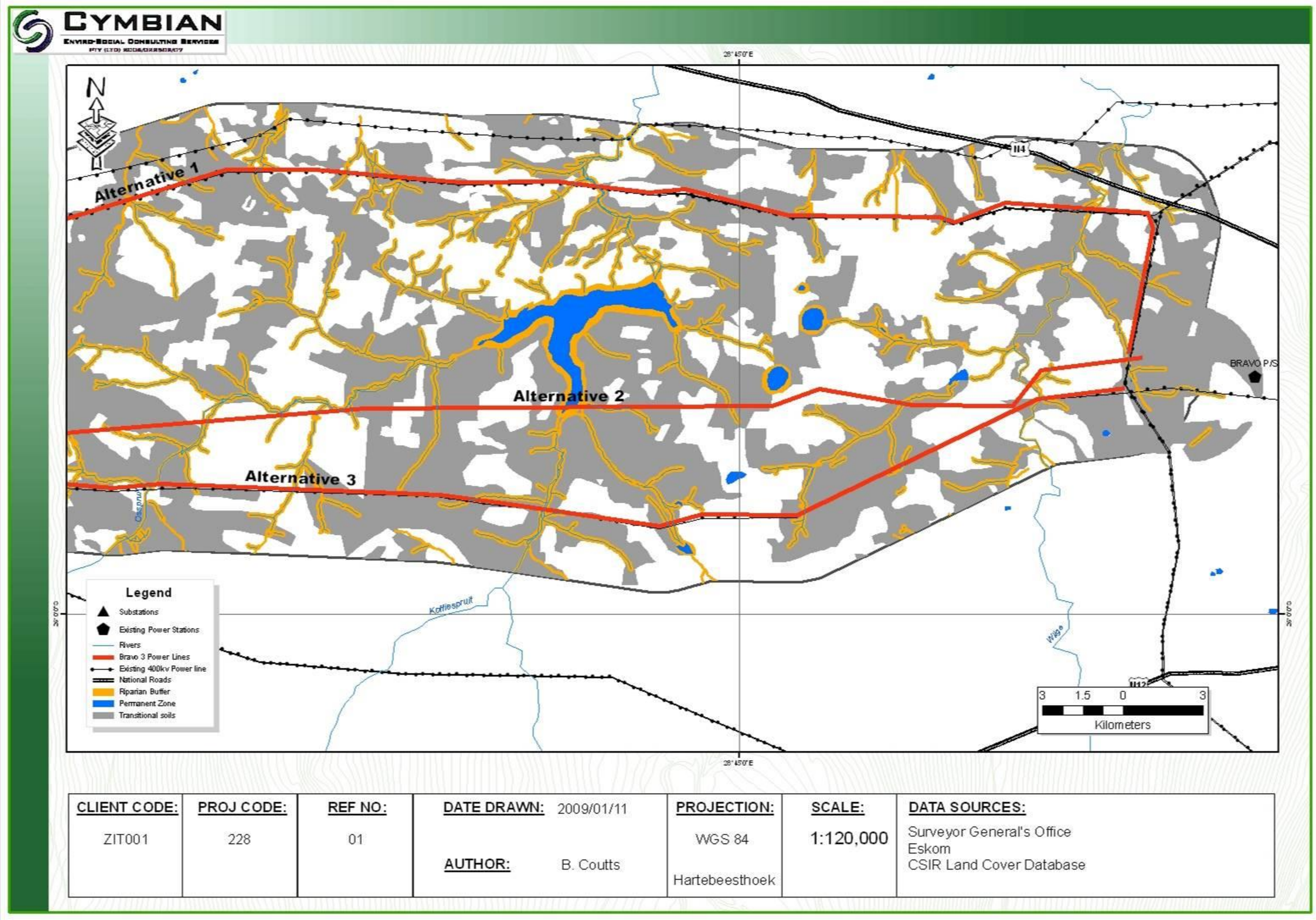
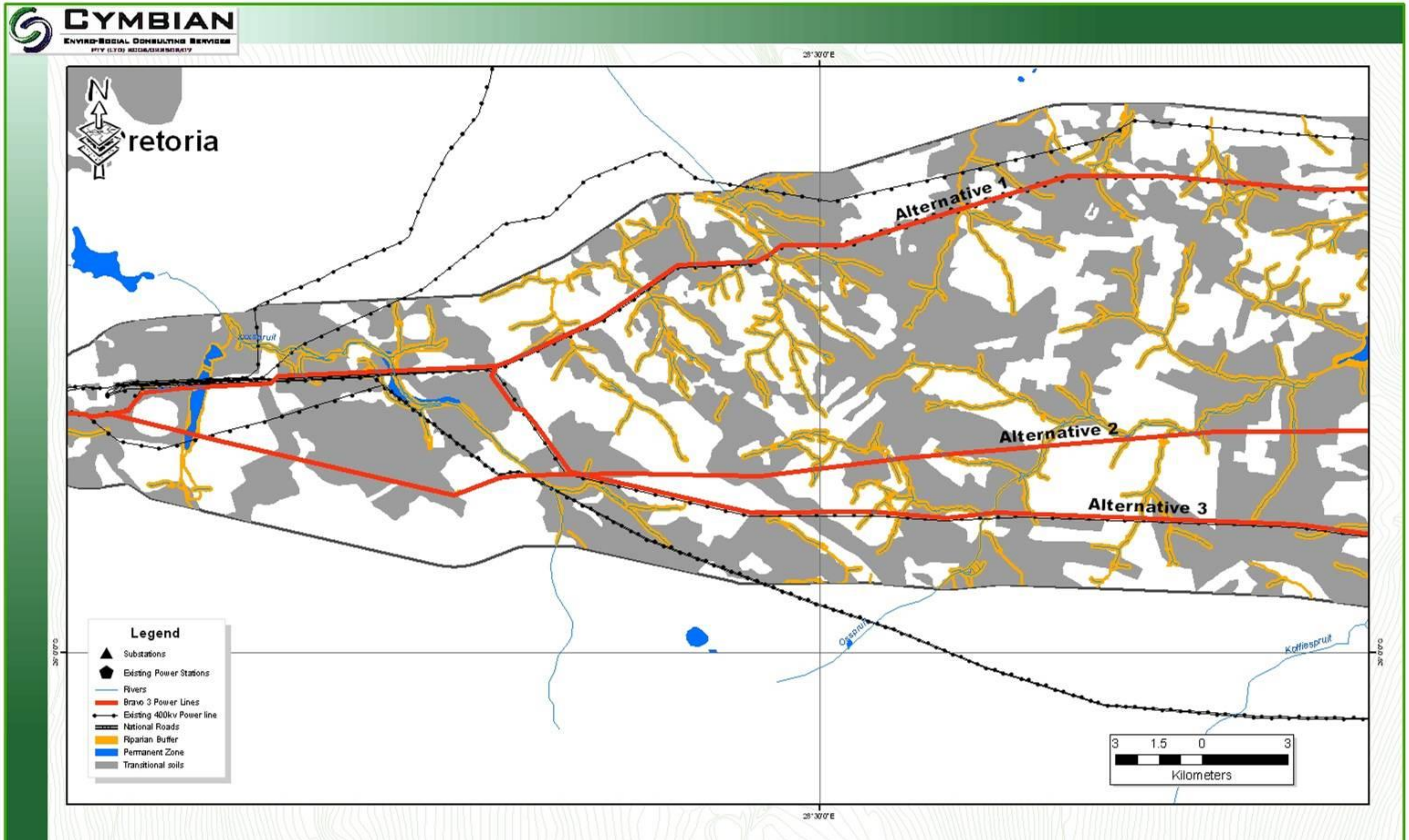


FIGURE 53: RIPARIAN AND WETLAND DELINEATION MAP OF THE EASTERN SECTION



CLIENT CODE:	PROJ CODE:	REF NO:	DATE DRAWN: 2009/01/11	PROJECTION:	SCALE:	DATA SOURCES:
ZIT001	228	01	AUTHOR: B. Coutts	WGS 84 Hartebeesthoek	1:120,000	Surveyor General's Office Eskom CSIR Land Cover Database

FIGURE 54: RIPARIAN AND WETLAND DELINEATION MAP OF THE CENTRAL SECTION

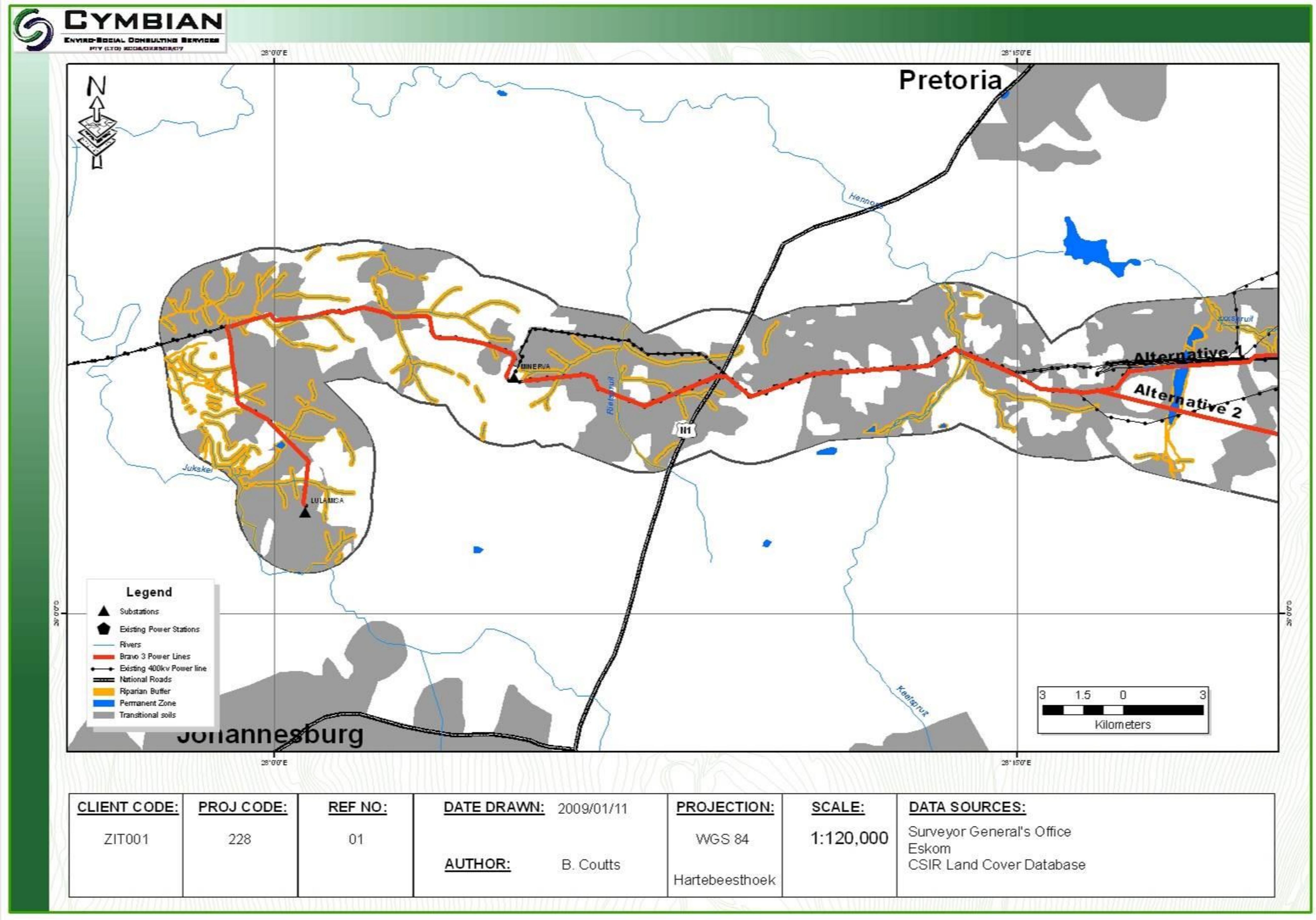


FIGURE 55: RIPARIAN AND WETLAND DELINEATION MAP OF THE WESTERN SECTION

7.1.11 Biodiversity Rating

In order to quantify the sensitivity of the fauna, flora and wetlands, a biodiversity assessment is undertaken.

Biodiversity Assessment Methodology

Each vegetation unit and its associated fauna were subjected to a biodiversity assessment according to the following methodology. The biodiversity of an area is measured as a combination of the variety of species and habitats within the area, as well as the ecological processes and functional value of the site. This can be captured in two broader categories namely conservation status and functional status. The conservation status encompasses species diversity, habitat diversity and ecological processes. The functional status encompasses ecological services and human use services.

It is suggested, due to the number of variables to be considered, that the following scoring system is used to first determine the value of each of the components (conservation status and functional status) from which the overall biodiversity value is determined.

Conservation status

The conservation status of a particular habitat / vegetation unit is determined using the methodology described in Table 12 below. The conservation status encompasses species diversity, habitat diversity and ecological processes. Each of the habitats found on site are rated accordingly in the Sections below.

TABLE 12: CONSERVATION STATUS DETERMINATION

A. How much of the larger vegetation type or system of which the defined area is a representative example, still exists?	**Rating**
Only a small area still exists (< 500km^2)	5
A moderate area still exists (500 to 1000 km^2)	3
A large areas still exist (> 1000 km^2)	1
B. What is (based on a qualitative assessment) the species and habitat diversity of the defined area?	**Rating**
Noticeably high	5
Difficult to assess	3
Obviously low	1
C. What is the condition (qualitative assessment) of the defined area?	**Rating**
Pristine and largely undisturbed	5
Moderately disturbed	3
Highly disturbed	1

The possible results for the conservation status of the defined area are based on a combination of the attributes, as follows.

A (Size) + B (Diversity) + C (Condition) = Conservation Status

Based on the combined score, the conservation status can range from very high to low, as described below in Table 13:

TABLE 13: CONSERVATION STATUS RATING

Conservation Status	Rating
High conservation status, needs to be maintained and improved	11 – 15
Moderate conservation status, heavily disturbed and will require improvement	6 – 10
Low conservation status, heavily reduced and of limited value.	3 – 5

Functional status

The functional status encompasses ecological services and human use services. All these elements are rated according to the methodology described in Table 14 below. A detailed rating of each habitat is given below.

TABLE 14: FUNCTIONAL STATUS DETERMINATION

A. Are there currently any signs of obvious recreational use of the area, such as walking/hiking, bird watching, mountain biking, fishing, etc?	Rating
Obvious signs of regular use	5
Signs of periodic use	3
No noticeable signs of use	1
B. Does the area carry out any ecological service, such as water purification, flood attenuation, riverbank stabilisation, soil stabilisation, etc?	**Rating**
Has an obvious functional role	5
Difficult to determine its functional role	3
Clearly has no to very limited functional role	1
C. Does the area serve an aesthetic role?	**Rating**
Forms part of a larger landscape that is widely visible and has a high aesthetic appeal	5
Forms part of a landscape that has high aesthetic appeal but which is not widely visible	3
Forms part of a landscape that has low aesthetic appeal	1

The possible results for the functional status of the defined area are based on a combination of the attributes, as follows.

A (recreational use) + B (ecological service) + C (aesthetic value) = Functional Status

Based on the combined score, the functional status can range from very high to low as illustrated in Table 15 below:

TABLE 15: FUNCTIONAL STATUS RATING

Functional Status	Rating
High service value	11 – 15
Moderate service value	6 – 10
Low service value	3 – 5

Biodiversity value

The perceived biodiversity value of an area to human development is not always easy to describe, but it includes the natural system and its variety of species, the ecological processes and the service or functional value that it provides. The combination of the conservation status and functional status scores provides a ranking of the overall biodiversity value for a defined area, as shown in the matrix in Table 16 below.

TABLE 16: BIODIVERSITY VALUE RATING

Conservation status	Functional status		
	High service value	Moderate service value	Low service value
High	High	High	Moderate
Moderate	Moderate	Moderate	Low
Low	Moderate	Low	Low

Eight vegetation units were found on site and are given below:

- Egoli Granite Grassland
- Rand Highveld Grassland
- Eastern Highveld Grassland
- Cartonville Dolomite Grassland
- Gold Reef Mountain Bushveld
- Andesite Mountain Bushveld
- Marikana Thornveld and
- Eastern Temperate Freshwater Wetlands

Each of the abovementioned vegetation units are rated for their biodiversity value below.

Egoli Granite Grassland

This vegetation unit has a **High** biodiversity rating as indicated in Table 17 below. The **high** conservation value is attributed to the grassland species diversity and composition in the unit and the small area of Egoloi Granite Grassland remaining. The **high** functional rating is attributed to the obvious ecological services and the high aesthetic value of the Egoli Granite Grassland.

TABLE 17: BIODIVERSITY RATING FOR THE *EGOLI GRANITE GRASSLAND* UNIT

Conservation status	Size of vegetation unit	Species diversity	Condition
	5 – Small	5 - High	1 – Highly Disturbed
Functional status	Use	Ecological service	Aesthetic value
	3 – Periodic	5 – Obvious	3 - Moderate
Biodiversity Rating	Conservation status	Functional status	Biodiversity
	11 – High	11 - High	High

Rand Highveld Grassland

This vegetation unit has a **moderate** biodiversity rating as indicated in Table 18 below. The **moderate** conservation value is attributed to the grassland species diversity and large percentage of grassland present. The **high** functional rating is attributed to the obvious ecological services and the high aesthetic value of the Rand Highveld Grassland.

TABLE 18: BIODIVERSITY RATING FOR THE *RAND HIGHVELD GRASSLAND UNIT*

Conservation status	Size of vegetation unit	Species diversity	Condition
	3 – Moderatel	5 - High	1 – Highly Disturbed
Functional status	Use	Ecological service	Aesthetic value
	3 – Periodic	5 – Obvious	5 - High
Biodiversity Rating	Conservation status	Functional status	Biodiversity
	9 –Moderate	13 - High	Moderate

Eastern Highveld Grassland

This vegetation unit has a **low** biodiversity rating as indicated in Table 19 below. The **moderate** conservation value is attributed to the moderate grassland species diversity. The **low** functional rating is attributed to the low ecological services and the moderate aesthetic value of the grassland. Eastern Highveld Grassland makes up a very small part of the route and therefore has a low Biodiversity rating.

TABLE 19: BIODIVERSITY RATING FOR THE *EASTERN HIGHVELD GRASSLAND* UNIT

Conservation status	Size of vegetation unit	Species diversity	Condition
	5 – High	3 - Moderate	1 – Highly Disturbed
Functional status	Use	Ecological service	Aesthetic value
	1 – none	1 - Low	3 - Moderate5 - High
Biodiversity Rating	Conservation status	Functional status	Biodiversity
	9 – Moderate	5 - Low	Low

Cartonville Dolomite Grassland

This vegetation unit has a **moderate** biodiversity rating as indicated in Table 20 below. The **moderate** conservation value is attributed to the high species diversity and percentage of grassland present. The **moderate** functional rating is attributed to the ecological services that are difficult to determine and the moderate aesthetic value of the Cartonville Dolomite Grassland.

TABLE 20: BIODIVERSITY RATING FOR THE *CARTONVILLE DOLOMITE GRASSLAND UNIT*

Conservation status	Size of vegetation unit	Species diversity	Condition
	3 – Moderatel	5 - High	1 – Highly Disturbed
Functional status	Use	Ecological service	Aesthetic value
	3 – Periodic	3 - Undetermined	3 - Moderate
Biodiversity Rating	Conservation status	Functional status	Biodiversity
	9 –Moderate	9 —Moderate	Moderate

Gold Reef Mountain Bushveld

This vegetation unit has a **high** biodiversity rating as indicated in Table 21 below. The **high** conservation value is attributed to the Moderate species diversity and the low level of disturbance. The **high** functional rating is attributed to the aesthetic value of the vegetation unit.

TABLE 21: BIODIVERSITY RATING FOR THE *GOLD REEF MOUNTAIN BUSHVELD* UNIT

Conservation status	Size of vegetation unit	Species diversity	Condition
	3 - Moderate	3 - Moderate	5 – Low disturbance
Functional status	Use	Ecological service	Aesthetic value
	3 - Periodic	3 - Undetermined	5 - High
Biodiversity Rating	Conservation status	Functional status	Biodiversity
	11 - High	11 - High	High

Andesite Mountain Bushveld

This vegetation unit has a **high** biodiversity rating as indicated in Table 22 below. The **high** conservation value is attributed to the Moderate species diversity and the low level of disturbance. The **high** functional rating is attributed to the aesthetic value of the vegetation unit.

TABLE 22: BIODIVERSITY RATING FOR THE *GOLD REEF MOUNTAIN BUSHVELD* UNIT

Conservation status	Size of vegetation unit	Species diversity	Condition
	3 - Moderate	3 - Moderate	5 – Low disturbance
Functional status	Use	Ecological service	Aesthetic value
	3 - Periodic	3 - Undetermined	5 - High
Biodiversity Rating	Conservation status	Functional status	Biodiversity
	11 - High	11 - High	High

Marikana Thornveld

This vegetation unit has a **high** biodiversity rating as indicated in Table 23 below. The **high** conservation value is attributed to the species diversity and in the unit and the small area of Marikana Thornveld remaining. The **moderate** functional rating is attributed to the undefined ecological services and the moderate aesthetic value of the Marikana Thornveld. This vegetation unit has been classified as endangered.

TABLE 23: BIODIVERSITY RATING FOR THE *MARIKANA THORNVELD* UNIT

Conservation status	Size of vegetation unit	Species diversity	Condition
	5 – Small	5 - High	1 – Highly Disturbed
Functional status	Use	Ecological service	Aesthetic value
	3 – Periodic	3 -Undefined	3 - Moderate
Biodiversity Rating	Conservation status	Functional status	Biodiversity
	11 – High	9 - Moderate	High

Eastern Temperate Freshwater Wetlands

This vegetation unit has a **high** biodiversity rating as indicated in Table 24 below. The **high** conservation value is attributed to the high grassland species diversity in the unit and the small area of wetlands remaining. The **high** functional rating is attributed to the obvious ecological services and the high aesthetic value of the wetlands and seepage areas.

TABLE 24: BIODIVERSITY RATING FOR THE *EASTERN TEMPERATE FRESHWATER WETLANDS*

	Size of vegetation unit	Species diversity	Condition
Conservation status	5 – Small	5 – High	3 – Moderately Disturbed
	Use	Ecological service	Aesthetic value
Functional status	1 – none	5 – Obvious	5 - High
	Conservation status	Functional status	Biodiversity
Biodiversity Rating	13 – High	11 - High	High

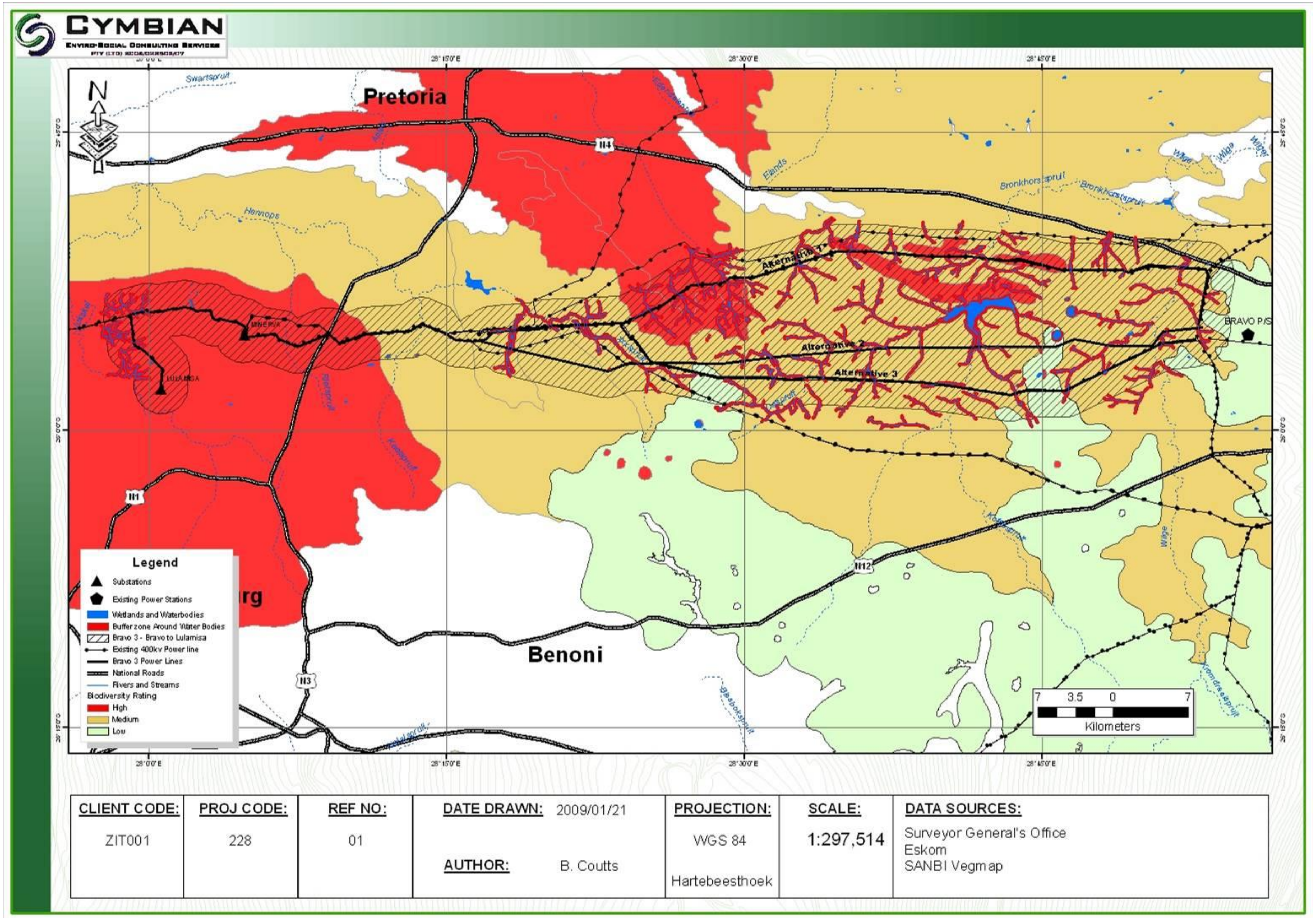


FIGURE 56: BIODIVERSITY RATING MAP

7.1.12 Visual Character

Landscape Character

The landscape character is described in detail above under the Topography section. Figure 57 below illustrates some of the existing power lines on site.

FIGURE 57: VIEW OF THE EXISTING POWER LINE ON SITE

Viewshed

It should be noted that the viewsheds generated are only an approximation for each alternative that has been generated in Figure 58, Figure 59, Figure 60 and Figure 61. Proposed views for the upgraded maybe blocked by buildings, vegetation and changes in local topography. Potential glimpses of the proposed upgrade may be available outside of the generated viewshed maps because of high elevation localities. Each figure represents the visibility of each alternative. The colours indicate the visibility of each alternative from the surrounding landscape. The green represents a low visibility of the proposed upgrade and the red represents a high visibility of the upgrade from the surrounding environment. From Lulamisa to Minerva shows a low visibility from the surrounding area, which may be false because of the land use around and near the Lulamisa substation. Located around the area is a high informal residential area, which is not taken into account in the generating the viewshed.

Notable features of the viewshed are summarised by the following points:

- The viewshed extends a great distance south of the proposed upgrade
- To the north the viewshed is limited by a ridge, which Alternative 1 will run along
- To the west the viewshed has a higher visibility due to the locality of Pretoria, Johannesburg and Midrand
- The viewshed to the west extends approximately 60 km to the west

Impact Assessment

The visual simulations prepared by Cymbian illustrate the extent to which the upgrade will be visible from key observation points (static and dynamic views).

The vertical form/dimensions of the buildings/structures would be hidden by their location among existing buildings and within a well vegetated area. The visual contrast is increased by the “shape” and scale of the buildings/structures, which generally will not be viewed along the skyline.

Static Views

The upgrade would potentially be visible from the Bronkhortspruit, and Bapsfotein areas with respect to viewshed Alternatives 1, 2 and 3. The visibility would potentially be low because the farmlands in the area are sparsely populated. These views would differ greatly depending on locality from the upgrade and the local topography. Site specific conditions need to be taken into account, such as vegetation, buildings and fences, which may hinder ones view of the power line upgrade

Dynamic Views

The power lines will potential be visible from the N4 highway mainly to those travelling along this route. The power lines cross over the N1 highway and at this stage will be visible for motorists travelling along this route for approximately 0.25 seconds travelling at 120 km/h. other roads that intersect the power lines is the R42, R25, 515, R21, R55 and the R28, which all would have similar visibility to motorists. The traffic the road carries has to be taken into account. National roads, such as the N1 and N4 carry higher volumes of traffic resulting in higher visibility of the power lines. Surrounding atmospheric conditions would also affect the visibility of the power lines. Rainy days will result in a lower visibility. Table 25 gives a summary of the dynamic impacts. This is similar for both route Alternatives

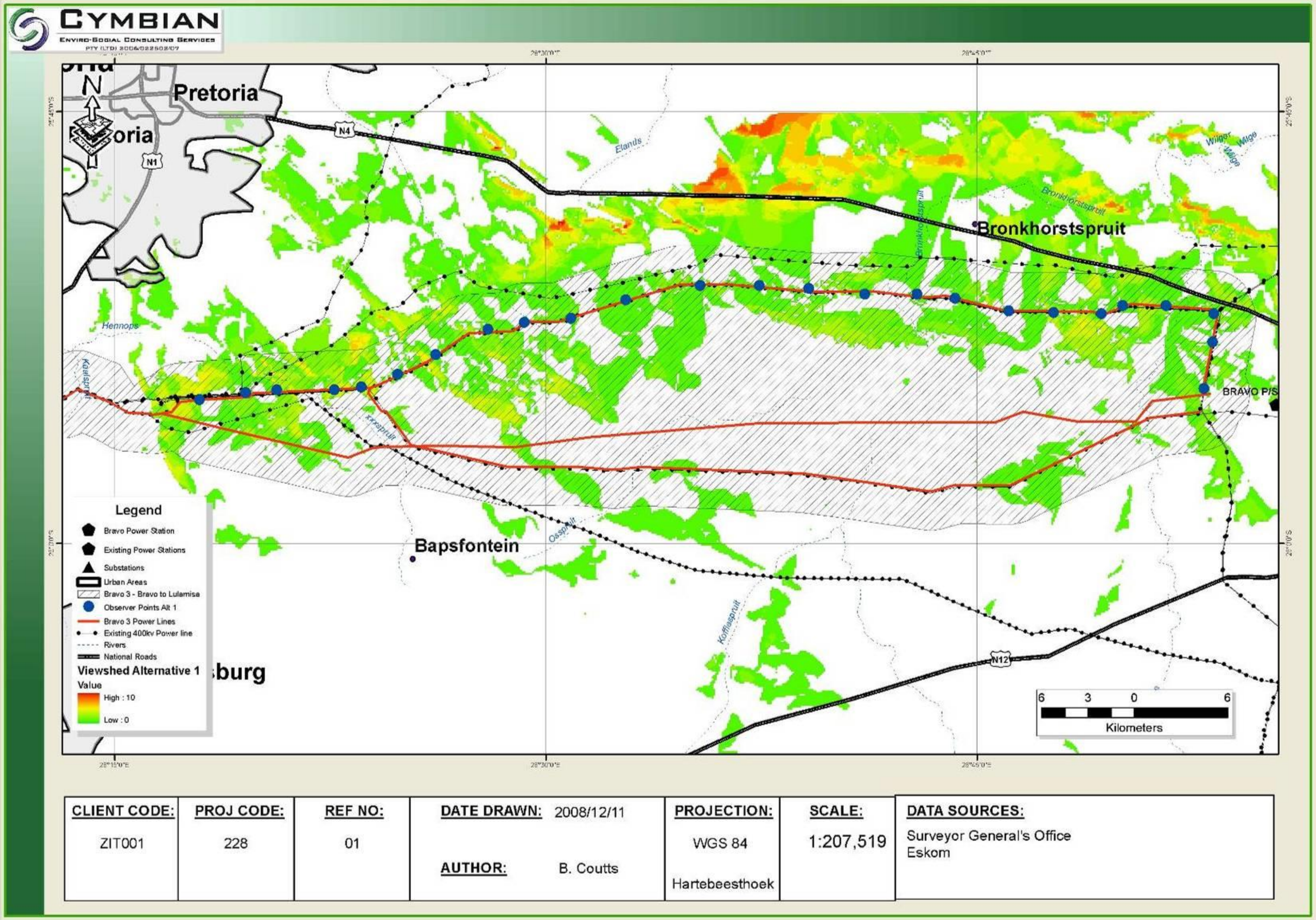


FIGURE 58: VIEWSHED FROM THE ALTERNATIVE 1 ALIGNMENT.

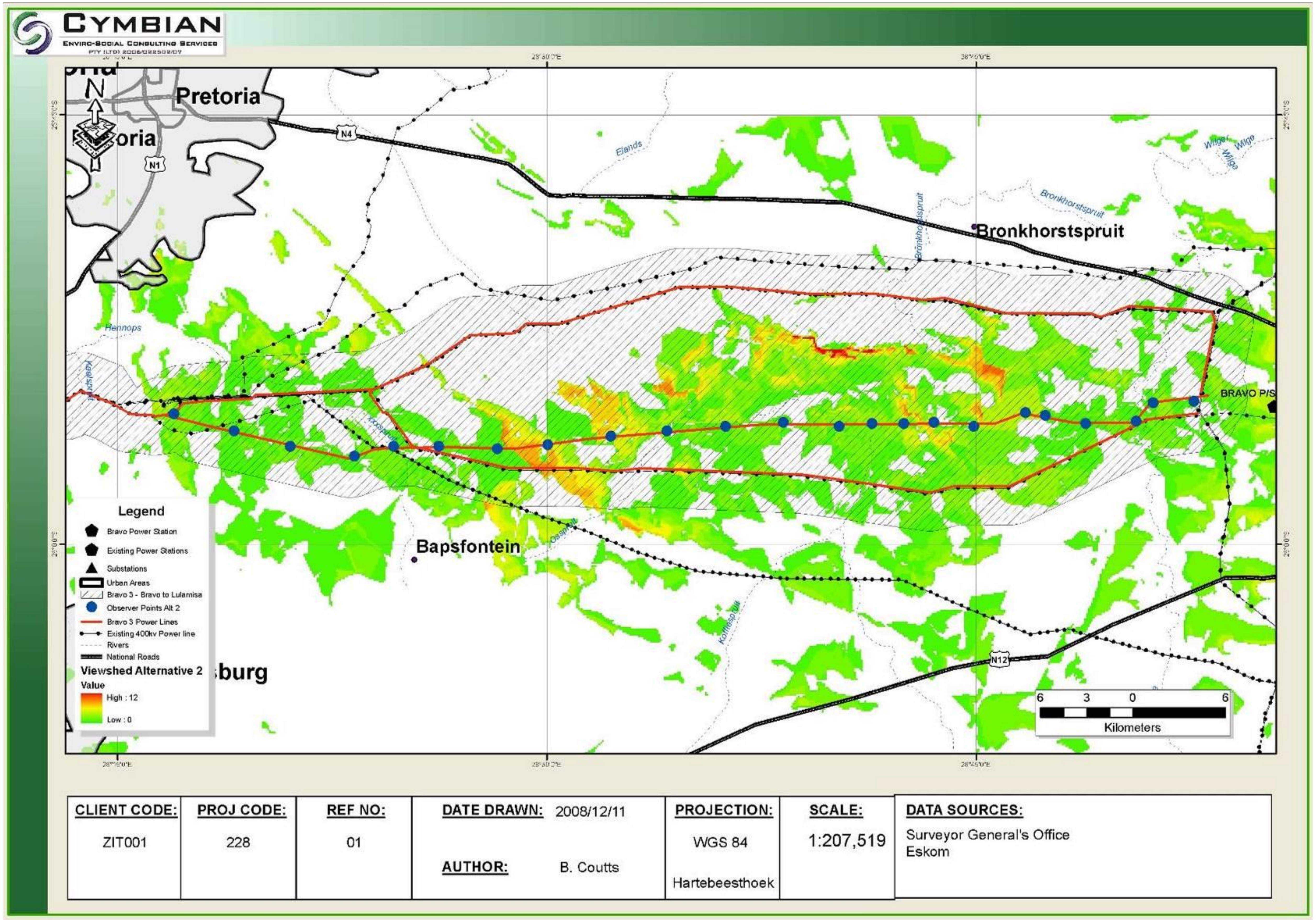


FIGURE 59: VIEWSHED FROM THE ALTERNATIVE 2 ALIGNMENT

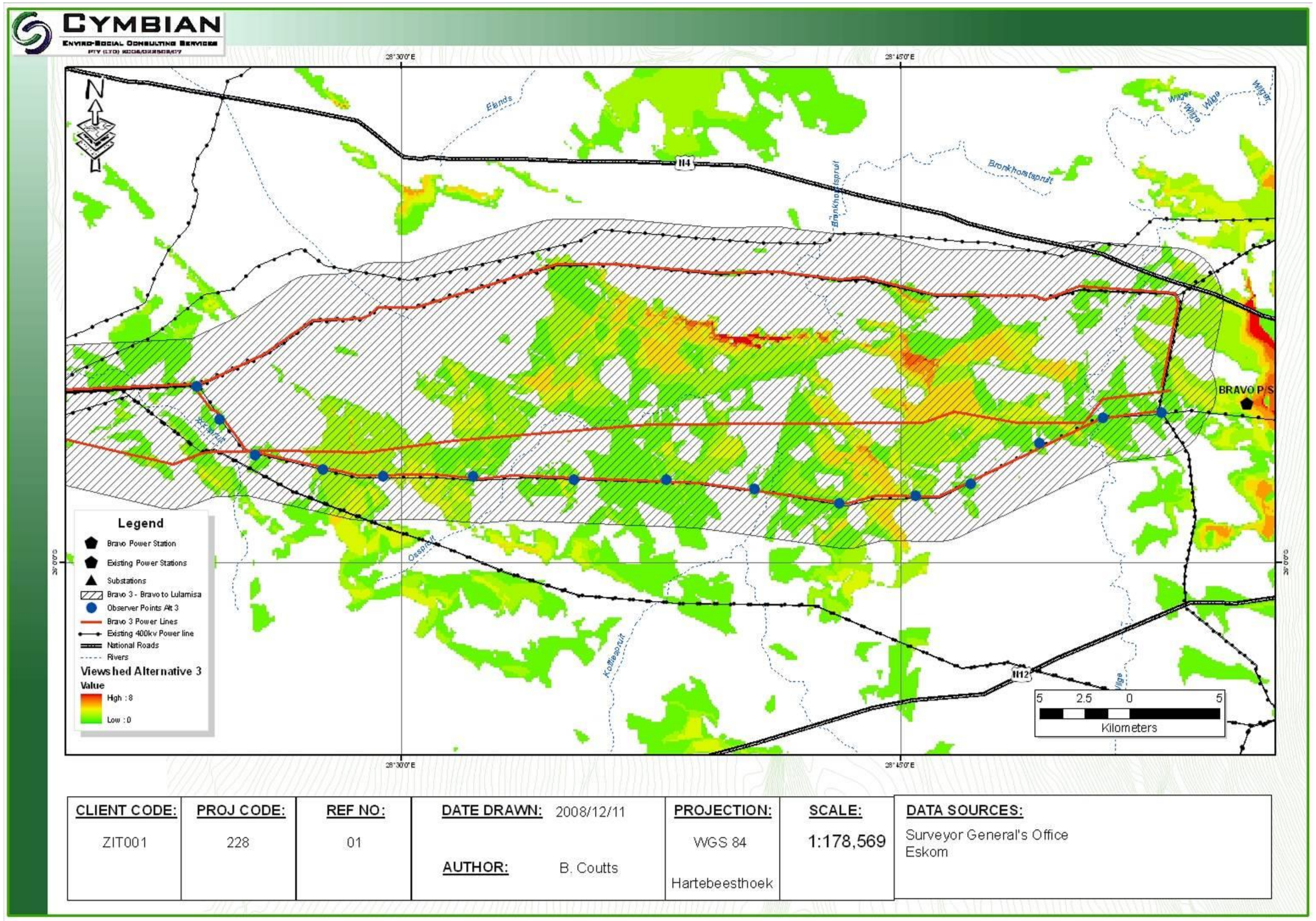


FIGURE 60: VIEWSHED FROM THE ALTERNATIVE 3 ALIGNMENT

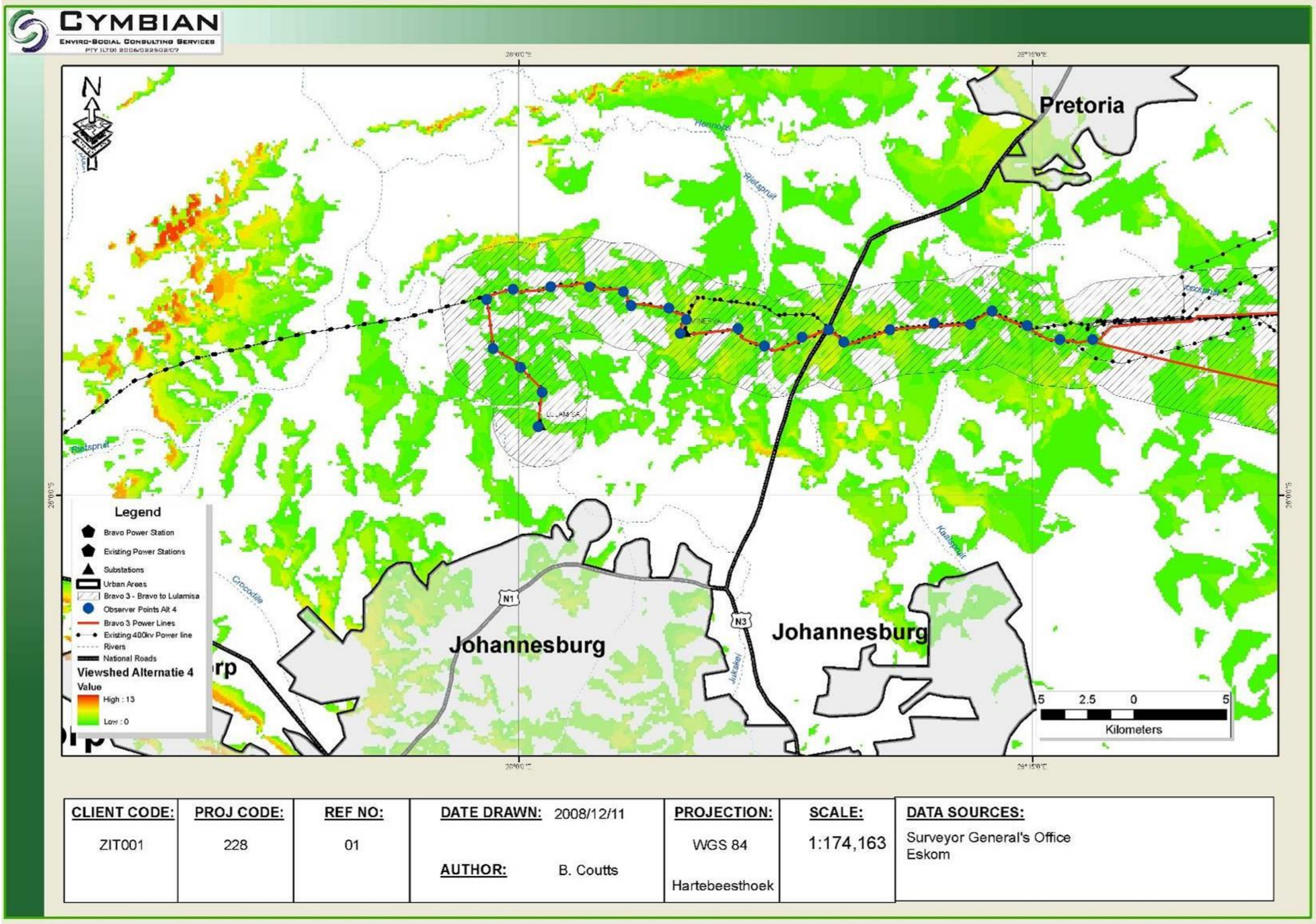


FIGURE 61: VIEWSHED FROM THE ALTERNATIVE 4 ALIGNMENT

TABLE 25: DYNAMIC IMPACT TABLE

Road Name	*Speed limit (km/h)*	*Length of Road (km)*	*Approximate Period of View (sec)*	*View Distance*
Alternative 1 N4	*120*	*33.7*	*1011*	*3-6 km*
Alternative 2 N4	*120*	*8.1*	*243*	*10-14 km*
Alternative 3 N4	*120*	*5.5*	*165*	*15-16 km*
Alternative 1 N12	*120*	*4.4*	*132*	*19-27 km*
Alternative 2 N12	*120*	*26.6*	*798*	*11-18 km*
Alternative 3 N12	*120*	*24.4*	*732*	*10-13 km*
Alternative 2 N3	*120*	*1.9*	*57*	*0.5-3 km*
Alternative 4 N3	*120*	*18.1*	*543*	*0-1 km*
Alternative 4 N1	*120*	*10.6*	*318*	*15-18 km*
Alternative 2 N17	*120*	*2*	*60*	*50-52 km*
Alternative 3 N17	*120*	*3.9*	*117*	*40-50 km*

Conclusion

Table 26 lists the observation points together with the category of viewer, context of view, relative numbers of viewers and approximate distance of observation point to the proposed site. The location of these observation points are shown in Figure 58, Figure 59, Figure 60 and Figure 61

TABLE 26: VISUAL IMPACT MATRIX

Potential Observation Point	*Category of Potential Receptor*	*Context of View*	*Approximate View Distance*	*Period of View*	*Visibility Rating*
Surrounding Farmland	*Static*	*Level*	*0 – 11 km*	*Long Term*	*Medium*
Johannesburg/Pretoria	*Static*	*Level Above*	*> 10 km*	*Long Term*	*Medium*
Gravel Roads	*Dynamic*	*Above & below*	*1 – 11 km*	*Medium*	*Low*
Tar Roads	*Dynamic*	*Level - Above*	*5 – 11 km*	*Short*	*Low*

It should however be noted that there are a number of existing power lines in the study area as shown in the Figures above. Viewers in the viewshed have become accustomed to these power lines in the landscape and an additional 100 km of power line will not increase the impact significantly, however if Alternative 2 is selected the visual impact will be greater because there is no existing power line located on this route.

7.2 Cultural Environment

7.2.1 Archaeological and Cultural Historical Features

Focused archaeological research has been conducted in the Gauteng and Mpumalanga Provinces of South Africa for more than four decades. This research consists of surveys and of excavations of Stone Age and Iron Age sites as well as the recording of rock art and historical sites. The Gauteng and Mpumalanga Provinces have a rich heritage comprised of remains dating from the pre-historical and from the historical (or colonial) periods of South Africa. Pre-historical and historical remains in the Gauteng and Mpumalanga Provinces therefore form a record of the heritage of most groups living in South Africa today.

Various types and ranges of heritage resources that qualify as part of South Africa's 'national estate' as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999) occur in the Gauteng and Mpumalanga Provinces.

Within a cultural landscape

The project area is located in the midst of a cultural landscape that is marked by heritage remains dating from the pre-historical into the historical (colonial) period. Stone Age sites, Iron Age sites and colonial remains therefore do occur in the project area. However, the historical character of the project area is gradually been erased by various kinds of development.

The archaeological and historical significance of the project area must be described and explained in more detail before the results of the Phase I HIA study are discussed.

FIGURE 62:- THE PROJECT AREA NEAR BRONKHORSTSPRUIT IN THE EAST IS CHARACTERISED BY OUTSTRETCHED GRASS VELDT, AGRICULTURAL FIELDS AND QUARTZITE RIDGES. NOTE EXISTING NORTHERN CORRIDOR RUNNING ACROSS CREST OF RIDGE.

FIGURE 63:- THE CENTRAL OPTION FOR THE PROPOSED NEW 400 KV BRAVO/LULAMISA POWER LINE RUNS ACROSS THE BRONKHORSTSPRUIT DAM NEAR BRONKHORSTSPRUIT.

Contextualising the project area

The following brief overview of pre-historical, historical, cultural and economic evidence will help to contextualise the project area.

Stone Age sites

Stone Age sites are marked by stone artefacts that are found scattered on the surface of the earth or as parts of deposits in caves and rock shelters. The Stone Age is divided into the Early Stone Age (covers the period from 2.5 million years ago to 250 000 years ago), the Middle Stone Age (refers to the period from 250 000 years ago to 22 000 years ago) and the Late Stone Age (the period from 22 000 years ago to 200 years ago).

The Later Stone Age is also associated with rock paintings and engravings which were done by the San, Khoi Khoi and in more recent times by Iron Age farmers.

The Mooiplaas rock engraving site is located on the farm Mooiplaas 367 JR to the north of the project area. This engraving site comprises nearly sixty footprints, 15 to 35 cm long and up to 5cm deep engraved on the surface of four rock plates. The engravings also include more than 15 cupules.

Iron Age remains

The Iron Age is associated with the first agro-pastoralists who lived in semi-permanent villages and who practised metal working during the last two millennia. The Iron Age is usually divided into the Early Iron Age (covers the 1st millennium AD) and the Later Iron Age (covers the first 880 years of the 2nd millennium AD).

Early Iron Age farming communities practised a mixed economy consisting of plant cultivation and stock herding in the interior of South Africa during the first half of the first millennium A. D. These Bantu-Negroid people, who probably interbred with the local San and Khoi-Khoi, were ironworkers of some repute and established the first permanent villages south of the Limpopo River. Some of their settlements occur to the north of the Magaliesberg and project area.

During the Late Iron Age farming was practised in the northern, central and eastern parts of the country. Stone walled settlements built from the 17th century onwards are particularly numerous to the west of the study area, where they are associated with the Tswana. Several of these stone walled sites also occur between the Bronberge and the Magaliesberg where they reveal Ndebele spheres of influence. This group originated from KwaZulu-Natal during the 17th century. The group initially settled at Elangeni, somewhere near Randburg. The Manala section of the Ndebele subsequently occupied a wide area to the east of Pretoria between the Bronberge in the south and the Magaliesberg to the north. This sphere of influence stretched from Wapadrand in the west to Tierpoort and Bapsfontein in the east and from Mamelodi in the west to Pienaarspoort in the east. This sphere of influence was known as KwaQobongo and can be divided into three areas which were consecutively occupied by the group, namely namely Ezotshaneni (ca. 1677 to 1717), Embilaneni (c. 1717 to 1747) and KoNonduna (c.1747 to 1825).

Concentrations of stone walled sites probably associated with the Ndebele were recorded on Tweefontein 372 JR (Wapadrand), Klipkop 396 JR, Hatherly 331 JR, Zwartkopjes 364 JR, Tierpoort 371 JR, Zwavelpoort 373 JR and Rietfontein 395 JR.

The historical period

The first colonists settled in places in the Magaliesberg such as Tierpoort, Garsfontein and Swawelpoort near the Bronberge. In the second half of the 19th century, Pretoria was established, on 16 November 1855, to meet the need for a central meeting place for the disunited Voortrekker republics. At first Pretoria developed slowly, and for many years maintained a rural atmosphere. The first mail coach service was established in 1864, telegraph communications followed in 1877 and on New Year's day 1893, the railway line from Elandsfontein (Germiston) reached Pretoria. The Delagoa Bay railway line was opened on 1 January 1895 and the railway line to Pietersburg on 1 May 1899.

Other towns close to the project area include Bronkhorstspruit, Centurion and Randburg.

Bronkhorstspruit which was laid out by Cornelius Erasmus on a part of his farm Hondsrivier in 1904. The town was named Erasmus for a number of years. From July 1935, the town's name, which is derived from a water-cress called 'bronkhors' by early settlers, was changed to Bronkhorstspruit. The 20th century saw the introduction of large-scale irrigation and dry land farming in the eastern parts of the study area. Today, milling is Bronkhorstspruit's main industry.

Bronkhorstspruit is rich in heritage resources. The town and its outskirts were occupied from the earliest times by Stone Age peoples while Iron Age farmers, who preferred the rocky ridges and outcrops exposed in the rolling landscape, occupied the area from the 17th century onwards. The first Colonists who moved north of the Vaal River during the second half of the 20th century also established farm homesteads, outbuildings and infrastructure across the landscape. The first railroad line between Pretoria and Delagoa Bay passed through Donkerpoort, to the north of the project area.

The Anglo Transvaal Wars

The Transvaal Anglo Boer War followed in 1880 to 1881. The Second Anglo Boer War raged from 1899 to 1902. Battlefields, graveyards and fortifications from this time still exist from Irene (Centurion) through to Pretoria, Bronkhorstspruit, Cullinan and to Balmoral and Witbank in the east.

The annexation of the Transvaal Republic with the hoisting of the Union Jack on 12 April 1877 in Pretoria was confronted, four years later, by the re-proclamation of the independence of the South African Republic on 16 December 1880. War erupted. Two companies of the 94 Regiment of Foot was ordered from Lydenburg to Pretoria as reinforcements. A Boer commando under Commandant F. Joubert confronted the British column of Lieutenant-Colonel P.R. Anstruther at Bronkhorstspruit. The column, which was comprised of 250 men and 36 wagons, stretched for almost a kilometre. The British suffered heavy casualties (75 killed and 80 wounded) in a battle that lasted fifteen minutes.

The Battle of Bronkhorstspruit must have taken place on the farm Klipeiland 524 JR as is indicated on the 1:50 000 topographical map of Bronkhorstspruit 2528DC.

The graveyard in which the British soldiers were buried was subsequently moved to make way for a road. The site is situated outside Bronkhorstspruit, some 2.5 kilometres down the road to Delmas. A Garden of Remembrance is situated on one side of the road and a national monument sign on the other side of the road. Both are protected sites.

7.3 Socio-Economic Environment

In order to address the overall objective of this study, it was necessary to compile a detailed description of the study area. The first subsection below provides a profile of the social processes in terms of demographic, economic, institutional and empowerment, socio-cultural, geographical and biophysical baseline conditions in the study area. Each subsection concludes with a table summarising how the project is likely to change these baseline profiles, and the related impacts that could be expected as a result of the project.

A change process can be defined as change that takes place within the receiving environment as a result of a direct or indirect intervention. A potential impact follows as a result of the change process. However, a change process can only result in an impact once it is experienced as such by an individual/community on a physical and/or cognitive level.

7.3.1 Baseline Demographic Processes

Demographic processes relate to the number of people and composition of a community and include an overview of the population size and the educational profile of the affected communities.

Population

The Kungwini Local Municipality (KLM) covers an area of approximately 2 202 km^2 and in 2007 had a total population of 104 150 people. Compared to the population size of 2001, when the population stood at approximately 160 752 people, this means that the population size within the KLM decreased at an average rate of 9 434 people per annum or a total of 56 602 over the 6-year period between 2001 and 2007. This population decrease also brought about a change in the population density in the area from 73.0 persons per km^2 in 2001 to 47.3 persons per km^2 in 2007.

The City of Tshwane Metropolitan Municipality (CTMM) covers an area of 2 175 km^2, which is more or less the same size of the KLM. In 2001, the CTMM had a total population of 1 982 228 people (with a population density of approximately 911.8 people per km^2), which increased at an average rate of 60 612 persons per annum to a total population of 2 345 907 people in 2007. This increase in the population size also affected the population density in the area, which grew at an average of 27.9 persons per km^2 to a population density of approximately 1 079.1 persons per km^2 in 2007. As is the case with the KLM, the predominant population group is Black African (74.6%), followed by White (22.1%).

In 2007, the CJMM was home to close on 3.9 million people. When compared to 2001, this translates to an average population growth rate of approximately 20.5%. The city's population is therefore expanding at an average rate of 110 480 people per annum. The population density is high at approximately 2 363.6 persons per km2, which is more than double than that of the CTMM and approximately 50 times higher than the population density of the KLM. However, it should be noted that known high density areas such as Alexandra and Soweto might skew this data, whereas previously known 'white areas' are known to have lower population densities.

In 2001, the KLM had a total of 50 427 households which steadily decreased at a rate of 3 127 households per annum to a total of 31 666 households in 2007. In both the CTMM and the CJMM the number of households increased between the years 2001 and 2007, by approximately 26 379 additional households per annum in the CTMM, and 14 854 households per annum in the CJMM. The total number of households in the CTMM therefore stood at 686 641 in 2007, whereas in the CJMM it stood at 1 116 014 households.

It seems that in both areas (the CTMM and the CJMM) the number of households developed more ore less on par with the population growth rate so that there has been an average increase of 0.1 persons per household over the 6-year period between 2001.

The predominant population groups in the whole of the study area remained the same between 2001 and 2007 and are therefore still Black African (84.0% for the KLM, 74.6% for the CTMM and 74.8% for the CJMM), followed by White (14.1% for the KLM, 22.1% for the CTMM and 15.0% for the CJMM). In all the areas, the female population group was slightly bigger than that of their male counterparts at 51.2% for the KLM, 50.1% for the CTMM and 50.4% for the CJMM.

More than two thirds (ranging between 66% and 70%) of the total population of the study fall within the working age category, which is defined by Statistics South Africa as the ages between 15 and 64.

Table 27 below provides an overview of the population demographics of the study area in relation to South Africa as a whole, the province and the district. From this table it is evident that there are more females than males in the study area, which, might be ascribed to the migrant labour patterns in South Africa where the male moves to a different area in search of work. If this is the case, it can very well be assumed that these males are employed elsewhere and would therefore not be seeking work at the proposed project. It is therefore necessary to take cognisance of the fact that a large segment of work seekers might be female.

TABLE 27: SUMMARY OF POPULATION CHARACTERISTICS

	South Africa	GP	CJMM		CTMM		MDM		KLM	
	2007		2001	2007	2001	2007	2001	2007	2001	2007
Area size (km^2)	1 219 912	16 927	1 645		2 175		4 063		2 202	
Total population	48 502 063	10 451 713	3 225 301	3 888 180	1 982 233	2 345 907	160 752	153 539	160 752	104 150
			Average increase of 110 480 persons per annum		Average increase of 60 612 persons per annum		Average decrease of 1 202 persons per annum		Average decrease of 9 434 persons per annum	
Population density (people per km^2)	39.8	617.5	1 960.7	2 363.6	911.8	1 079.1	39.6	37.8	73.0	47.3
			Average increase of xxx persons per km^2 per annum		Average increase of 27.9 persons per km^2 per annum		Average decrease of 0.3 persons per km^2 per annum		Average decrease of 4.3 persons per km^2 per annum	
Total households	12 500 610	3 175 579	1 006 742	1 165 014	597 515	686 641	50 427	46 503	50 427	31 666
			Average increase of 26 379 households per annum		Average increase of 14 854 households per annum		Average decrease of 654 households per annum		Average decrease of 3 127 households per annum	
Avg. persons per household	3.9	3.3	3.2	3.3	3.3	3.4	3.2	3.3	3.2	3.3
Predominant Population Groups	Black African (79.5%)[5]	Black African (75.2%) White (18.4%)	Black African (73.5%) White (16.0%)	Black African (74.8%) White (15.0%)	Black African (72.6%) Whites (23.9%)	Black African (74.6%) Whites (22.1%)	Black African (78.0%) Whites (20.0%)	Black African (77.9%) Whites (19.9%)	Black African (78.0%) Whites (20.0%)	Black African (84.0%) Whites (14.1%)
			Black African population increased by approximately 1.3%, whereas White population decreased by approximately 1.0%.		Black African population increased by approximately 2.0%, whereas White population decreased by approximately 1.8%.		Both the Black African and White population decreased by approximately 0.1%, respectively.		Black African population increased by approximately 6.0%, whereas White population decreased by approximately 5.9%.	
Predominant Gender	Female (50.8%)[9]	Male (50.3%)	Male (50.0%) Female (50.0%)	Female (50.4%)	Female (50.7%)	Female (50.1%)	Male (52.3%)	Male (51.3%)	Male (52.3%)	Female (51.2%)
Predominant Age Group	Working age (% unknown)	Working age (70.0%)	Working age (73.2%)	Working age (70.4%)	Working age (71.0%)	Working age (70.6%)	Working age (70.0%)	Working age (67.9%)	Working age (70.0%)	Working age (66.2%)

5

Education

An overview of the educational profile for the study area on local municipal level is provided in Figure 64. Overall it would appear as if the area is characterised by a semi-skilled to skilled population, which is reflected in the fact that, in 2007, only a small minority of the population has had no form of formal education.

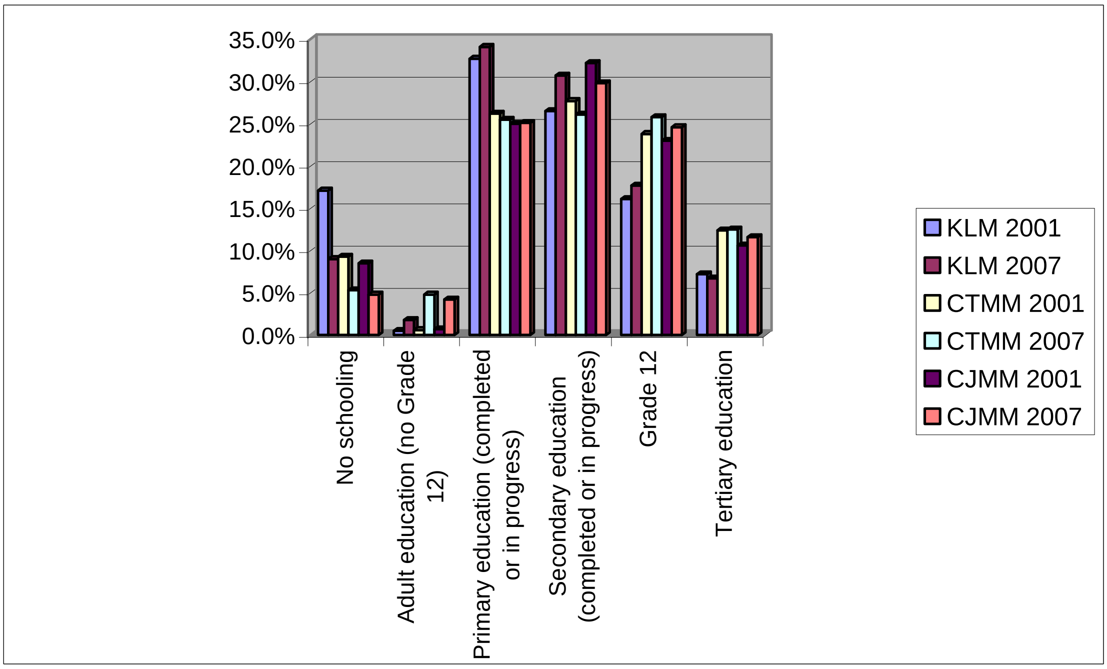


FIGURE 64: COMPARATIVE EDUCATIONAL PROFILE (GROUPED) FOR THE STUDY AREA

When considering the educational levels reported for the total population of the study area between 2001 and 2007, the number of people who attended and/or completed a primary level education, decreased as reflected in Figure 64 above. On the upside, the number of people who have had no schooling also decreased, while at the same time the number of people who completed some form of secondary education increased.

The number of people who obtained a higher (post-Grade 12) qualification also increased. The increase in the secondary and tertiary educational levels could be as a result of people's need to get out of the poverty cycle, thereby realising that some form of education might be beneficial.

One of the driving forces behind social change is educational attainment, which in turn is linked to poverty levels as there appears to be a correlation between the level of educational attainment and income levels. People with higher educational levels tend to be economically better off, and therefore contribute more to the reduction of the unemployment rate. Educational attainment is also linked to poverty in the sense that funds are required to further studies, therefore people living in less favourable economic conditions tend to be unable to further their education, which in turn holds them in a downward poverty spiral.

7.3.2 Baseline Geographical Processes

Geographical processes relate to land use patterns and infrastructure in the area. This section therefore describes the land use in the study area from a social perspective, specifically in terms of settlement patterns and land use developments.

Land use is defined as “the way land is developed and used in terms of the types of activities allowed (agriculture, residences, industries, etc.) and the size of buildings and structures permitted. Certain types of pollution problems are often associated with particular land uses, such as sedimentation from construction activities”.[6]

Another definition of land use is as follows: “Patterns of land use arise naturally in a culture through customs and practices, but land use may also be formally regulated by zoning, other laws or private agreements such as restrictive covenants”.[7]

A general assessment of the land uses in the study area indicated the following trends:

- Residential;
- Commercial cattle and crop farming;
- Mining; and
- Industries.

The following subsections briefly describe the land use trends in the municipal areas that formed part of the study area, namely the KLM, the CTMM and the CJMM.

Kungwini Local Municipality

According to the KLM IDP, agriculture is the most dominant land use in the total district area of Metsweding. Even though agriculture accounts for approximately 80% of the land use in the district, it only contributed approximately 3.7% to the local economy[8]. The bulk of production within the agriculture sector takes place on privately owned commercial farms, notably farms around Bronkhorstspruit. The most significant farming commodities are cattle and crop farming. In terms of crop farming, commodities include maize, ground-nuts, sunflowers, cotton and sorghum. Vegetables

[6] www.soil.ncsu.edu/publications/BMPs/glossary.html

[7] www.wikipedia.org/wiki/Land_use.html

[8] Kungwini Local Municipality Integrated Development Plan 2008/09

are mostly produced on subsistence farms, which are cultivated for private use or sometimes sold on the informal market.

The tourism industry in the KLM is regarded as small, but developing. The best known tourist attractions in the area include the following:

- Bronkhorstspruit Dam;
- Various nature reserves;
- Conference and accommodation facilities;
- Nan Hua Buddhist temple; and
- Sizanani Cultural village.

Mining is another important land use within the KLM, and includes the extracting and beneficiating of minerals including solids, liquids and crude petroleum and gas. These minerals are extracted through underground and surface mining operations, as well as quarries. The majority of mines within the KLM extract silica.

According to the KLM IDP, there is a total of 23 informal settlements within the KLM, ranging in size from as small as 9 shacks to as large as 4 000 shacks per settlement.

Figure 65 to Figure 67 below provides an overview of the land use surrounding the proposed transmission power line corridor sections within the KLM's area of jurisdiction.

FIGURE 65: LAND USE SURROUNDING THE NORTHERN ALTERNATIVE WITHIN THE KLM

FIGURE 66: LAND USE SURROUNDING THE CENTRAL ALTERNATIVE WITHIN THE KLM

FIGURE 67: LAND USE SURROUNDING THE SOUTHERN CORRIDOR WITHIN THE KLM (NEW CORRIDOR PARALLEL TO EXISTING TRANSMISSION POWER LINE IN DISTANCE)

City of Tshwane Metropolitan Municipality

The City of Tshwane Metropolitan Municipality (CTMM) has developed a spatial development strategy to guide its Spatial Development Framework (SDF). It is believed that the CTMM should not be viewed as a single city, but rather as a polycentric (multi-nodal) metropolitan region. Currently the CTMM experiences development pressure in the central, eastern and southern parts of the city. Furthermore, the continued outward urban sprawl hampers the delivery of effective municipal services to these areas, even in cases where such developments are located within existing urban areas. The main aim of the Tshwane Spatial Development Strategy (TSDS) is therefore to integrate the municipal areas to enable an efficient, equitable, liveable and sustainable urban environment. In support of this aim, the following objectives have been identified:

- Residential areas should be integrated with areas of economic and social opportunity;
- Those segments of the population who are living in poverty should be integrated in to the mainstream functioning of the city;
- Increase the density in strategic areas within the CTMM;
- Areas that are suitable to economic development should be identified;
- Movement networks within the CTMM should be identified;
- Direct infrastructure investment should take place within strategic focus areas;
- Human settlements should be sustainable and foster healthy communities;
- The CTMM should play a unique roll within the GP; and
- A sustainable metropolitan area should be created in terms of environmental, social and economic aspects.

Furthermore, the CTMM has identified the metropolitan open space network as an important structuring element and therefore the presence of such open spaces has a decisive influence on where development would be allowed. Open spaces include rivers, mountains, protected areas, dams, nature reserves, wetlands, etc. These areas are excluded from any future developments to ensure that the ecological integrity of the city is protected.

The CTMM have also identified potential movement corridors and encourages development in relation to these movement corridors. Currently four existing and/or potential corridors have been identified:

- The N1/Ben Schoeman Highway link between Johannesburg/Midrand and Tshwane;
- The R21 link between Tshwane and O.R. Tambo International Airport;
- The Bakwena-Platinum Highway Corridor (Zone of Choice); and
- The Mabopane-Centurion Corridor around the proposed western bypass.

Apart from the protection of open spaces and the enhancement of developments along movement corridors, certain specialised activity areas have also been identified. A specialised activity area is an area that makes provision for specialised development such as industrial areas, educational areas, high-tech areas, etc. These specialised activity areas are mostly closely interlinked with the development corridors described above. The majority of these specialised activity areas are located within the quadrant between the PWV9, the N1 and the PWV2.

Figure 68 below provides an overview of the land use surrounding the proposed transmission power line corridor section within the CTMM's area of jurisdiction.

FIGURE 68: LAND USE SURROUNDING THE PROPOSED ROUTE CORRIDOR SECTION THROUGH THE CTMM

City of Johannesburg Metropolitan Municipality

In keeping with the CJMM's 2030 vision for the City of Johannesburg, economic growth and improved levels of production and consumption should be socially, economically and environmentally sustainable. This in turn will require integrated management of the natural environment, the built environment and the human environment. In terms of these three environments the preferred state is as follows[9]:

- *Natural environment*: the remaining biodiversity, ecosystems and natural open spaces should be conserved and scarce natural resources should be used efficiently.
- *Built environment*: the cultural and historical heritage of the area should be conserved, and buildings and open spaces should be aesthetically pleasing and designed in such a way that it supports ecological principles.
- *Human environment*: the environment in which people work, relax and interact should be safe and healthy, the air and water should be clean and noise should not be invasive. The environment

[9] COJ State of the Environment, 2003.

should also provide sufficient opportunities for leisure and should promote individual and community well-being.

The CJMM has a nodal hierarchy that distinguishes between mixed use nodes and specialist nodes. Every node has a distinct character with its own development rationale. The growth of these nodal points is regulated by the City to prevent situations where, for example, non-residential uses creep into residential nodes. Nodes are mostly characterised by:

- Activity clusters based on convenience and accessibility;
- Highly accessible by both public as well as private transport and transport routes;
- Mixed activities and diverse public facilities;
- Density of development; and
- A definite nodal core that supports mostly pedestrian traffic, but which does not exclude vehicular traffic completely.

In addition to these development nodes, there are also two major corridors in the city, namely the East-West Corridor and the North-South Corridor. Applicable to this study is the North-South Corridor which runs north of the municipal boundary along the alignment of the N1/M1 highways. The corridor is characterised by high-tech industries and offices.

Figure 69 to Figure 71 below provides an overview of the land use surrounding the proposed transmission power line corridor sections within the CJMM's area of jurisdiction.

FIGURE 69: LAND USE SURROUNDING THE LULUMISA SUBSTATION IN THE DIEPSLOOT AREA

FIGURE 70: LAND USE SURROUNDING PROPOSED ROUTE CORRIDOR NORTH OF THE N14

FIGURE 71: OLIEVENHOUTBOSCH WITH CORRIDOR IN DISTANCE (PARALLEL TO EXISTING TRANSMISSION POWER LINES)

7.3.3 Baseline Economic Processes

Economic processes relate to the way in which people make a living and the economic activities within that society. The employment status within a community gives an indication of the economic stability of such a community and also serves as an indicator of such a community's general well-being.

Employment and Economic Sectors

Table 28 below provides an overview of the employment and economic sectors of the study area in relation to South Africa as a whole, the province and the district. From this table it is clear that the study area is not only characterised by a predominantly semi-skilled to skilled male population, but also a fairly high employment rate where, on average, close on three quarters of the working age population within the study area is formally employed.

Overall it would therefore appear as if the economy of the study area is growing at a steady pace. As economic industries are growing, more employment opportunities are created thereby further reducing the unemployment rate, creating sources of income which in turn leads to the creation of other opportunities such as further education, a need for housing (which in turn creates further employment opportunities, both directly and indirectly), etc.

TABLE 28: SUMMARY OF EMPLOYMENT AND ECONOMIC SECTORS

	South Africa	GP	CJMM		CTMM		MDM		KLM	
	2001	2007	2001	2007	2001	2007	2001	2007	2001	2007
Employed*	33.7%	52.2%	45.8%	53.7%	46.2%	52.0%	49.2%	52.6%	49.2%	55.7%
Unemployed*	24.0%	21.6%	27.3%	22.6%	21.5%	17.1%	19.4%	12.1%	19.4%	14.5%
Not economically active	42.3%	26.3%	27.0%	23.7%	32.3%	25.9%	31.4%	25.9%	31.4%	29.8%
Employment rate**	58.4%	70.7%	62.7%	70.4%	68.2%	75.3%	71.8%	81.3%	49.2%	79.4%
Predominant industry	Community services (29.1%)	Manu-facturing (16.7%)	Unspecified (68.4%)	Unspecified (17.4%)	Unspecified (68.8%)	Unspecified (19.1%)	Unspecified (68.5%)	Unspecified (26.7%)	Unspecified (68.5%)	Unspecified (26.1%)

Household and Personal Income

In 2001, one in every 5-6 households in the study area had no annual household income. In addition, approximately a third of the households within the metropolitan areas (Tshwane and Johannesburg) lived below the acceptable minimum standard, with approximately a half (48.9%) of households in Kungwini who lived below the minimum standard. The minimum acceptable standard is nationally defined as an annual household income of at least R20 000 per annum.

Unfortunately Community Survey 2007 did not include data on household incomes and therefore this report also includes an overview of personal income (which was covered in CS 2007) in an attempt to provide an overview of the baseline economic conditions of individuals in the area.

The graph below (Figure 72) provides a comparative overview of the personal income levels of individuals in the study area between 2001 and 2007. However, it should be noted that the 'no income' category also includes persons under the age of 14 (who is not regarded as people within a working age category and therefore would earn no income) as well as persons from the 'not economically active' population, who are therefore not only unemployed, but who are also not actively seeking employment and therefore also do not earn an income.

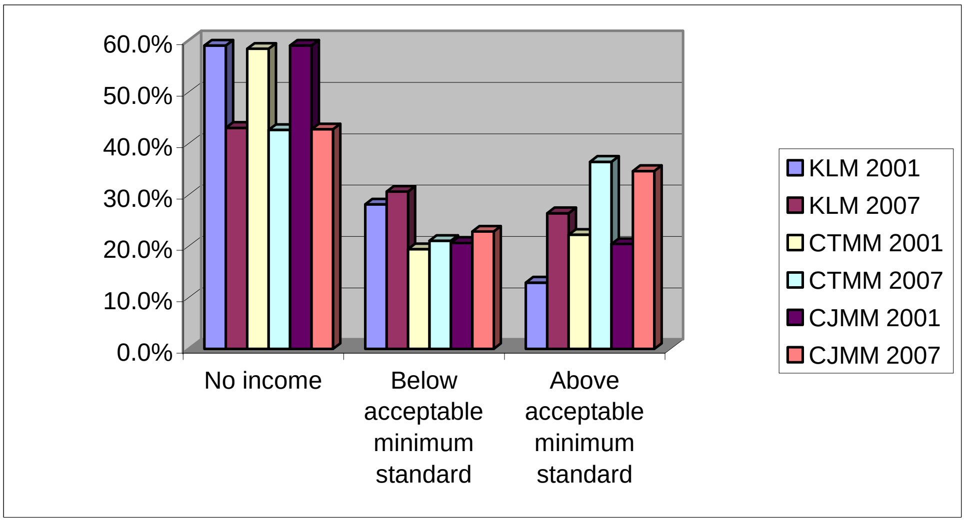


FIGURE 72: OVERVIEW OF MONTHLY PERSONAL INCOME (2001 AND 2007 COMPARED)

The number of individuals with no personal income decreased by between approximately 15% and 18% over the 6 year period between 2001 and 2007, bearing in mind that a large segment of those with no personal income are either under the age of 14 or not economically active. The number of individuals who earn a personal monthly income below the national accepted minimum standard (defined as earning at least R1 600 per month) has increased by an average of 2% across all the municipal areas between 2001 and 2007. The number of individuals who earn above the acceptable minimum standard increased on average by approximately 14% in the study area.

From this data, it would appear as if more people entered the economic market, which is linked to the increased employment rate and the broadening of the economic sectors within the study area.

7.3.4 Baseline Empowerment and Institutional Processes

Institutional and empowerment processes relate to the role, efficiency and operation of government sectors and other organisations within the area in terms of service delivery. It also investigates the ability of people to engage in decision-making processes to such an extent that they have an impact on the way in which decisions are made that would concern them.

Municipal Services

The years between 2001 and 2007 saw a steady increase in the delivery of municipal services to the households within the study area.

The municipal infrastructure is mostly located within the urban areas of the municipal areas. Municipal infrastructure backlogs are mostly confined to the previously disadvantaged township areas, and, as could be expected, in informal settlement areas. The outlying rural areas rely almost exclusively on water and sanitation services that are below Reconstruction & Development Programme (RDP) standard. In terms of water services, RDP standard is defined as piped water either within a dwelling or within 200m of such a dwelling. Sanitation services on par or above RDP standard is defined as any waterborne sanitation services that are connected to a municipal sewerage system or a ventilated pit latrine (VIP) system.

Table 29 below provides an overview of the municipal services of the affected area in relation to the province and the district as a whole. No data could be obtained for the overall municipal service delivery in South Africa.

TABLE 29: OVERVIEW OF MUNICIPAL SERVICE DELIVERY TO THE AFFECTED AREAS

	South Africa	GP	CJMM		CTMM		MDM		KLM	
	2001	2007	2001	2007	2001	2007	2001	2007	2001	2007
Energy Cooking	Not available	Electricity (81.3%)	Electricity (78.5%)	Electricity (88.2%)	Electricity (71.3%)	Electricity (74.1%)	Electricity (56.3%)	Electricity (70.1%)	Electricity (56.3%)	Electricity (71.3%)
Energy Heating	Not available	Electricity (76.7%)	Electricity (77.2%)	Electricity (84.7%)	Electricity (70.2%)	Electricity (70.2%)	Electricity (53.8%)	Electricity (60.3%)	Electricity (53.8%)	Electricity (59.4%)
Energy Lighting	Not available	Electricity (83.3%)	Electricity (85.1%)	Electricity (89.4%)	Electricity (79.9%)	Electricity (77.4%)	Electricity (70.3%)	Electricity (79.2%)	Electricity (70.3%)	Electricity (82.8%)
Refuse	Not available	Removed once a week (84.8%)	Removed once a week (90.9%)	Removed once a week (90.2%)	Removed once a week (77.6%)	Removed once a week (75.5%)	Removed once a week (46.7%)	Removed once a week (50.0%)	Removed once a week (46.7%)	Removed once a week (45.4%)
Sanitation	Not available	RDP standard or above (86.1%)	RDP standard or above (88.2%)	RDP standard or above (92.4%)	RDP standard or above (74.9%)	RDP standard or above (76.3%)	RDP standard or above (68.7%)	RDP standard or above (68.8%)	RDP standard or above (68.0%)	RDP standard or above (67.4%)
Water	Not available	RDP standard or above (97.9%)	RDP standard or above (93.4%)	RDP standard or above (98.3%)	RDP standard or above (94.0%)	RDP standard or above (97.3%)	RDP standard or above (77.7%)	RDP standard or above (86.5%)	RDP standard or above (77.7%)	RDP standard or above (86.2%)

Empowerment and Participation

In terms of baseline empowerment processes, the hierarchy of needs as set out by Maslow, offers an insightful backdrop in terms of people's potential level of involvement in the EIA process and the issues that might be pertinent to them in a development of this nature. Maslow argued that the type of need that a person experiences is dependent on the fulfilment of other needs. The various categories of needs are organised in a hierarchy, which indicates which level of need has to be fulfilled before the next level of need would be experienced (refer to Figure 73).

Therefore, in order to expect people to fully participate in a process that might affect their future, people would have to function on a higher level within the hierarchy of needs (the need for self esteem, characterised by knowledge and understanding needs as well as the need for an environment that is aesthetically appealing, as indicated by the dashed red arrow). This means that their basic needs had to be met first (as indicated by the solid red arrow). The flipside is that people, who live in poverty as a result of high unemployment rates, low income levels and a poor education, struggle to survive on a daily basis and are therefore more focused on their more basic needs.

FIGURE 73: MASLOW'S HIERARCHY OF NEEDS

Source: www.arrod.co.uk

People who are more focused on their basic needs are therefore in a sense disempowered to fully participate in the process. The issue here is not that these communities are misinformed or lack information as such, but rather that these communities are ignorant about their rights and responsibilities as participants in the process. In such an instance it can very well be expected that such community members' expectation of the project mostly relates to employment opportunities. However, due to the fact such residents mostly function on a very basic needs level, they might fail to comprehend the "bigger picture" or in other words, the associated impacts (both negative and positive) that the proposed project would bring to their area. Their lack of understanding has bearing on future generations that will inhabit the area.

7.3.5 Baseline Socio-Cultural Processes

Socio-cultural processes relate to the way in which humans behave, interact and relate to each other and their environment, as well as the belief and value systems which guide these interactions. The expected impacts on the socio-cultural process will be explained in the impact assessment section below.

8 IMPACT ASSESSMENT METHODOLOGY

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in Table 30.

TABLE 30: QUANTITATIVE RATING AND EQUIVALENT DESCRIPTORS FOR THE IMPACT ASSESSMENT CRITERIA.

RATING	SIGNIFICANCE	EXTENT SCALE	TEMPORAL SCALE
1	VERY LOW	*Isolated route / proposed route*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

8.1 Significance Assessment

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in Table 31 below.

TABLE 31: DESCRIPTION OF THE SIGNIFICANCE RATING SCALE.

RATING		DESCRIPTION
5	VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	HIGH	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	MODERATE	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	LOW	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	VERY LOW	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

8.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in Table 32.

TABLE 32: DESCRIPTION OF THE SIGNIFICANCE RATING SCALE.

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a regional scale (District Municipality to Provincial Level).
3	Local	The impact will affect an area up to 5 km from the proposed route corridor.

RATING		DESCRIPTION
2	Study Area	The impact will affect a route corridor not exceeding the Boundary of the corridor.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the route site.

8.3 Duration Scale

In order to accurately describe the impact it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in Table 33.

TABLE 33: DESCRIPTION OF THE TEMPORAL RATING SCALE.

RATING		DESCRIPTION
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium term	The environmental impact identified will operate for the duration of life of the line.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

8.4 Degree of Probability

Probability or likelihood of an impact occurring will be described as shown in Table 34 below.

TABLE 34: DESCRIPTION OF THE DEGREE OF PROBABILITY OF AN IMPACT ACCRUING.

RATING	DESCRIPTION
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	It’s going to happen / has occurred

8.5 Degree of Certainty

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used as discussed in Table 35. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

TABLE 35: DESCRIPTION OF THE DEGREE OF CERTAINTY RATING SCALE.

RATING	DESCRIPTION
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.

8.6 Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale as described below:

$$\textit{\textbf{Impact Risk}} = \frac{\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal}}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown below:

TABLE 36: EXAMPLE OF RATING SCALE.

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	LOW	*Local*	Medium Term	*Could Happen*	
Impact to air	**2**	***3***	**3**	**3**	**1.6**

Note: The significance, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a criteria rating of 2,67. The probability (3) is divided by 5 to give a probability rating of 0,6. The criteria rating of 2,67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to 5 classes as described in the table below.

TABLE 37: IMPACT RISK CLASSES.

RATING	IMPACT CLASS	DESCRIPTION
0.1 – 1.0	**1**	**Very Low**
1.1 – 2.0	**2**	**Low**
2.1 – 3.0	**3**	**Moderate**
3.1 – 4.0	**4**	**High**
4.1 – 5.0	**5**	**Very High**

Therefore with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

8.7 Notation of Impacts

In order to make the report easier to read the following notation format is used to highlight the various components of the assessment:

Significance or magnitude- IN CAPITALS

Duration – <u>in underline</u>

Probability – <u>*in italics and underlined*</u>.

Degree of certainty - **in bold**

Spatial Scale – *in italics*

9 ALTERNATIVE SENSITIVITY ANALYSIS

This section provides a short sensitivity matrix, which compares the three different alternatives and their associated environmental sensitivities. The “Lulamisa to Minerva” alternative is included in the matrix below as this portion of the line is representative of the portion of the line where all three alternatives merge into one route.

TABLE 38: ALTERNATIVE SENSITIVITY MATRIX

Sensitivity	Alternative 1	Alternative 2	Alternative 3	Lulamisa to Minerva
Geology	None	None	None	None
Climate	None	None	None	None
Topography	None	None	None	None
Land Use	Traverses short section of ridges land farmland	Traverses Bronkhorstspruit Dam and farmland	Traverses agricultural land and short section of residential area	Traverses short section of farmland and urban areas
Surface Water	Traverses over several rivers and small un-named tributaries on site	Traverses a large section of the Bronkhorstspruit Dam	Traverses over several rivers, small un-named tributaries and wetland areas on site	Traverses over one main river and vlei
Soils & Land Capability	Mainly agricultural, rocky soils and sensitive clay soils	Along sensitive wetland and clay soils	Along sensitive wetland and clay soils	Along disturbed soils
Flora	Sensitive vegetation units and plants present	Sensitive vegetation units and plants present	Sensitive vegetation units and plants present	Sensitive vegetation units and plants present in undisturbed areas
Fauna	None	None	None	None
Wetlands	Few sensitive wetlands	Traverses wetland	Traverses wetland	Transverse wetlands
Visual	Moderate Visibility	Moderate visibility	Moderate visibility	High visibility
Heritage	Low, mainly stone walls and graves	None	Low, limited graves visible.	None
Social	Low - Moderate	Low - Moderate	Low	Moderate
Total Sensitivities	**3**	**4**	**4**	**5**

On the basis of the matrix presented above, it is suggested that the Bravo 3 Alternative 1 be utilised as the preferred alternative for the proposed project, as it has the least sensitive features associated with the alignment, but due to the locality of Alternative 1 located on the ridges and the space available limits the land use in the area an intern protects the indigenous fauna and flora

10 IMPACT ASSESSMENT

The Impact Assessment will highlight and describe the impact to the environment following the abovementioned methodology and will assess the following components:

- Geology;
- Climate;
- Surface Water;
- Topography;
- Soils;
- Land Capability
- Land Use;
- Flora;
- Fauna; and
- Visual Assessment.

The impact assessment was undertaken for the construction, operational and decommissioning phases of the project. The impact of each line/route alternative was also assessed separately, however, where the impact was not significantly different, only one impact assessment was undertaken. Also, at the time of writing this report, no technical data was available as to the type of tower to be used for the construction of the transmission lines. Therefore, it is assumed that the Self-supporting strain and suspension tower type would be used. Contained in this assumption is that the maximum distance between towers would be 300 m and that the tower would be erected on concrete footings with dimensions of 2 x 2 x 2 m (area = 4 m^2 and volume = 8 m^3).

10.1 Construction Phase

During the construction phase, the 400 kV power lines will be erected. A 400 kV Transmission line requires a servitude width of 55 m. Where there are physical constraints such as other power lines adjacent to the new servitude, a minimum of 35 m-separation distance from such lines is required. Without physical constraints, parallel lines will have at least 55 m-separation distance. The power line cables are strung between pylons / towers, which are steel structures erected on concrete footings fixed in the substrate (soil or rock) below the pylon.

The major impacts during construction are the construction activities associated with the erection of the power lines and include, amongst others, heavy vehicle movement, construction of an access road and any wastes generated.

10.1.1 Geology

Initial Impact

Impacts that could occur to geology are limited to the physical removal of geological strata, resulting in permanent damage to those strata. However when placing pylons on ridges damage may occur to the shallow strata. When placing pylons in valleys there no indication of damage due to the depth of the geological strata which lies well below the surface ground level. There are no present indications that any existing impacts to geology have ocurred and therefore there is no initial impact rating

Additional Impact

The additional impact resulting from the power line construction could occur because of power line construction on the rocky ridges (depending on which alternative is selected); the impact would be limited to the construction of the pylon footings. Impact to the geological strata may occur due to which alternative is selected. If Alternative 1 is selected, for example approximately 60 pylons could be placed on ridges, which would equate to 240 footings. This would result in a combined area 1 920 m^3 of geological strata would be disturbed. This Low impact could probably occur along other ridges as existing servitudes exist and these possible servitudes may provide alternative routes for the proposed constructed power lines. This results in a final impact class of **Low** as rated in the table below for a selected Alternative. If Alternative 1 is selected than the impacts would be much larger because of the greater distance covered.

TABLE 39: GEOLOGY ADDITIONAL IMPACT ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Geology	VERY LOW	*Isolated sites*	Long Term	*Probably*	Low
	1	**1**	**4**	**4**	**1.6**

Cumulative Impact

Since there is no initial impact, the cumulative impact is the same as rated for the additional impact above.

Mitigation Measures

The following mitigation measures are proposed:

- No blasting activities will be permitted;
- Topsoil and subsoil strata should be stripped separately;
- Disturbed areas are profiled and stabilised, and erosion control measures are installed in places identified as being at risk of erosion. Methods of stabilisation may include: brushcut packing,

mulch or chip cover, straw stabilising, sodding, hydroseeding, soil binders, gabions, reno mattresses, armourflex, retaining walls;

- Excavation of any material on site is done in accordance with the relevant SANS codes;
- All disturbed areas are profiled and stabilised, and erosion control measures are installed in places identified as being at risk of erosion. Methods of stabilisation may include: brushcut packing, mulch or chip cover, straw stabilising, sodding, hydroseeding, soil binders, gabions, reno mattresses, armourflex, retaining walls; and
- Clear demarcation of excavation areas, topsoil storage areas, subsoil storage areas, and construction hard parks should be undertaken with painted stakes and / or fences prior to commencement of construction activities.

Residual Impact

If so for any reason geology is encountered, it should not be removed and the pylon footings must be place directly on the geology. The impact is **Very Low** over a long period. The impact class is very low. The only concern is the amount of pylons placed on ridges, which may lead to a much larger impact over a greater distance

TABLE 40: GEOLOGY RESIDUAL IMPACT ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Geology	VERY LOW	*Isolated sites*	Long Term	*Unlikely*	Very Low
	1	***1***	**4**	**2**	**0.8**

10.1.2 Topography

Initial Impact

There are no initial impacts present on site except for existing infrastructure. These include existing roads fences and power lines. None of these has affected the topography as existing power lines follow the topography and no shaping of the landscape is need.

Additional Impact

As mentioned above the power lines follow the topography of the landscape and no landscaping is needed.

TABLE 41: TOPOGRAPHY ADDITIONAL ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Topography	VERY LOW	*Isolated sites / proposed*	Long Term	*Practically impossible*	Very Low

		site			
	1	***1***	**4**	**1**	**0.4**

Therefore, from Table 41 above, the significance will be VERY LOW, occur in *Isolated sites / proposed site* and will be Long Term and is *Practically impossible* to occur, resulting in a rating of 0.4 or a Very Low impact class.

Cumulative Impact

Since there are no initial impacts the cumulative impacts are the same as above.

Mitigation Measures

- Temporary storm-water control measures should be installed in case a rain event should occur that has the potential to cause erosion of exposed soil;
- Cut-off drains must be installed to facilitate the control of surface water runoff velocities;
- Storm-water control barriers should be used to divert surface water runoff into grassland buffers and not directly into the exposed workings;
- Stockpiles of soils and material should be located on high ground out of the reach of flood flows; and
- Stockpiles will be sited in areas demarcated for such purposes prior to the commencement of construction activities.

Residual Impact

Should the need arise to grade the power line route, it can be mitigated by ensuring that the grading only takes place for the area immediately under the pylons. Thus, restricting the impacted area to a small footprint under the pylons.

TABLE 42: TOPOGRAPHY RESIDUAL IMPACT ASSESMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Topography	VERY LOW	*Isolated sites / proposed site*	Long Term	*Unlikely*	Very Low
	1	***1***	**4**	**2**	**0.8**

From Table 42 it can be seen that the Residual Impact Assesment will be VERY LOW, occur in *Isolated sites / proposed site* and will be Long Term and is *Unlikely* to occur. The rating of 0.8 places the Residual Impact Assesment in a Very Low impact class.

10.1.3 Soils, Land Capability and Land Use

Soils, land capability and land use need to be grouped together, because the type of soil will determine the capability of the land and what the land can be used for in the future. If the soil is arable, then it is suitable for farming and the land use will be farms.

The land use of the site is divided up into three sections. The land use in the area is divided up into land that is used for agriculture, land used for industry and land that are used for urban areas. Approximately 80% of the area that the existing servitudes and Alternative 2 run along is used for agriculture. Urban areas are located closer to Pretoria and Johannesburg. A Hard Park will need to be constructed but will be taken down after construction.

Agricultural areas and livestock grazing areas that are impacted due to existing power line servitudes. If other Alternatives are selected that don't run along existing servitudes there will be a greater impact compared to areas that have existing servitudes. Other existing impacts are the existing pylon footings and cultivation of soils.

Initial Impact

The soils within the study site have been impacted on already by the existing infrastructure and surrounding farmlands

TABLE 43: SOIL AND LAND CAPABILITY INITIAL IMPACT ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soils	Moderate	*Study Site*	Long Term	*Is ocurring/Has Occured*	Moderate
	3	**2**	**4**	**5**	**3**

The Initial Impact Assesment to soils, land capability and land use as calculated in Table 43, is MODERATE, occurs in *Study sites*, is Long term and *Has occurred*, resulting in a rating of 3 or a Moderate impact class.

Additional Impact

The adittional-impact of the proposed power lines will be the loss of the soil as a resource and therefore render the land not suitable for any other use. This would occur under the power lines at the concrete footings, as well as along the access road. For Alternative 1 and 3 with existing servitudes, roads may not need to be consrtucted, but for Alernative 2 a haul road will need to be constructed for access. The road will remain and act as a servitude for Eskom employess and maintainace staff.

TABLE 44: SOIL IMPACT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soil, Land Capability and Land Use	LOW	*Study Sites*	Long Term	*It's going to happen*	Moderate
	2	***2***	**4**	**5**	**2.6**

The additional impact to soils, land capability and land use will be LOW, occur in *Study Site* , is Long term and *It's going to happen*, resulting in a rating of 2.6 or a Moderate impact class

TABLE 45: SOIL AND LAND CAPABILITY ADDITIONAL IMPACT ASSESSMENT – ALTERNATIVE 1 AND 3

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soil, Land Capability and Land Use	VERY LOW	*Isolated sites /proposed sites*	Long Term	*It's going to happen*	Moderate
	1	***1***	**4**	**5**	**2**

The addirional impact to soils, land capability and land use for Alternatives 1 and 3 will be VERY LOW, occur in *Isolated sites/proposed sites* , is Long term and *It's going to happen*, resulting in a rating of 2 or a Low impact class

TABLE 46: SOIL AND LAND CAPABILITY ADDITIONAL IMPACT ASSESSMENT – ALTERNATIVES 2

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soil, Land Capability and Land Use	Moderate	*Study Sites*	Long Term	*It's going to happen*	Moderate
	3	***2***	**4**	**5**	**3**

The additional impact to soils, land capability and land use will be MODERATE, occur in *Study Site* , is Long term and *It's going to happen*, resulting in a rating of 3 or a Moderate impact class

Cumulative Impact

The cumulative impact, as rated in Table 47 below, will be LOW, occur in the *Study area* and will be Long Term and *It's going to happen / has occurred*

TABLE 47: SOIL, LAND CAPABILITY AND LAND USE CUMULATIVE IMPACT RATING SCALE

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soil, Land	MODERATE	*Study area*	Long Term	*It's going to happen / has*	

Capability and Land Use				*occurred*	
	3	***2***	**<u>4</u>**	**5**	**3**

Mitigation Measures

- Demarcate topsoil and subsoil stockpile areas, berms, and storm-water management features prior to the commencement of construction activities;
- At least 300mm of topsoil (or until refusal) must be stripped and stockpiled separately;
- Strip sub-soils and stockpile adjacent to the working area in close proximity to the final footprint;
- Stockpiles are to be located on high ground out of the reach of flood flows;
- Sub-soil stockpiles should be sited upslope of the development site, and shaped to channel storm-water runoff around the site and disturbed areas;
- Topsoil stockpiles are to be sited outside of the development footprint;
- Use berms to minimise erosion where vegetation is disturbed, including hard parks, plant sites, borrow pit and office areas;
- Spread absorbent sand on areas where oil spills are likely to occur, such as the refuelling area in the hard park;
- Oil-contaminated soils are to be removed to a contained storage area and bio-remediated or disposed of at a licensed facility.

Residual Impact

Mitigation measures include, amongst others, the stripping and stockpiling of soil excavated for construction. This would ensure that the soil could be re-used elsewhere in the project area or utilized for rehabilitation purposes

10.1.4 Surface Water

Surface water features are demarcated as sensitive because of the high variety of fauna and flora that occur in the area. Areas such as rivers, dams and wetlands provide habitats for many plant and animal species that are endangered, which makes these areas very sensitive and of a high conservation status.

Initial Impact

There are a number of streams and drainage lines that have been dammed which may have caused damage to down stream aquatic life. The presents of agriculture and urban areas will also have had an affects on surface water flow. The construction of the existing power lines have had minimal affect on surface water flow

TABLE 48: SURFACE WATER INITIAL IMPACT RATING SCALE

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Surface water	VERY LOW	*Isolated sites / proposed site*	Medium Term	*Could happen*	Low
	1	***1***	**3**	**3**	**1.6**

The initial impact for surface water is VERY LOW, occurs in *Isolated sites / proposed site* and will be Medium Term and *It's going to happen / has occurred*. This results in a rating of 1.6 or a Low impact class.

Additional Impact

The construction of the proposed power lines should have no affect on drainage lines because of the distance found between pylons, but it should be noted that many drainage, streams, rivers and wetlands cross over the proposed and existing lines, It must be noted that buffer zones should be in place to project sensitive aquatic areas

Waste generated during the construction phase may enter the environment through surface water runoff i.e. litter or pollution such as hydrocarbons can be washed into aquatic systems affecting those systems negatively. Storm-water flowing over the site will also mobilise loose sediments, which may enter the surface water environment affecting water quality. Storm-water containing sediment can be discharged to grassland buffers to ensure sediments fall out prior to water entering surface water bodies. Care must be taken that storm-water containing hydrocarbons and other pollution sources are not discharged.

TABLE 49: SURFACE WATER ADDITIONAL-IMPACT RATING SCALE

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Surface water	VERY LOW	*Isolated sites / proposed site*	Medium Term	*Could Happen*	Very Low
	1	***1***	**3**	**3**	**1**

The additional impact for surface water is VERY LOW, occurs in *Isolated sites / proposed site*, will be Long Term and *Could Happen* to occur. This results in a rating of 1 or a Very Low impact class.

Cumulative Impact

Alternative 1 and 3 follow existing servitudes and Alternative 2 is the proposed line that does not follow an exiting servitude and crosses over the Bronkhorstspruit Dam. The distance that the line has to cross is estimated at 175 m, which falls within the maximum distance of the pylon construction.

TABLE 50: SURFACE WATER CUMULATIVE IMPACT RATING SCALE

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Surface water	LOW	*Study area*	Long Term	*Could happen*	Low
	2	***2***	**4**	**3**	**1.6**

The Cumulative impact, as rated in Table 50 aboce, will be LOW, occur in the *Study area* and will be Long Term and *It's going to happen / has occurred.* This results in a rating of 1.6 or a Low impact class

Mitigation Measures

- Demarcated areas where waste can be safely contained and stored on a temporary basis during the construction phase should be provided at the hard park;
- Waste is not to be buried on site;
- Hydro-carbons should be stored in a bunded storage area;
- All hazardous materials inter alia paints, turpentine and thinners must be stored appropriately to prevent these contaminants from entering the environment;
- Spill-sorb or similar type product must be used to absorb hydrocarbon spills in the event that such spills should occur;
- Care must be taken to ensure that in removing vegetation adequate erosion control measures are implemented;
- A storm-water management plan, including sufficient erosion-control measures, must be compiled in consultation with a suitably qualified environmental practitioner / control officer during the detailed design phase prior to the commencement of construction; and
- The propagation of low-growing dense vegetation suitable for the habitat such as grasses, sedges or reeds is the best natural method to reduce erosion potential in sensitive areas.

Residual Impact

In order to mitigate for residual impacts it is important that no power lines cross drainage points. This is not feasible because of the amounts of drainage points the power lines will have to cross the mitigation measures should be able to regulate the amount of residual impact occurred on site however low these impacts are. The overall rating for the residual impacts is the same as that of the additional impacts.

10.1.5 Flora

Initial Impact

The vegetation in and around the study area has significantly been transformed by farming activities, urbanisation and industrial activities. In addition, the remaining natural vegetation is being utilised for grazing and is being invaded by alien invasive species.

TABLE 51: FLORA INITIAL IMPACT RATING SCALE

Impact	**Significance**	***Spatial Scale***	**Temporal Scale**	**Probability**	**Rating**
Impact to Flora	**MODERATE**	***Study Site***	**Long Term**	**Is occurring**	**Moderate**
	3	***2***	**4**	**5**	**3.00**

The initial impacts to flora include extensive grazing, cultivation and alien invasive colonisation. The initial impact to flora is **definitely** MODERATE negative impact acting over the long term, and is *presently occurring* in the *study area*. As indicated in Table 51 above the impact rating class is a Moderate Impact.

Additional Impact

Additional impacts will be the removal of vegetation for the construction of the new power lines and the associated haul roads. There is a major concern to the affects on endangered and threatened endangered vegetation types. Vegetation types that are of concern are Marikana Thornveld (rated as endangered and 2.5% of the route is covered by this vegetation type), Carletonville Dolomitic Grassland (rated as vulnerable) and Egoli Grassland (rated as endangered and approximately 25% of the corridors fall within this vegetation type). There is concern about the loss of vulnerable and threatened vegetation types below illustrates the length that each route alternative will cross over each vegetation types identified.

TABLE 52: FLORA IMPACT

Vegetation Type	Alternative 1	Alternative 2	Alternative 3	Minerva to Lulamisa
Egoli Granite Grassland	0 km	0 km	0	16.9 km
Rand Highveld Grassland	28.6 km	20.3 km	27 km	0 km
Eastern Highveld Grassland	0 km	0.8 km	3.7 km	0 km
Cartonville Dolomite Grassland	1.3 km	7.3 km	0 km	5.7 km
Gold Reef Mountain Bushveld	12.9 km	0 km	0 km	0 km
Andesite Mountain Bushveld	3.5 km	0 km	0 km	0 km
Marikana Thornveld	5.8 km	0 km	0 km	0 km

Eastern Temperate Freshwater Wetlands	0.5 km	3 km	1 km	0.3 km
Cultivated Lands	17.7 km	29.3 km	24.3 km	2.7 km
Disturbed Lands	3 km	2 km	1.4 km	12.2 km

TABLE 53: VEGETATION ADDITIONAL-IMPACT RATING SCALEALTERNATIVE 1

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Vegetation	LOW	*Study Site*	Short Term	*It's going to happen*	Moderate
	2	***2***	**2**	**5**	**2**

The additional impact to vegetation is LOW, occurs in *Isolated sites / proposed site* and will be Medium Term and *It's going to happen*. A rating of 2.2 gives an impact class of Moderate.

TABLE 54: VEGETATION ADDITIONAL-IMPACT RATING SCALEALTERNATIVE 2

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Vegetation	LOW	*Study Site*	Long Term	*It's going to happen*	Moderate
	2	***2***	**4**	**5**	**2.6**

The additional impact to vegetation is LOW, occurs in *Isolated sites / proposed site* and will be Medium Term and *It's going to happen*. A rating of 2.3 gives an impact class of Moderate.

TABLE 55: VEGETATION ADDITIONAL-IMPACT RATING SCALEALTERNATIVE 3

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Vegetation	LOW	*Study Site*	Short Term	*It's going to happen*	Moderate
	2	***2***	**2**	**5**	**2**

The additional impact to vegetation is LOW, occurs in *Isolated sites / proposed site* and will be Medium Term and *It's going to happen*. A rating of 2 gives an impact class of Moderate

Due to Alternative 1 and 3 following existing servitude, acces to these areas is easier and the resultant construction phase is shorter. For Alternative 2 the construction phase is longer because the line does not follow any existing servitudes, this results in a higher rating compared to Alternative 1 and 3. Alternative 3 does run over more cultivated land so the loss in endemic floral species would be less than Alternative 1 and 3.

TABLE 56: VEGETATION ADDITONAL-IMPACT RATING SCALE: MINIRVA TO LULAMISA

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Vegetation	HIGH	*Study Site*	Medium Term	*It's going to happen*	Moderate
	4	***2***	**3**	**5**	**3**

The additional impact for vegetation is HIGH, occurs in *Isolated sites / proposed site* and will be Medium Term and *It's going to happen*. A rating of 3 gives an impact class of Moderate

The Minerva to Lulamisa section traverses over sensitive grassland species and placement of pylons should be very particular in order to avoid these sensitive areas

Cumulative Impact

The cumulative impacts take into account the affects that the construction and the initial impacts have on the vegetation. Due to the construction of the power lines through sensitive vegetation the cumulative impacts by be higher than expected for sections of the power line.

TABLE 57: VEGETATION CUMULATIVE-IMPACT RATING SCALE

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Vegetation	LOW	*Study area*	Long Term	*It's going to happen / has occurred*	Moderate
	2	***2***	**5**	**5**	**3**

The cumulative impact as rated in Table 57 above, will be LOW, occur in the *Study area* and will be Long Term and *It's going to happen / has occurred*. This results in a rating of 3 or a Moderate impact class.

Mitigation Measures

- All construction areas should be demarcated prior to construction to ensure that the footprint of the impacts are limited (including areas where vehicles may traverse);
- Topsoil and vegetation should be stripped together to a depth of 300mm on all areas earmarked for the new development to ensure the seed bank is maintained to facilitate with rehabilitation, especially in the area of the borrow pit.
- The entire borrow area should be rehabilitated to the same / better condition as before.
- A suitable seedmix of indigenous plants should be used in all rehabilitation programmes on the site.
- All alien invasive species on site should be removed and follow up monitoring and removal programmes should be initiated once construction is complete

- Minimal construction work should take place in sensitive areas.

Residual Impact

All impacted vegetation should be rehabilitated to its current state or original state before construction took place

TABLE 58: VEGETATION RESIDUAL-IMPACT RATING SCALE

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Vegetation	VERY LOW	*Study Sute*	Medium Term	*Unlikely*	
	1	***2***	**3**	**2**	**0.8**

The residual-impact\, as calculated in Table 58 above, will be VERY LOW, occur in *Study sites* and will be Medium Term and is *Unlikely* to occur. A rating of 0.8 is a Very Low impact class.

10.1.6 Fauna

Initial Impact

As described in the habitat assessment in Section 3.9, the site is relatively disturbed with the disturbed/grazed grassland, the undisturbed/natural grassland and the wetland and riparian zones the main habitat still available for fauna. The site is disturbed and while this is not ideal habitat for fauna, it will still provide habitat for various fauna. The suitable areas did show high species diversity, indicating that the impact is limited to isolated sites throughout the study area.

The study area is criss crossed with existing high voltage power lines that could potentially impact on the faunal life, especially large avi-faunal species. While there appears to be no negative impacts associated with electro magnetic fields generated by the power lines, Eskom's document, *Transmission Bird Collision Prevention Guideline* (Ref. no.: TGL41-335)[5], the major impact to birds or avi-fauna is in the form of collisions with power lines. According to the document, it was found that the majority of birds affected are large flighted birds, which are also often endangered or threatened species.

These large flighted birds are also long lived, with low breeding rate and often mate for life. Therefore, a single mortality due to a collision with a power line should be viewed as a high impact. In addition some of the most sensitive species to power line collisions such as Blue Crane are found in the study site in addition to other sensitive species such as White-Bellied Korhaan and Secretary Birds.

The current impact on fauna on site is **probably** of a HIGH negative significance, affecting the *region*, and acting in the long-term. The impact can *likely occur*. The impact class is classified as a High impact.

TABLE 59: FAUNA INITIAL IMPACT ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	HIGH	*Region*	Long Term	*Likely*	High
	4	**4**	**4**	**4**	**3.2**

Additional Impact

The impact to fauna during the construction phase of the power lines will mostly be in the form of disturbance from the construction workers and vehicle noise. Due to the fact that the area is habitat to sensitive species, the impact could be quite high.

The additional impact to fauna is **probably** MODERATE negative impact acting over the short term, and *will occur* in *isolated sites*. As indicated in Table 60 below the impact rating class is a Low Impact.

TABLE 60: FAUNA ADDITIONAL IMPACT ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	MODERATE	*Isolated Site*	Short Term	*Will occur*	Low
	3	**1**	**2**	**5**	**2**

Cumulative Impact

The cumulative impact to fauna remains as assessed for the initial impact assessment as the impacts are identical. Therefore the impact remains a High impact to Fauna.

Mitigation Measures

- All construction areas should be demarcated prior to construction to ensure that the footprint of the impacts are limited (including areas where vehicles may traverse);
- The sensitive habitat should be avoided and construction limited to 50 m from the edge of the wetlands and streams;
- Alternative 1 should be considered as the preferred alternative;
- All alien invasive species on site should be removed and follow up monitoring and removal programmes should be initiated once construction is complete;
- Adhere to the Eskom vegetation management guideline (**Error! Reference source not found.**); and
- Install power lines according to the Eskom bird collision prevention guideline.

Residual Impact

The mitigation measures proposed above will ensure that the construction of the proposed power line remains a Moderate impact but the Residual Impact remains High. If the mitigation measures were to be extended into the existing power lines and bird flappers be installed, the residual impact could be mitigated to a Moderate Impact Class.

10.1.7 Wetlands

The impact assessment for wetlands is the same as for the surface water section, please refer to Section 7.1.4.

10.1.8 Visual Impact

At present the viewers in the viewshed are seeing the Lulamisa and Minerva Sub-station and the various mining activities including the coal collieries in the area. In addition to the Power Station there are numerous power lines already traversing the landscape. The initial impact to the visual environment is HIGH negative acting in the long term, and *has already occurred*. The impact has **definitely** impacted on the *local region*

Initial Impact

The study site has several existing high voltage power lines that impact on the visual character of the landscape.

TABLE 61: VISUAL INITIAL RATING SCALE

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Visual	HIGH	*Local*	Long Term	*Has occurred*	High
	4	***3***	**4**	**5**	**3.6**

The initial impact to the visual landscape is High, occurs in *Local,* is Long Term and *Has occurred*. This results in a rating of 3.6 and a High impact class.

Additional Impact

During the construction phase, the local residents will be able to see the construction workings. This will impact negatively on the visual character of the landscape but is of short duration.

TABLE 62: VISUAL VISUAL ADDITIONAL IMPACT RATING SCALE

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Visual	LOW	*Local*	Short Term	*It's going to happen*	Low
	2	***3***	**2**	**5**	**2**

The additional impact to the visual landscape is VERY LOW, occurs in *Local site* and will be Short termand *It's going to happen*. A rating of 2 gives an impact class of Low.

Cumulative Impact

The cumulative impact will not change and the cumulative impact remains a High impact.

Mitigation Measures

- Only the footprint of the proposed power line should be exposed. In all other areas, the natural vegetation should be retained;
- Dust suppression techniques should be in place at all times during the construction phase;
- Access roads should be minimised to prevent unnecessary dust; and
- Utilise non-shiny structures for the hard park and toilets, i.e. avoid unpainted roofs.

Residual Impact

The initial visual impact of the power lines can not be mitigated and therefore the mitigation measures merely ensure that the additional impact is managed responsibly. The residual impact remains a High impact.

10.1.9 Archaeology and Cultural Historical Sites

Types and ranges of heritage resources

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

- Remains of stone walled sites which can be associated with the Battle of Bronkhorstspruit (1880) and with dwellings dating from the early 20th century.
- Memorabilia consisting of a monument and a Garden of Remembrance associated with the Battle of Bronkhorstspruit (1880).
- Graveyards with possible historical significance.
- Houses and other structures with possible historical significance.

The stone walls, memorabilia associated with the Battle of Bronkhorstspruit and graveyards were geo-referenced, mapped and discussed in this section of the report (Figure 74). Their significance is indicated and mitigation measures are outlined should they be affected by the proposed project.

The importance of historical structures such as houses is merely pointed out as each and every historical structure in close proximity to the proposed transmission line corridors were not geo-referenced due to time restrictions and the fact that Eskom does not outright demolish structures in order to make way for new power lines.

Remains from the more recent past have no significance and are not discussed in this report.

The Phase I HIA study is now briefly discussed and illustrated with photographs.

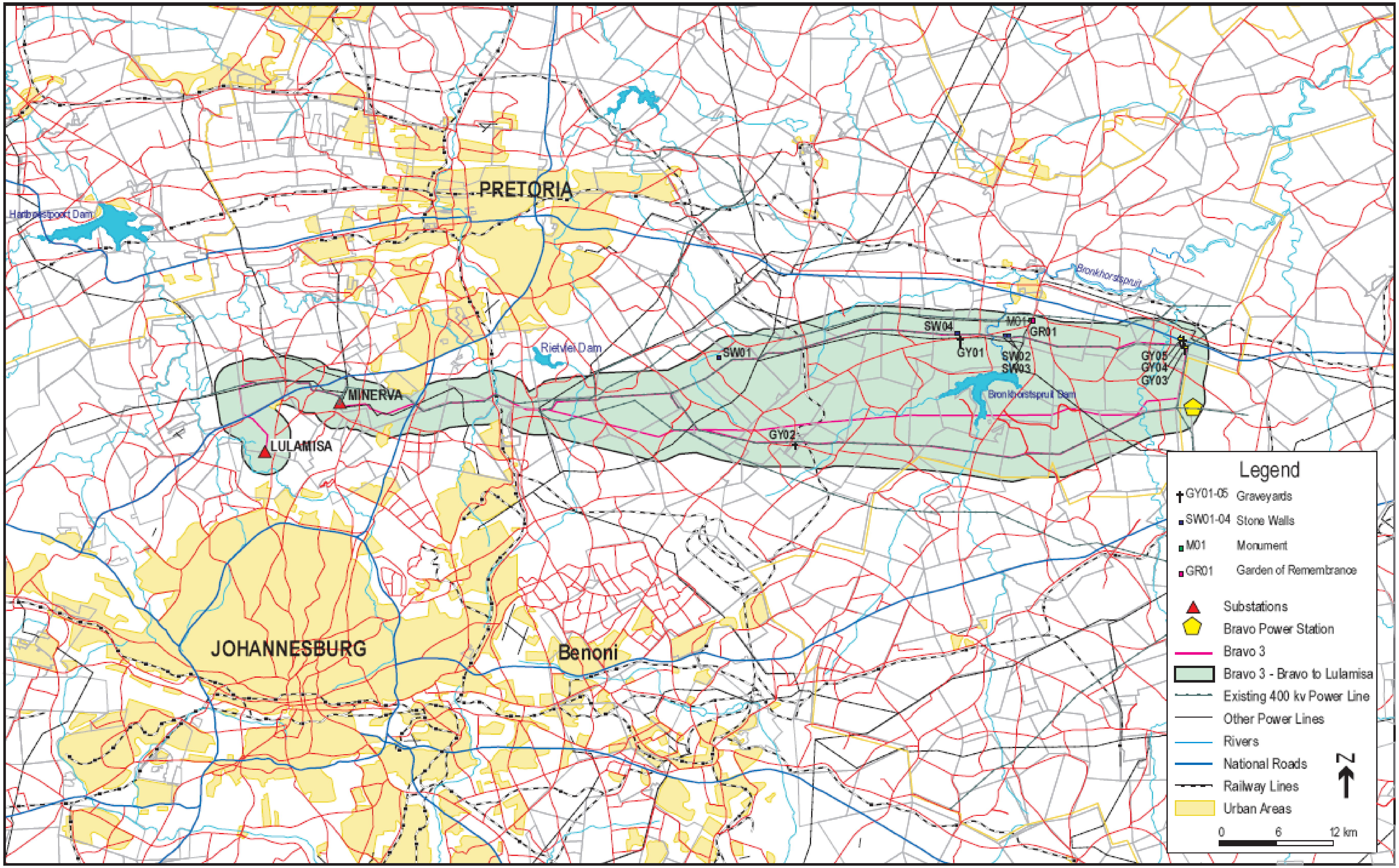


FIGURE 74: STONE WALLS, MEMORABILIA COMMEMORATING THE BATTLE OF BRONKHORSTSPRUIT AND GRAVEYARDS IN AND NEAR THE PROJECT AREA.

Stone walls

The Battle of Bronkhorstspruit probably occurred on the farm Klipeiland 524JR as is indicated on the 1:50 000 topographical map of Bronkhorstspruit 2528DC.

Stone walls constructed with quartzite occur on several of the low quartzite ridges to the south of Bronkhorstspruit. Some of these walls occur near Eskom's central option for the proposed new Bravo/Lulamisa power line.

It is highly likely that:

- Some of these structures may be associated with the Battle of Bronkhorstspruit (1880) as they occur in the general area where this battle took place. The stone walls probably served as outlook positions and may have been used for defensive purposes as well.
- Some of the stone walls served as dwellings for people working as farm labourers on farms in the project area during the early 20th century.

Memorabilia associated with the Battle of Bronkhorstspruit

The Battle of Bronkhorstspruit is commemorated on the farm Klipeiland 524JR by a Garden of Remembrance and a national monument sign located on opposite sides of the R25/42.

The beacon at the Garden of Remembrance holds the following inscription:

- 'In memory of the 94th Regiment (Later 2nd Bn Connaught Rangers) who were killed in action in this area on the 20th Dec 1880 or subsequently died of wounds. Erected by the Northern Transvaal Soldiers Grave Association. War Veteran Association 23rd April 1961.'

FIGURE 75: QUARTZITE STONE WALLS ON A RIDGE TO THE SOUTH OF BRONKHORSTSPRUIT. SOME OF THESE STONE WALLS SERVED AS DWELLINGS FOR FARM WORKERS. IT IS ALSO POSSIBLE THAT SOME OF THE WALLS MAY HAVE SERVED AS DEFENSIVE STRUCTURES DURING THE BATTLE OF BRONKHORSTSPRUIT (1880) (ABOVE)

The monument holds the following inscription:

- 'A Boer commando of about 250 men commanded by Cmde Frans Joubert defeated a British force of 257 men with 34 wagons under Lt Col Anstruther here on 20th December 1880. During the brief battle Lt Col Anstruther with 66 of his men and two Boers were killed. Historical Monument Commission 1999'.

FIGURE 76: MONUMENT COMMEMORATING BATTLE OF BRONKHORSTPRUIT (1880) (ABOVE).

FIGURE 77: GY01 CLOSE TO SOUTHERN OPTION FOR THE PROPOSED NEW 400 KV BRAVO/LULAMISA POWER LINE (BELOW).

Graveyards

At least five graveyards were observed close to options for the proposed new Bravo/Lulamisa power line. More graveyards may occur in or near the proposed power line corridors considering the lengths of the various options for the new power line.

The graveyards that were observed were the following;

Graveyard 01

This graveyard is located near the Boschkop Agricultural Holdings and holds the remains of approximately twenty individuals. Most of the graves are edged with cement strips and fitted with cement headstones. Some are also decorated with granite headstones.

This graveyard is located on a small holding next (south) to the southern option for the proposed new Bravo/Lulamisa power line.

Graveyard 02

GY02 is located on the northern shoulder of the R25, directly to the south of a quartzite reef running from the east to the west, more or less parallel with the R25.

Eskom's existing 400 kV power line and the proposed northern option for the Bravo-Lulamisa power line is located along this reef and above (north) of the graveyard.

The graveyard contains an unknown number of graves as they are covered with tall grass. Several of the graves are fitted with granite headstones.

Graveyards 03-05

A number of graves are scattered in an area to the north of the Bravo power station at a point where the northern option for the proposed Bravo/Lulamisa power line turns towards the west. The three locations with single and more than one grave were recorded as three separate graveyards. At least one of the graves is associated with stone walls.

FIGURE 78: ONE OF AT LEAST THREE GRAVES NEAR THE NORTHERN OPTION FOR THE PROPOSED NEAR BRAVO/LULAMISA POWER LINE. THIS GRAVE IS ASSOCIATED WITH A FEW STONE WALLS.

Historical structures

Historical structures such as farmhouses, sometimes with outbuildings, occur in some instances close to some of the options for the proposed new Bravo/Lulamisa power line.

These structures were not geo-referenced due to time restrictions. It is also unlikely that they will be affected by the proposed project as Eskom do not outright demolish structures to make way for new power lines. However, cognisance should be taken of any structures older than sixty years which may be affected by the proposed project.

TABLE 63: COORDINATES FOR STONE WALLS ON QUARTZITE RIDGES LOCATED IN THE GENERAL AREA WHERE THE BATTLE OF BRONKHORSTSPRUIT OCCURRED DURING 1880 (ABOVE). SOME OF THESE STONE WALLS ALSO SERVED AS RESIDENCES DATING FROM THE EARLY 20TH CENTURY (ABOVE).

Heritage resources	Coordinates	Significance
Stone walls (SW01)	S 25°52’58.5” E 28°26’58.5”	**HIGH**
Stone walls (SW02)	S 25º51’29.2” E 28º43’18.0”	**HIGH**
Stone walls (SW03)	S 25º51’28.2” E 28º43’02.4”	**HIGH**
Stone walls (SW04)	S 25º51’18.3” E 28º40’29.9”	**HIGH**

TABLE 64: COORDINATES FOR A MONUMENT AND GARDEN OF REMEMBRANCE ASSOCIATED WITH THE BATTLE OF BRONKHORSTSPRUIT (1880) ON OPPOSITE SIDES OF THE R25/42 TO THE SOUTH BRONKHORSTSPRUIT (ABOVE).

Heritage resources	Coordinates	Significance
Monument	25º 50.403' 28º 44.464'	**HIGH**
Garden of Remembrance	25º 50.425' 28º 44.518'	**HIGH**

TABLE 65: COORDINATES FOR GRAVEYARDS IN CLOSE PROXIMITY OF THE VARIOUS OPTIONS FOR THE 400 KV BRAVO/LULAMISA POWER LINE (ABOVE).

Heritage resources	Coordinates	Significance
GY01	S 25º 51.590' E 28º 40.485'	**HIGH**
GY02	S 25º 57.603' E 28º 30.968'	**HIGH**
GY03	S 25º52’03.2” E 28º53’33.5”	**HIGH**
GY04	S 25º51’58.5” E 28º53’25.7”	**HIGH**
GY05	S25º51’54.6” E 28º53’10.2”	**HIGH**

The significance of the heritage resources

It is possible that some of the types and ranges of heritage resources that were identified in and near the proposed project area may be impacted by the project. The significance of these various types and ranges of heritage resources therefore is indicated by means of stipulations derived from the National Heritage Resources Act (No 25 of 1999).

Stone walls

Stone walled sites qualify as archaeological and historical remains and are protected by Section 38 of the National Heritage Resources Act (No 25 of 1999).

Memorabilia

The monument and Garden of Remembrance qualify as commemorative beacons which are protected by Section 37 of the National Heritage Resources Act (No 25 of 1999).

Graveyards

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

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

Historical structures

Historical structures such as houses or outbuildings which are older than sixty years are protected by Section 34 of the National Heritage Resources Act (No 25 of 1999).

Mitigating the heritage resources

The following mitigation measures have to be followed whenever any of the identified heritage resources may be affected by the proposed project

Stone walls

Stone walled sites must be avoided by pylons by placing the pylons on opposite ends of small stone walled sites. However, when stone walls cover large surfaces which represent cultural landscapes should rather be avoided by the power lines.

If stone walls have to be destroyed to make way for pylons and power lines these stone walled sites need to be subjected to Phase II investigations. These investigations require that the stone walled sites be documented by means of mapping the sites and possibly by means of small test excavations of the site. Phase II investigations can only be conducted by archaeologists accredited with the Association for Southern African Professional Archaeologists (ASAPA). The archaeologist has to obtain the necessary permit from the South African Heritage Resources Authority (SAHRA) which will authorise the Phase II investigation and subsequent destruction of the archaeological site.

Memorabilia

The memorabilia associated with the Battle of Bronkhorstspruit must be avoided by the proposed project as they represent heritage sites with outstanding significance. These memorabilia are also accessible to the public and are regularly visited by tourist or school groups or other interested individuals.

Graveyards

GY01 and GY02 as well as any other undiscovered graves and graveyards in the project area can be mitigated by following one of the following strategies, namely:

- Graveyards and graves can be conserved *in situ* beneath power lines. Pylons should be erected on opposite ends of graves or graveyards. Consequently, power lines can be strung across and above graveyards and graves. Conserving graves and graveyards in power line corridors create the risk that they may be damaged, accidentally, and that Eskom may be held responsible for such damages. Controlled access must exist for any relatives or friends who wish to visit graves or graveyards in power line corridors.

- Graveyards can also be exhumed and relocated. The exhumation of human remains and the relocation of graveyards are regulated by various laws, regulations and administrative procedures. This task is undertaken by forensic archaeologists or by reputed undertakers who are acquainted with all the administrative procedures and relevant legislation that have to be adhered to whenever human remains are exhumed and relocated. This process also includes social consultation with a 60 days statutory notice period for graves older than sixty years. Permission for the exhumation and relocation of human remains have to be obtained from the descendants of the deceased (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local police.

Historical structures

Historical structures may not be affected (demolished, renovated, altered) by the proposed project *prior* to their investigation by a historical architect in good standing with the South African Heritage Resources Agency (SAHRA). The historical architect has to acquire a permit from the South African Heritage Resources Authority (SAHRA) *prio*r to any of these structures and features been affected or altered as a result of the proposed project.

10.1.10 Socio-Economic Environment

As mentioned in Section 7.3 a change process can be defined as change that takes place within the receiving environment as a result of a direct or indirect intervention. A potential impact follows as a result of the change process. However, a change process can only result in an impact once it is experienced as such by an individual/community on a physical and/or cognitive level.

The following changes are expected during the construction and decommissioning phases and are discussed in more detail below:

- Demographic change;
- Geographic change;
- Economic change;
- Institutional and empowerment; and
- Socio-cultural change.

Expected Demographic Change Process

It is expected that the construction and operation of the proposed transmission power line will lead to a change in the number and composition of the population within the affected areas, which in turn may impact on health, safety and community cohesion.

Table 66 below provides an overview of the expected change process to occur as well as the expected impacts that might occur as a result of these change processes taking place.

TABLE 66: EXPECTED DEMOGRAPHIC CHANGE PROCESSES

DEMOGRAPHIC CHANGE PROCESSES				
Expected Change Process		***Yes***	***No***	***Expected Impact***
Population change	***Will the development lead to an increase in numbers of a certain section of the population, e.g. migratory workers?***	***X***		***Influx of construction workers that will lead to a change in the number and composition of the local community, and impact on economy, health, safety and social well-being.***
In-migration of unemployed work seekers	***Will the development intentionally or unintentionally contribute to the in-migration of work seekers into the area?***	***X***		***Influx of job seekers that will lead to a change in the number and composition of the local community, and impact on economy, health, safety and social well-being.***
Relocation or displacement of individuals or families	***Will the development at this or future stages lead to the relocation of residents?***	***X***		***Relocation of households would have an impact on people's way of life and the standard of life that these people have grown accustomed to.***

This sub-section deals with the expected demographic change processes and resultant impacts that can be expected with the introduction of the proposed project to the affected areas. The demographic change processes that can be expected during this phase of the project are as follows:

- Influx of construction workers;
- Influx of job seekers;
- Relocation of households and/or population segments.

These change processes will be discussed separately together with a detailed assessment of the expected impact as a result of the change process taking place. All the demographic change processes during the construction and decommissioning phases, apart from relocation of households and/or population segments, are expected to result in Category 1 impacts, which are defined as those impacts that are not expected to differ between the proposed alternatives.

Influx of Construction Workers

The impact of the influx of construction/decommissioning workers is mostly applicable to the areas surrounding the construction camps where workers spend evenings and weekends. Contact between the local community and the workers can be expected and conflict could be expected. An estimated total of approximately 245 people from various disciplines will form part of the construction team. As some of these disciplines require unskilled labour, up to a total number of approximately 20 people, it assumed that this segment of the construction team would be sourced from within the local area, thereby reducing the number of construction workers who enter the area to approximately 225 people.

On a total population of 104 150 people, as is the case with the KLM, this means a population increase of approximately 0.2% over the construction period. In the CTMM and CJMM, this influx results in a population increase of between 0.005% and 0.01%, which is regarded as an insignificant increase. The influx of construction workers to the area is therefore not expected to cause any significant impacts on the baseline population size. It is however unclear if, and how many, of these construction workers will live in a construction village.

Influx of Job Seekers

Job seekers can be expected in the area, either at the construction village or at the construction site. Although a small number of job seekers could be employed in this way, job seekers mostly hang around the camp for a few days in the hope of securing a job on site. Local individuals could jeopardise their current employment in leaving their workplace in the hope of earning a better income in construction. It is not possible to accurately predict the amount of job seekers that would flood to the area, which could range from a single job seeker to hundreds and thousands of job seekers.

The influx of job seekers into the environment will lead to an increased demand on local services and will not necessarily lead to a boost in the local economy, seeing as these job seekers are mostly unemployed. The influx of job seekers might further lead to conflict with local residents in respect of competition over limited job opportunities.

Apart from situations such as these, the influx of job seekers could also lead to the expansion of informal settlements, which could be close to the servitude area, as these settlers have no resources and therefore aim to settle as close to economic activity as possible. A construction site or process taking place in the area is viewed as an economic activity as it might offer the opportunity of employment. A job seeker would normally first live in the field while trying to secure employment at the construction site. Later on he/she might grow accustomed to the area (even if they did not secure employment) and then also move their family into the area, which is normally the period in which they would construct a more ‘formal’ housing structure.

An assessment of these category 1 impacts was conducted through the use of the assessment criteria to determine the significance of each of the identified issues, as per Table 67 below.

TABLE 67: CONSTRUCTION & DECOMMISSIONING PHASES: DEMOGRAPHIC CHANGE PROCESSES CATEGORY 1 IMPACT ASSESSMENT

	Significance		*Spatial*		*Duration*		*Degree of Probability*		*Degree of Certainty*	*Risk*		*Status*
PRE-MITIGATION												
Influx of construction workers	*Very low*	*1*	*Study area*	*2*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*0.78*	*Very low*	*Negative*
Influx of job seekers	*Low*	*2*	*Study area*	*2*	*Short term*	*2*	*Could happen*	*3*	*Possible*	*0.96*	*Very low*	*Negative*
POST MITIGATION												
Influx of construction workers	*No impact*	*0*	*Study area*	*2*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*0.6*	*Very low*	*Neutral*
Influx of job seekers	*Very low*	*1*	*Study area*	*2*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*0.78*	*Very low*	*Negative*

MITIGATION MEASURES

Construction Workers:

- **Raise awareness amongst construction workers about local traditions and practices.**
- **Inform local businesses that construction workers will move into the area to enable local businesses to plan for the extra demand.**
- **Ensure that the local community communicate their expectations of construction workers' behaviour with them.**
- **Construction workers should be clearly identifiable by wearing proper construction uniforms displaying the logo of the construction company. Construction workers could also be issued with identification tags.**

Job Seekers:

- **Ensure that employment procedures / policy are communicated to local stakeholders, especially community representative organisations and ward councillors.**
- **Have clear rules and regulations for access to the camp / site office to control loitering. Consult with the local SAPS to establish standard operating procedures for the control and/or removal of loiterers at the construction site.**
- **Eskom (or its appointed contractor) should monitor areas where people gather in the field on a regular basis as this is normally the first indication that settlement might take place in the area. These people should be removed in co-operation with the local SAPS to prevent the formation and/or expansion of informal settlements in such an area, especially if it encroaches upon the servitude.**

Relocation of Households and/or Population Segments

In various cases along the proposed alternative route corridors, settlement has taken place within the existing transmission power lines' servitudes. By proxy this means that settlement would also encroach on or within the proposed new servitude. This also implies that relocation would have to take place of households that have settled within the existing servitude.

On the corridor between the Lulumisa and Minerva substations, a total of 12 buildings could be found that are either within the existing servitude or encroach upon the proposed new servitude. The majority of these structures (10 residential houses) are located within the Laezonia Agricultural Holdings area, west of the R511. Figure 79 below provides an approximate location of the incidences of settlement within the servitude (indicated by red arrows).

FIGURE 79: AREAS OF SETTLEMENT WITHIN SERVITUDE ON THE SECTION BETWEEN THE LULUMISA AND MINERVA SUBSTATIONS

On the section through Olievenhoutbosch, a total of either 106 or 83 residential houses were observed within the proposed new servitude, depending on whether the proposed new transmission power line would be to the north or to the south of the existing transmission power line. If the new line is located to the north of the existing line, a total of 83 residential houses would be affected, whereas a total of 106 residential houses would be affected if the new line is located south of the existing line. However, on the northern side of the existing line, an informal settlement was observed that encroached upon the servitude. A further 7 structures were observed either within or in very close proximity to the proposed servitude, as reflected in Figure 80.

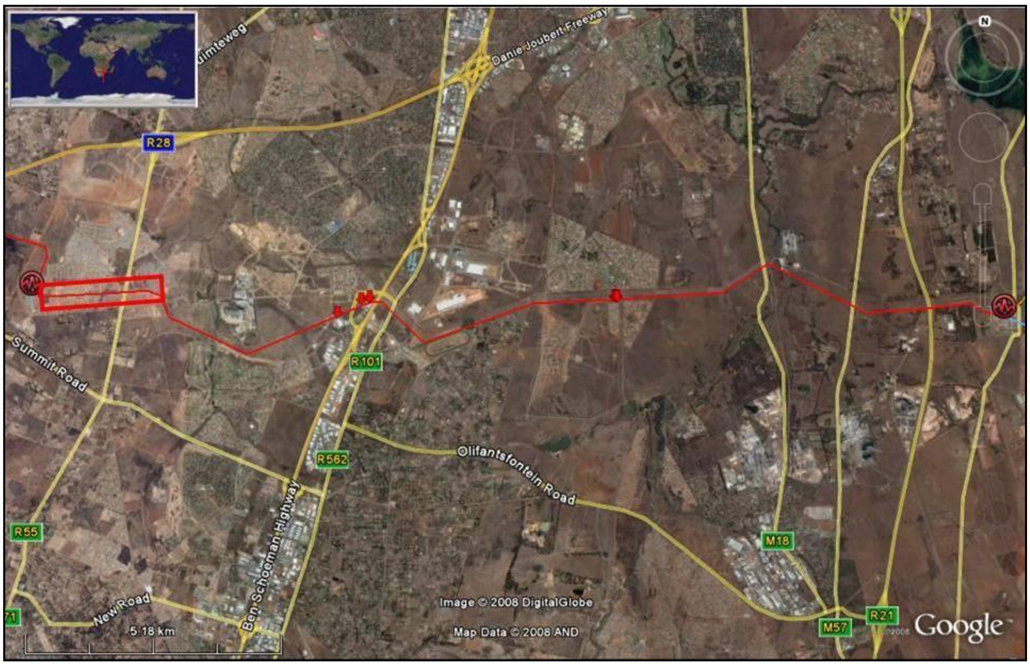


FIGURE 80: AREAS OF SETTLEMENT WITHIN SERVITUDE ON THE SECTION BETWEEN MINERVA SUBSTATION AND THE APOLLO CONVERTER STATION

A total of 28 structures were observed either within or in close proximity to the proposed servitude on the **northern alternative** section between the Apollo Converter Station and the Bravo Power Station. Most of these structures (25 residential houses) are located in the Tierpoort Small Holdings area, which is located east of the R50 and west of the R515. The approximate location of the affected structures on the northern alternative is as per Figure 81 below.

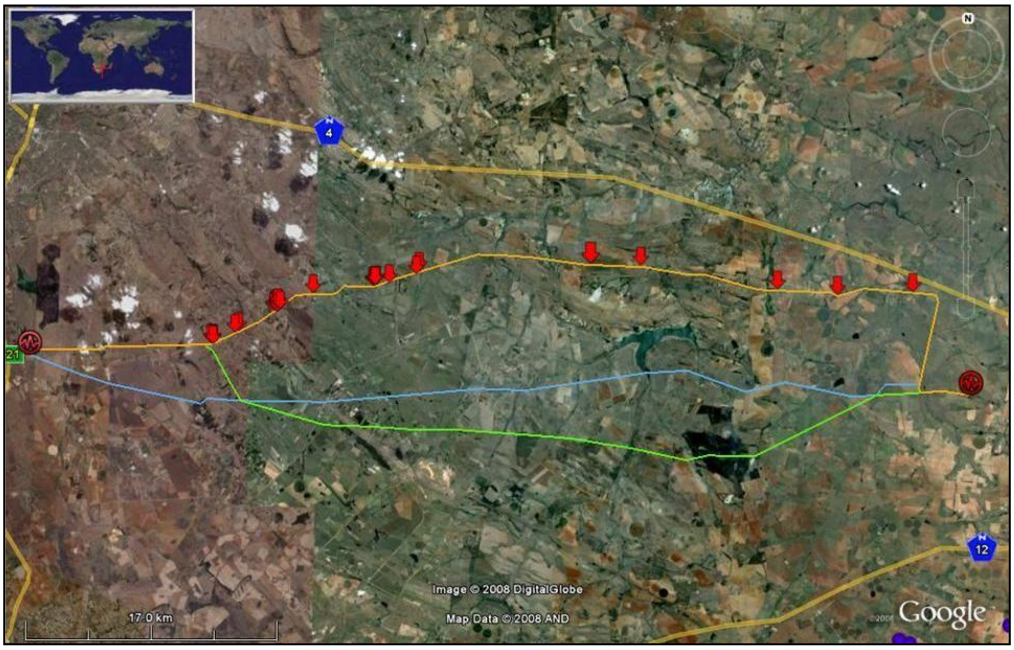


FIGURE 81: AREAS OF SETTLEMENT WITHIN SERVITUDE ON THE NORTHERN ALTERNATIVE SECTION BETWEEN THE APOLLO CONVERTER STATION AND THE BRAVO POWER STATION

On the **central alternative** section between the Apollo Converter Station and the Bravo Power station, a total of 7 structures were observed. However, as this is mostly a 'greenfields' alternative, it is believed that all these structures could be avoided by amending the alignment slightly. The approximate location of the affected structures on the central alternative is as per Figure 82 below.

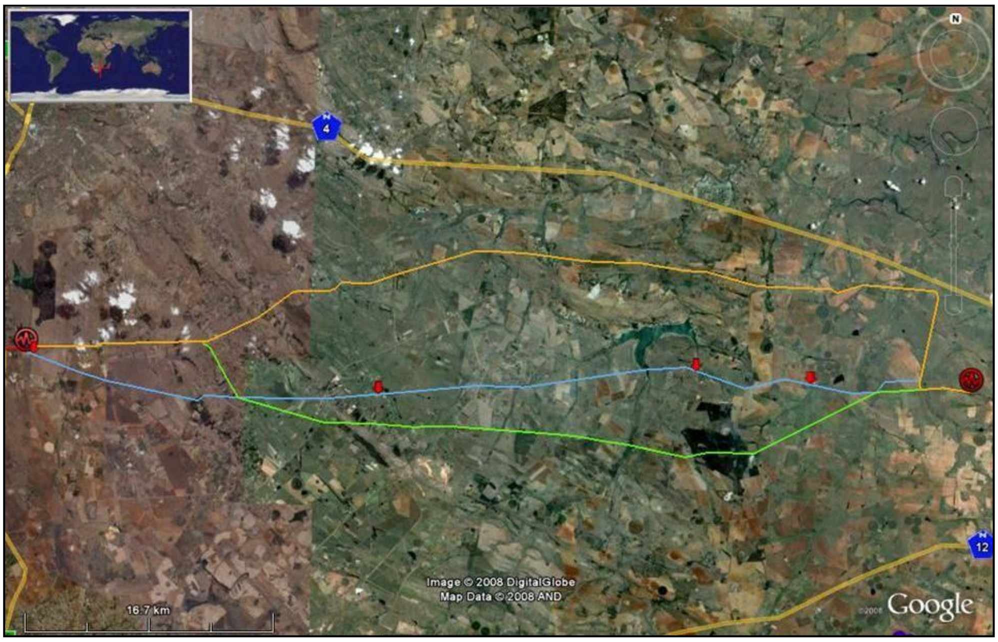


FIGURE 82: AFFECTED STRUCTURES ALONG THE CENTRAL ALTERNATIVE.

A total of 11 structures have been observed either in or in close proximity of the servitude on the **southern alignment** section between the Apollo Converter Station and the Bravo Power Station. The approximate location of the affected structures on the southern alternative is as per Figure 83 below.

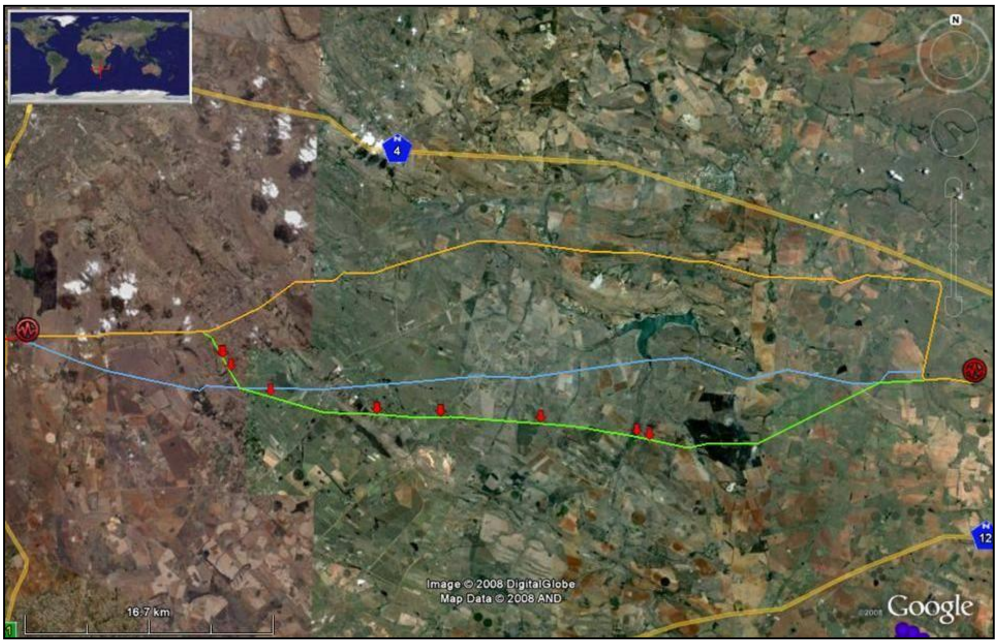


FIGURE 83: AREAS OF SETTLEMENT WITHIN SERVITUDE ON THE SOUTHERN ALTERNATIVE SECTION BETWEEN THE APOLLO CONVERTER STATION AND THE BRAVO POWER STATION

In all instances it is not foreseen that these households would necessarily have to be resettled as it might also be possible to fine-tune the alignment that is preferred in the end to avoid such households.

Furthermore, the possibility cannot be ruled out that some areas will not be inhabited by the time construction commences, notably where the alignment comes in close proximity to the informal settlement at Olievenhoutbosch. In the past, there have been incidences where households have deliberately settled in an area that is known to be earmarked as a servitude. Such households then claim to have been living in that area for an extended period of time. Such claims are motivated by the fact that they might be able to claim compensation from Eskom for having to be resettled.

Furthermore, the uncontrolled development of informal settlements could lead to a situation where Eskom does not have unrestricted access to their servitudes. In such an instance, Eskom would not be able to reach the transmission power line in the event of either routine maintenance or an emergency (malfunctioning) on the line. This could cause severe delays on maintenance being carried out. People settling within the servitude would also impact on their own health and safety.

As the impact of relocation depends on the level of attachment to a place, which in turn is informed by variables such as age and number of years spent in that particular area, it is believed that if the servitude is inspected for settlement on a regular basis, Eskom would be able to remove people and/or households from the servitude without causing severe negative impacts. The sooner that people are removed from the servitude, the less likely it becomes that they have become attached to the area, as they have only been living there for a short space of time. The impact is therefore not viewed as purely negative due to the fact that Eskom would have unrestricted access to their servitude in case of emergency. The safety of the relocated party would also be enhanced if they are removed from the servitude.

An assessment of this category 2 impact, which is those impacts that are expected to cause significant changes between the proposed alternatives, was conducted through the use of the assessment criteria to determine the significance of the impact per site, as per Table 68 below.

TABLE 68: CONSTRUCTION & DECOMMISSIONING PHASES: DEMOGRAPHIC CHANGE PROCESSES CATEGORY 2 IMPACT ASSESSMENT: RELOCATION OF HOUSEHOLDS AND/OR POPULATION SEGMENT

	Lulumisa – Minerva Section		Minerva – Apollo Section		Apollo – Bravo Section					
					Northern Alternative		Central Alternative		Southern Alternative	
PRE-MITIGATION										
Significance	High	4	High	4	High	4	High	4	High	4
Spatial	Study area	2	Study area	2	Study area	2	Study area	2	Study area	2
Duration	Permanent	5	Permanent	5	Permanent	5	Permanent	5	Permanent	5
Degree of Probability	Very likely	4	Going to happen	5	Very likely	4	Could happen	3	Very likely	4
Degree of Certainty	Probable		Definite		Probable		Possible		Probable	
Risk	2.96	Moderate	3.7	High	2.96	Moderate	2.22	Moderate	2.96	Moderate
Status	Negative		Negative		Negative		Negative		Negative	
POST-MITIGATION										
Significance	Moderate	3	Moderate	4	Moderate	3	Moderate	3	Moderate	3
Spatial	Isolated	1	Isolated	1	Isolated	1	Isolated	1	Isolated	1
Duration	Permanent	5	Permanent	5	Permanent	5	Permanent	5	Permanent	5
Degree of Probability	Very likely	4	Very likely	4	Very likely	4	Could happen	3	Very likely	4
Degree of Certainty	Probable		Probable		Definite		Possible		Probable	
Risk	2.4	Moderate	2.64	Moderate	2.4	Moderate	1.8	Low	2.4	Moderate
Status	Negative		Negative		Negative		Negative		Negative	

MITIGATION MEASURES

- *Avoid the resettlement and/or displacement of households as far as possible by realigning sections of the preferred route corridor to avoid areas of human settlement – this is especially required in Olievenhoutbosch. If technically feasible, it is suggested that the transmission power line exit the Minerva substation to the south and continue in a southerly direction past Olievenhoutbosch after which it can turn in a easterly direction.*
- *If resettlement is unavoidable, residents should be sufficiently compensated and assisted with the relocation process.*
- *A form of compensation should also be granted to individuals who are residing in informal settlements within the servitude.*
- *A formal grievance procedure should be implemented and communicated to landowners to ensure a fair and transparent process.*
- *Eskom (or its appointed contractor) should monitor areas where people gather in the field on a regular basis as this is normally the first indication that settlement might take place in the area. These people should be removed in co-operation with the local SAPS to prevent the formation and/or expansion of informal settlements in such an area, especially if it encroaches upon the servitude.*
- *The servitude should be inspected on a regular basis to determine whether any settlement has taken place, either within the servitude, or encroaching upon the servitude.*
- *Households that encroach upon or settle within the servitude have to be relocated as soon as possible. Eskom or its appointed contractors should assist these households with the relocation process.*
- *In some way, a barrier (psychological and/or physical) should indicate that no structures should be built in the servitude. One way of achieving such a barrier is to educate community leaders on the health and safety aspects of the servitude, who then in turn can ensure that settlement does not take place within the servitude.*

PREFERRED ALIGNMENT

The central alternative affects the least amount of households, followed by the southern alternative. The western alternative affects the greatest amount of households.

Expected Geographical Change Processes

Geographical change processes refer changes in land use, whether it is on a temporary or permanent basis. The construction and operation of a transmission power line will lead to a change in the land use, mostly as a result of the surface infrastructure. The assessment of a land use change process from a social perspective takes into account how the proposed transmission power lines might affect the behaviour and/or lives of landowners and/or land users in the area.

In light of the above, potential geographical impacts from a social perspective are considered within the context of change processes in the use of the land. An example of how the presence of a transmission power line could lead to land use changes is illustrated in Figure 84.

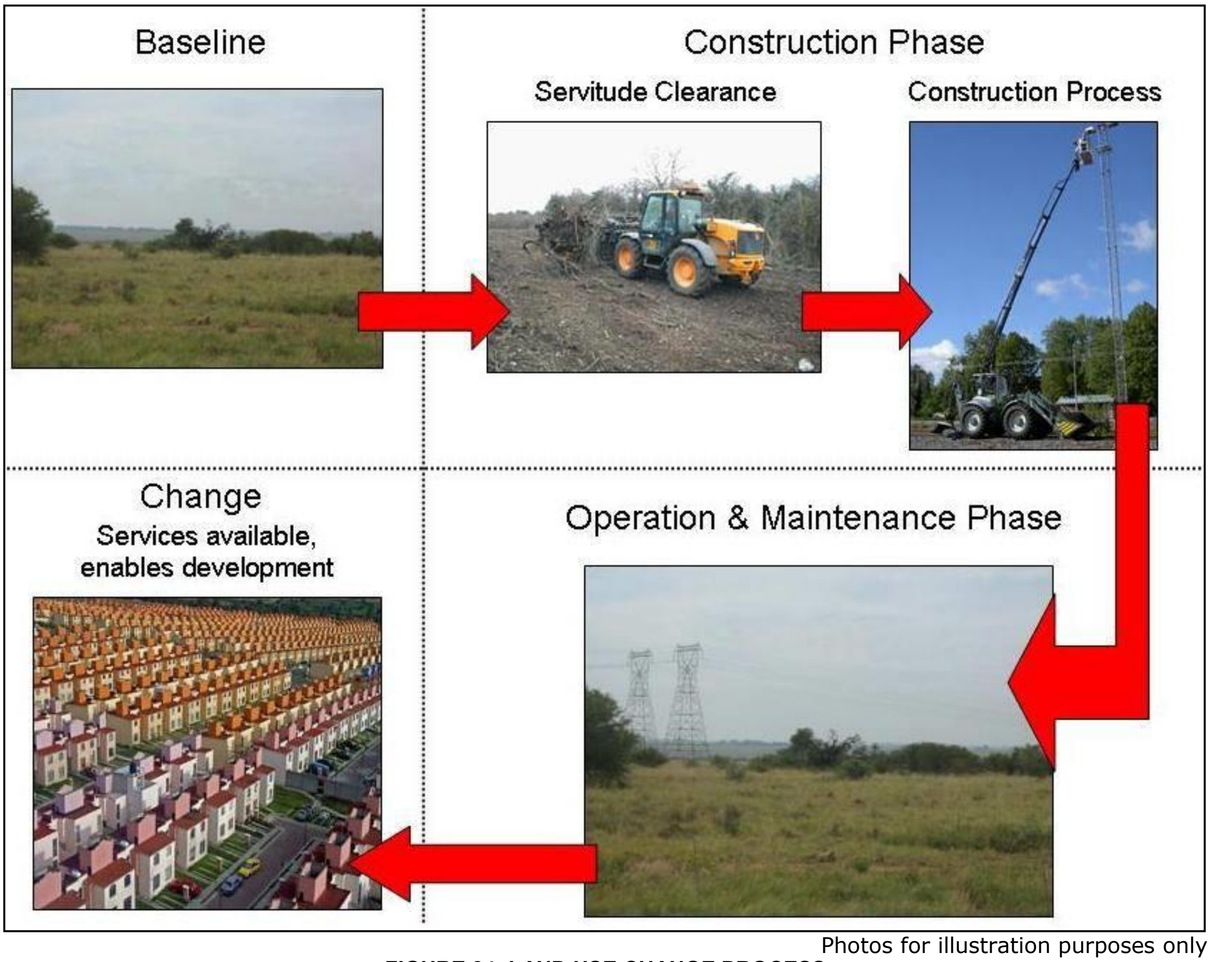


FIGURE 84: LAND USE CHANGE PROCESS

Table 69 below provides an overview of the expected change process as well as the expected impacts that might occur as a result of the change process taking place.

TABLE 69: GEOGRAPHICAL CHANGE PROCESSES

GEOGRAPHICAL CHANGE PROCESSES				
Expected Change Process		***Yes***	***No***	***Expected Impact***
Access to environ-mental resources	***Will the development impact on people's access to environmental resources, such as water, wood, medicinal plants etc?***		***X***	***No impact foreseen.***
Change in access to resources that sustain livelihoods	***Will the development impact on people's (legal or illegal, formal or informal) access to environmental resources that help to sustain their livelihoods, e.g. grazing land for their cattle; wood for heat/cooking/selling, etc.?***	***X***		***Temporary loss of cultivated and grazing land due to construction activities, leads to a decreased area for cultivation and grazing, resulting in an economic impact. Also permanent loss of cultivated and grazing land through the land acquisition process.***
Land acquisition and disposal, including availability of land	***Will the development contribute to or directly impact on the ability of local residents to keep or acquire property/land?***	***X***		***Permanent servitude of 55m will restrict access to that portion of land, although certain land uses will still be permitted within the servitude.***
	Will the development set a precedent for change in land use in the area?		***X***	***No impact foreseen.***
	Are there any potential land-claims for the area?		***X***	***No impact foreseen.***
	Will the development affect the claims process?	***-***	***-***	***Not applicable.***

This sub-section deals with the expected geographical change processes and resultant impacts that can be expected with the introduction of the proposed project to the affected areas. The geographical change processes that can be expected during this phase of the project relate to the following land uses:

- Cultivated land; and
- Grazing land.

These change processes will be discussed separately together with a detailed assessment of the expected impact as a result of the change process taking place. The change processes during the construction and decommissioning phases are expected to result in Category 1 impacts, which are defined as those impacts that are not expected to differ between the proposed alternatives, as all of the corridor alternatives pass through agricultural land at same stage, either in whole or in part.

Cultivated land

A temporary loss of cultivated land can be expected during the construction of the proposed Transmission power line due to the physical space needed for these construction activities. This would mean that a farmer would not have access to a part of his/her land for the cultivation and/or harvesting of crops for the duration of the construction activities, which in turn would result in a temporary loss of income for that portion of the land. Where crops are cleared for the servitude, this would have an economic impact on the farmer as a result of a reduced harvest. However, normally the loss of cultivated land is considered during the negotiation process and included in the compensation amount payable to the landowner.

Grazing land

As is the case with cultivated land, a temporary loss of grazing land can also be expected during the construction phase due to the physical space needed for the construction activities. This would mean that a farmer would not have access to a part of his/her grazing land for the duration of the construction activities, which might have planning and economic implications.

An assessment of these category 1 impacts was conducted through the use of the assessment criteria to determine the significance of each of the identified issues, as per Table 70 below.

TABLE 70: CONSTRUCTION & DECOMMISSIONING PHASES: GEOGRAPHICAL CHANGE PROCESSES CATEGORY 1 IMPACT ASSESSMENT

	Significance		*Spatial*		*Duration*		*Degree of Probability*		*Degree of Certainty*	*Risk*		*Status*
PRE-MITIGATION												
Temporary loss of cultivated land	*High*	*4*	*Study area*	*2*	*Short term*	*2*	*Very likely*	*4*	*Probable*	*2.16*	*Moderate*	*Negative*
Temporary loss of grazing land	*Moderate*	*3*	*Study area*	*2*	*Short term*	*2*	*Could happen*	*3*	*Probable*	*1.38*	*Low*	*Negative*
POST MITIGATION												
Temporary loss of cultivated land	*Moderate*	*3*	*Study area*	*2*	*Short term*	*2*	*Could happen*	*3*	*Probable*	*1.38*	*Low*	*Negative*
Temporary loss of grazing land	*Low*	*2*	*Study area*	*2*	*Short term*	*2*	*Could happen*	*3*	*Probable*	*1.2*	*Low*	*Negative to Neutral*

MITIGATION MEASURES

Cultivated Land:

- ***Compensation for the temporary loss of cultivated land should be included in the negotiation process with the landowner.***
- ***Initial servitude clearing on the farmland should take place after the harvesting season, as far as possible. Landowners should be compensated for the loss of cultivated land.***
- ***The area should be rehabilitated upon completion of the construction activities to ensure that the land is returned in the same condition as prior to the construction activities.***

Grazing Land:

- ***Mitigation measures should be implemented to avoid any negative impact on animals (e.g. fencing off the construction area).***
- ***Eskom or its appointed contractor(s) should assist with the temporary relocation of livestock during construction, as well as relocating cattle back to their original grazing area once construction in an area is completed.***
- ***Grazing areas should be rehabilitated to their original grazing conditions to ensure that cattle can continue to graze in the area once they are returned to that area.***
- ***Where the area cannot be rehabilitated to its original condition within a reasonable period of time, Eskom or its appointed contractor(s) should provide funding to obtain alternative food sources to the farmer for the time period required for natural rehabilitation to occur within the grazing area.***

Expected Economical Change Processes and Resultant Impacts

Economical change processes relate to the changes brought about to the employment and general economic profile of the area as a result of the introduction of any development. Employment creates a source of income, which in turn enables the employed individual to access services and a support mechanism for his/her family, thereby enhancing not only the individual's quality of life, but also that of his/her household.

Table 71 below provides an overview of the expected change process as well as the expected impacts that might occur as a result of the change process taking place.

TABLE 71: ECONOMICAL CHANGE PROCESSES

ECONOMIC CHANGE PROCESSES				
Expected Change Process		***Yes***	***No***	***Expected Impact***
Increase in division between rich and poor	***Will the development exacerbate class equalities?***		***X***	***No impact foreseen.***
Enhanced / reinforced economic inequities	***Will the development enhance or enforce class inequality?***		***X***	***No impact foreseen.***
	Will the development deny or enhance economic opportunities for vulnerable communities?	***X***		***Unskilled labour, such as bush clearance, might be sourced from the local area thereby creating job and income opportunities.***
	Will the project create different levels of economic opportunity?	***X***		***Depending on the skills levels required, it is believed that different skills levels will have differently structured salary packages, thereby creating lower income to higher income opportunities.***
	Will the employment opportunities created by the development be sustainable?		***X***	***It is believed that most of the employment opportunities would be restricted to the construction phase.***
Change in the commercial / industrial focus of the community	***Will the development change the income generating focus of the community?***		***X***	***No impact foreseen.***
	Do residents have the required skills, life experience and		***X***	***No impact foreseen.***

ECONOMIC CHANGE PROCESSES				
Expected Change Process		***Yes***	***No***	***Expected Impact***
	contextual understanding to benefit from the proposed development?			
	Will a change in economic focus associated with the development have repercussions for social cohesion?		*X*	*No impact foreseen.*
Change in employment equity of vulnerable groups	*Are vulnerable groups able to take advantage of changed employment opportunities associated with the development?*	*X*		*Unskilled labour, such as bush clearance, might be sourced from the local area thereby creating job and income opportunities.*
	Will vulnerable groups have to compete with more appropriately qualified applicants from elsewhere?	*X*		*The required skills might not be available in the local area, which means that the appropriate skills might have to be 'imported', thereby causing a reduction in the job and income opportunities available to local residents.*
Change in occupational opportunities	*Will the development lead to an increase or decrease in employment opportunities?*	*X*		*An increase in employment opportunities is expected.*
	Will the development create different levels and types of employment?	*X*		*Employment opportunities will range from unskilled to highly skilled positions.*
	What types of skills will the development require?			*Skilled workers would be required.*
Land acquisition and disposal, including cost of land	*Will the development lead to a significant increase in the cost of land/property in the area?*	*X*		*Visibility of transmission line could affect the property value in some areas, although a decrease is expected as opposed to an increase in property value.*
	Will the development result in an increase of land/property prices?	*X*		*No impact foreseen.*

ECONOMIC CHANGE PROCESSES				
Expected Change Process		***Yes***	***No***	***Expected Impact***
	Will the increase in land/property prices exacerbate class and race inequity?		***X***	***No impact foreseen.***

The economical change processes that are expected to result in Category 1 impacts, which are defined as those impacts that are not expected to differ between the proposed alternatives, during this phase of the project are as follows:

- Compensation for servitude;
- Direct formal employment opportunities to local individuals; and
- Indirect formal and/or informal employment opportunities to local individuals.

These change processes will be discussed separately together with a detailed assessment of the expected impact as a result of the change processes taking place. No category 2 impacts are foreseen during this stage of the project.

Compensation for servitude

Eskom pays a once-off amount to landowners for right of way in the servitude of 55m per 400 kV line. Compensation is also paid for the potential loss of livelihood as a result of the servitude. Normally compensation is calculated based on current market related land values, after which Eskom would offer 100% of the value of the land. Should the lines take up more than 50% of the land, Eskom will offer to buy the farm out (personal communication, Eskom). The value of the servitude to be negotiated is calculated by multiplying the area of the servitude required from the land owner with the valuator’s unit price. The impact of financial gain should be long-term, because although a once-off amount is paid, this amount is deemed to reflect the lifelong economic effect. However, land owners are increasingly insisting on an annual access fee, which should be revised annually.

The financial gain is seen as a positive impact. The servitude is negotiated within a corridor (of up to 500 m wide) approved by the DEAT. Some modification of the proposed line alignment is possible within this approved corridor, but significant modification in the alignment will be subject to additional environmental review. Effective mitigation measures could result in a servitude which satisfies both parties.

However, the final status of the impact is dependant on the negotiation process. A transparent negotiation process that leads to a positive outcome (i.e. both parties are satisfied with the agreement) will have a positive impact. A breakdown in negotiations would lead to a negative impact in terms of a lengthy legal process that can either lead to an alternative route for the Transmission power line or the expropriation of land for the servitude. In this instance the project will be severely delayed. If there is a breakdown in the negotiation process, the potential impact would be high levels of frustration as a result of the litigation process and the resultant delay in construction, as well as the potential for a perceived economic loss for both parties.

It is furthermore difficult to determine the significance post mitigation as Eskom has no control over how a particular landowner would invest the money and therefore a post-mitigation assessment has not been conducted.

Direct formal employment opportunities to local individuals

It is believed that only a very limited number of local individuals within the study area could potentially be employed during construction. This is due to the fact that mostly skilled or semi-skilled labour is required during construction. Due to the skills levels required for the actual construction of the Transmission power lines, it is not foreseen that a large number of local labourers will be engaged in the construction phase.

However, if more than one construction team is utilised on various sections of the Transmission power lines, it is believed that more people will benefit from the employment opportunities created through this process, albeit on a shorter term. It is highly recommended that local individuals should be employed for work components that do not require a substantial amount of skill, e.g. foundation excavation, vegetation clearance, erection of gates, cleaning services, and security guards.

In construction projects commissioned by government, employment requirements usually include gender quotas, youth quotas and quotas for local labour to be employed during the project. In addition, a certain proportion of time for which construction workers are paid should be spent on skills development initiatives. According to the Human Resource Manager of the South African Federation of Civil Engineering Contractors (SAFCEC), the current norm in this industry is to use between 50–70% local labour during construction. This should be used as a guideline by Eskom as far as possible.

Although job opportunities are viewed as a positive impact, the fact that the job opportunities are only temporary in nature limits the extent of such a positive impacts in view of the fact that the economic relief and the associated impacts would only be temporary in nature. This impact also depends on the timeframe of the project.

Indirect formal and/or informal employment opportunities to local individuals

Indirect informal job opportunities mainly relate to services that are not directly linked with the construction activities, e.g. domestic services, food stalls, etc., either at the construction village or the construction site. However, the size, nature and location of the construction village (if used) as well as the construction site, together with the number of construction workers and other employees at either the construction village or the construction site respectively, will determine the extent of the services required. In general, informal job opportunities are expected to be limited.

Another potential opportunity is the rental of land for the accommodation of the construction workers and storage of equipment in return for financial compensation, albeit confined to the landowner. Housing construction workers within local communities and the use of local contractors to supply material should be considered as this increases the economic investment into the affected area.

An assessment of these category 1 impacts was conducted through the use of the assessment criteria to determine the significance of each of the identified issues, as per table 8a below.

TABLE 72: CONSTRUCTION & DECOMMISSIONING PHASE: ECONOMICAL CHANGE PROCESSES CATEGORY 1 IMPACT ASSESSMENT

	Significance		Spatial		Duration		Degree of Probability		Degree of Certainty	Risk		Status
PRE-MITIGATION												
Compensation for servitude	Moderate	3	Isolated	1	Incidental	1	Going to happen	5	Definite	1.7	Low	Positive
Direct formal employment opportunities to local individuals	Low	2	Local	3	Short term	2	Could happen	3	Possible	1.38	Low	Positive
Indirect formal and/or informal employment opportunities to local individuals	Low	2	Local	3	Short term	2	Could happen	3	Possible	1.38	Low	Positive
POST MITIGATION												
Compensation for servitude	-	-	-	-	-	-	-	-	-		-	-
Direct formal employment opportunities to local individuals	Moderate	3	Local	3	Short term	2	Could happen	3	Possible	1.62	Low	Positive
Indirect formal and/or informal employment opportunities to local individuals	Moderate	3	Local	3	Short term	2	Could happen	3	Possible	1.62	Low	Positive

MITIGATION MEASURES

Compensation:

- Compensation (not necessarily in the form of monetary compensation) to individuals who are residing in informal settlements within the servitude should be considered. However, this issue should be approached with caution as this might set a precedent for future projects (people might deliberately move onto the servitude for

Direct formal employment:

- Unskilled job opportunities should be afforded to local residents. Local trade unions could assist with the recruitment process to counteract the potential for social mobilisation.
- Equal opportunities for employment should be created to ensure that the local female population also have access to

Indirect formal and/or informal employment:

- Where possible, formalise informal job opportunities (e.g. the provision of services such as food) at the construction site and/or camp. The formalisation process could include issuing permits to vendors and removing non-permitted individuals as a way to reduce the potential for conflict amongst vendors and to curb loitering at the site and/or camp.

the purpose of receiving compensation). • *The land valuator should be experienced in valuating the land in question.* • *The process should be conducted with the necessary respect, and the negotiator should be transparent about the process and expectations (do not engage in "empty promises").* • *The negotiation should be done for the whole servitude and not part of the servitude.* • *Contracts should be reviewed by an independent body.* • *Land owners should be made aware that a pre- and post evaluation of their land value is possible.* • *In the case of tribal authorities, Eskom should consider establishing a trust fund in consultation with the tribal authority (as a form of compensation) for the community that is jointly administrated by Eskom and the tribal authority. Community development projects can then be funded from the trust fund, which would aid sustainable development in the area.*	*these opportunities. Females should be encouraged to apply for positions.* • *Individuals with the potential to develop their skills should be afforded training opportunities. Eskom or its appointed contractors should be involved in this process.* • *Mechanisms should be developed to provide alternative solutions for creating job security upon completion of the project. This could include formal and/or informal training on how to look for alternative employment, information on career progression, etc. to ensure that people are equipped to seek other jobs with the skills that they have gained.* • *Payment should comply with applicable Labour Law legislation in terms of minimum wages.* • *Where local labourers are employed on a more permanent basis, cognisance should be taken of the Labour Law in terms of registering the worker with the Unemployment Insurance Fund (UIF), Pay as You Earn (PAYE), workman's compensation and all other official bodies as required by law. This would enable the worker to claim UIF as a means of continuous financial support when the worker's position on the construction team has either become redundant or once the construction phase comes to an end.* • *Avoid employing foreign labour on the project. Immigrants are seen to be "taking" jobs or trading opportunities needed by South Africans - often at lower rates of pay or by evading trading regulations.*	• *Identify the segment of the local community that might benefit from informal indirect opportunities, and assist them with skills development and subsidise sustainable initiatives.* • *Encourage construction workers to use local services.* <

Expected Empowerment and Institutional Change Processes

Negotiation for land is a change process on legal and empowerment level. The same applies to the stakeholders that will be involved in the public participation process. The EIA process is an opportunity for these stakeholders to give input into the process and project. However, stakeholders would have to offer up their time to become actively involved in the process and they should clearly understand their rights in terms of the process to enable them to use these rights.

Attitude formation may start during the EIA process. Attitude formation is a change process, and not an impact. Attitude formation might result in delays in project implementation, which might result in secondary impacts such as economic impacts.

Table 73 below provides an overview of the expected change process as well as the expected impacts that might occur as a result of the change process taking place.

TABLE 73: INSTITUTIONAL & EMPOWERMENT CHANGE PROCESSES

INSTITUTIONAL AND EMPOWERMENT CHANGE PROCESSES				
Expected Change Process		***Yes***	***No***	***Expected Impact***
Change in / disruption of power relationships	***Will the development impact on the levels of power, opportunity and access of individuals or sections of the community, e.g. during the negotiation process?***	***X***		***A breakdown in the negotiation process could severely delay the project and result in an economic impact on both the landowner as well as on Eskom.***
	Is the development being used for the political gain of a section of the community, and what are the implications for the larger social environment?		***X***	***No impact foreseen.***
Exclusivity	***Will the development contribute to the culture of exclusivity?***		***X***	***The development would create economic growth through the availability of electricity, which has been assessed in table 8b.***
Inequality	***Will the development increase unequal access to opportunities or resources?***		***X***	***The development will enhance more equal opportunities to resources as services become available, as assessed in table 8b.***
Change in community	***Will the development change any aspect of community infrastructure,***		***X***	***No impact foreseen.***

INSTITUTIONAL AND EMPOWERMENT CHANGE PROCESSES				
Expected Change Process		***Yes***	***No***	***Expected Impact***
infrastructure	***such as crèches, clinics, schools, churches, formal or informal sports fields, open areas, dumping grounds etc?***			
	Will the development create increased demand for basic services, e.g. water, electricity, sewerage, roads?	***X***		***Additional demand on municipal services could impact on health if such services are not available.***
	Will the existing access of the community to basic services be impacted by the development?	***X***		***Additional demand on municipal services could impact on health if such services are not available.***
Change in housing needs / demands	***Will the development create a housing need, e.g. due to the in-migration of construction workers?***		***X***	***No impact foreseen.***
	Has the need for more housing been addressed by the development and or the authorities?			***Not applicable.***

The economical change processes that are expected to result in Category 1 impacts, which are defined as those impacts that are not expected to differ between the proposed alternatives, during this phase of the project are as follows:

- Negotiation process; and
- Additional demand on municipal services.

These change processes will be discussed separately together with a detailed assessment of the expected impact as a result of the change processes taking place. No category 2 impacts are foreseen during this stage of the project.

Negotiation process

The negotiation process is undertaken directly by Eskom and is independent of the EIA process. Eskom should determine in consultation with the landowners who should form part of this process and then ensure that all the relevant parties are present. Important points relating to the negotiation process are discussed in Appendix Q.

The results of a study conducted by MasterQ Research (2007) identified the differences amongst landowners in negotiation skills and knowledge as one of the weaknesses in the negotiation process. In addition, it seemed that the perception amongst certain stakeholders who participated in the study was that landowners with more money had more negotiating power. For example, during the negotiations for the Matimba-Witkop Nr. 2 400 kV transmission power line, one landowner managed the moving of an existing line to the edge of his land before he agreed to the construction of the second line. However, this landowner was held responsible for the financial implications of the moving of the line.

If negotiations are not handled with the necessary sensitivity the impact of this process can be severely negative, i.e. a deadlock in negotiations resulting in an indefinite delay of the project. It would normally be preferable that the negotiation process begins after the EIA has been completed. At this stage there is greater confidence in the appropriateness of the site, and it would be supported by environmental authorisation. Although Eskom has the right to engage with any landowner at any time, they do so at risk if environmental authorisation has not been awarded.

Additional demand on municipal services

Additional municipal services will be required at the construction site and the construction village during the construction phase. The additional demand on municipal services causes a slight concern as it would appear that, in some cases, the supply of these services are lacking, e.g. electricity is not well supplied throughout the area.

If a construction village is not managed properly, it may lead to a lack of adequate water as well as unhygienic conditions in the case of waste and sanitation services. This in turn could lead to waterborne diseases that will not only affect the construction worker, but could also spread to the local community.

An assessment of this category 1 impact was conducted through the use of the assessment criteria to determine the significance of the identified issue, as per table 11a below.

TABLE 74: CONSTRUCTION & DECOMMISSIONING PHASE: INSTITUTIONAL & EMPOWERMENT CHANGE PROCESSES CATEGORY 1 IMPACT ASSESSMENT

	Significance		*Spatial*		*Duration*		*Degree of Probability*		*Degree of Certainty*	*Risk*		*Status*
PRE-MITIGATION												
Negotiation process	*High*	*4*	*Study area*	*2*	*Short term*	*2*	*Going happen*	*5*	*Possible*	*2.7*	*Moderate*	*Depends on the outcome of the negotiation process*
Additional demand on municipal services	*Moderate*	*3*	*Study area*	*2*	*Short term*	*2*	*Could happen*	*3*	*Possible*	*1.38*	*Low*	*Negative*
POST MITIGATION												
Negotiation process	*High*	*4*	*Study area*	*2*	*Short term*	*2*	*Going happen*	*5*	*Possible*	*2.7*	*Moderate*	*Positive*
Additional demand on municipal services	*Low*	*2*	*Study area*	*2*	*Short term*	*2*	*Could happen*	*3*	*Possible*	*1.2*	*Low*	*Negative*

MITIGATION MEASURES

Negotiation Process:

- **The implementation of a fair and transparent negotiation process, as discussed under Section 2.4.**
- **Negotiations in should be approached with the necessary cultural sensitivity.**
- **Eskom should consider making use of an approved interpreter during the negotiation process to ensure that there are no misunderstandings as a result of language barriers.**

Additional demand on municipal services:

- ***Construction workers should be made aware of the limited capacity of the municipal services network.***
- ***Negotiations with the affected local municipalities must be conducted and a "demand-side management" should be implemented.***
- ***Sufficient portable chemical toilets should be provided on site and at the construction village. These must be regularly maintained and serviced.***
- ***Contractors should ensure adequate sanitation services (e.g. showers) at the construction village with effective drainage facilities to ensure that used water is appropriately treated and carried away from the site.***

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Expected Social-Cultural Change Processes and Resultant Impacts

Socio-cultural change processes that are associated with the construction and operation of the proposed project include changes to aspects such as health and safety and sense of place. In a social sense, it should be noted that the concept of 'health' is not only limited to physical health (i.e. the absence of ailments or illness), but also includes mental and social health. The expected changes that can occur in relation to health and safety aspects can be as a result of the presence of the proposed transmission power line and its associated infrastructure during operation, as well as the presence of construction workers and/or job seekers during construction.

The significance of the impacts of socio-cultural changes is difficult to determine on a prospective basis and are dependent on the demographic profile of, for example, construction workers and whether or not such differences affected local residents. For example, if construction workers were from a different cultural background than locals, conflict can be expected is such different cultural backgrounds are not respected. Conflict as a result of cultural differences or community disintegration as a result of the acceptance of construction workers' culture might occur – should the demographic profile of these construction workers be different, and should it matter to the communities involved.

Table 75 below provides an overview of the expected change process as well as the expected impacts that might occur as a result of the change process taking place.

TABLE 75: SOCIO-CULTURAL CHANGE PROCESSES

SOCIO-CULTURAL CHANGE PROCESSES				
Expected Change Process		***Yes***	***No***	***Expected Impact***
Disruption of social networks	***Will the development impact on existing social networks?***		***X***	***No impact foreseen.***
Disruption in daily living and movement patterns	***Will the development change the lifestyle of residents?***		***X***	***No impact foreseen.***
	Will the development impact on access to facilities and resources, such as schools, hospitals, fields, forests, etc?		***X***	***No impact foreseen.***
	Will it impact on movement patterns, such as pedestrians crossing roads?	***X***		***Impact of construction activities on movement patterns of local communities, potentially impacting on safety and ease of movement.***
	Will it divide communities physically (e.g. through the		***X***	***No impact foreseen.***

SOCIO-CULTURAL CHANGE PROCESSES				
Expected Change Process		**Yes**	**No**	**Expected Impact**
	building of a highway)?			
Dissimilarity in social practices	*Do new residents have dissimilar social practices to current residents?*		X	*No impact foreseen.*
	Do the new residents have different values, religious practices, social standard, etc?		X	*No impact foreseen.*
Alteration in family structure	*Could the development threaten family cohesiveness?*	X		*Socially acceptable integration, including the risk of spreading STIs and HIV/AIDS with an impact on health. The spread of STI and HIV is a matter of great concern, also in view of the light that construction workers move out of the area into another area where the spread of these STI and HIV continues. Apart from the obvious health implications, HIV infection in particular also has an economic impact.*
	Could it impact on immediate or extended family networks?	X		
	Could it impact on the traditional roles played by members of the family?	X		
Conflict	*Will the development lead to conflict between sectors of the social environment?*	X		*If social integration between newcomers and residents is hindered, it can lead to conflict, which in turn delays the construction process and has economic implications for the developer.*
	Is there conflict between the developer and the public?		X	*No impact foreseen.*
	Is this conflict being addressed?			*Not applicable.*
Safety and crime impacts	*Will the development impact on existing crime and safety patterns?*	X		*Presence of construction workers and job seekers leads people to believe that there will be an increase in crime, which impacts on surrounding landowners' sense of safety and security.*
Change in sense of place	*Will the development impact on people's "sense of place", e.g. through the large scale development of a rural community?*	X		*As the transmission power line might impact on people's perception of safety, these people might now feel unsafe in the area knowing that such infrastructure*

SOCIO-CULTURAL CHANGE PROCESSES				
Expected Change Process		***Yes***	***No***	***Expected Impact***
	Will the change "in sense of place" impact on people's relationship to the environment?	***X***		***is in close proximity to their houses. The presence of such a line also has a visual impact, changing the landscape from unspoilt to 'spoilt'.***
Implications for social history	***Does the development have any implications for the social history of affected communities?***		***X***	***No impact foreseen.***
	Will the development further marginalise communities that have been relocated during apartheid?		***X***	***No impact foreseen.***
	Will the development affect processes, structures or patterns that are valued as part of the social history of an area?		***X***	***No impact foreseen.***
Change in leisure opportunities	***Will the development impact on access to existing leisure opportunities?***	***X***		***Linked to 'sense of place'.***

The socio-cultural change processes that are expected to result in Category 1 impacts, which are defined as those impacts that are not expected to differ between the proposed alternatives, during this phase of the project are as follows:

- Integration with local community;
- Health;
- Safety and security; and
- Construction noise.

These change processes will be discussed separately together with a detailed assessment of the expected impact as a result of the change processes taking place. No category 2 impacts are foreseen during this stage of the project.

Integration with local community

This change process relates to the ease with which construction workers integrate into the local community and the ease with which the local community accepts the presence of the construction workers. If integration is hindered, it can lead to conflict, e.g. due to cultural differences.

Conflict can take place on multiple levels. Firstly, inter-conflict between the construction workers and the local community in terms of job opportunities and where the local community perceives the construction workers as competing for housing opportunities. Secondly, intra-conflict between construction workers themselves in terms of housing offered, and potentially in terms of salary packages. In a construction village conflict might be more intense due to the concentrated living and working conditions of the construction workers.

Where conflict is not resolved quickly and efficiently, it could give rise to labour strikes, site lock-outs, etc, which in turn delays the construction process and has clear economic implications for the developer. Not only does the contractor have to pay for the labour during the days of a legal strike, but they might also be required to acquire the services of a mediator in an attempt to resolve the issues.

Health

Construction workers form part of a significant section of the population known as migratory workers. The social cultural issues associated with this section of the population have been thoroughly researched. Due to their unique situation, construction workers engage in behaviour that makes them vulnerable, such as risky sexual behaviour (e.g. unprotected sex) and destructive behaviour (e.g. alcohol abuse, damaging the environment), which could be explained by their migratory status. When they are separated from their homes, they are also distanced from traditional norms, prevailing cultural traditions and support systems that normally regulate behaviour within a stable community. In addition, it might also be that construction workers who are faced with dangerous working conditions and the risk of physical injury might be more preoccupied by immediate (direct) risks and therefore tend to disregard salient (more indirect) risks, such as HIV infection. Again, it is likely that HIV transmission occurs, as the local population might be uneducated about the risk and transmission of HIV and would therefore more easily engage in risky behaviour as a result of ignorance.

Construction workers’ situations seem to make them vulnerable to high-risk sexual behaviour. There are ample research results to indicate that there is a direct link between temporary migration and HIV infection. Research also seems to indicate that construction workers might be more at risk of contracting HIV from members of local communities, as opposed to transmitting the infection to community members.

In this context health impacts focus mainly on the spread of certain sexually transmitted infections (STI), including HIV/AIDS. It is not uncommon for construction workers who are separated from their families for a period of time to establish temporary sexual relationships with members of the local community. It can also be expected that sex workers might visit the construction workers at their place of residence. The spread of STI and HIV then becomes a matter of great concern, also in view of the light that construction workers move out of the area into another area where the spread of these STI and HIV continues.

Apart from the obvious health implications, HIV infection in particular also has an economic impact, not only on the local area, but extending to the regional and national context. If viewed within the context of an increase in HIV/AIDS related deaths amongst the economically active individuals, it becomes clear that the workforce might potentially be reduced and that this in turn will affect basic services, as well as the smooth running of an economy.

It is a complex task to understand the macro-economic impact of HIV/AIDS on a country or region. Not only should one consider the direct and indirect costs, but also the loss of human capital and the natural system of developing a generation through the transference of knowledge and skills necessary for development.

Safety and security

Not only do health issues impact on communities, but the physical safety of communities can also be endangered as a result of the influx of job seekers and construction workers (e.g. potential increase in crime). There is perception that crime increases in an area the moment that construction workers arrive on site. Because of this perception, occurrences of crime during the time of the project are likely to be ascribed to the construction workers. This has a mental health impact, such as fear. However, it should be noted that in most instances it is not the actual construction worker who engage in criminal activities but more likely job seekers who loiter at the site in search of employment.

Construction noise

A constant high level of noise has a prolonged detrimental effect on a person's general well-being and functioning. People living in close proximity to a construction site will be exposed to such a constant level of noise generated by the construction activities taking place.

The experience of the increase in noise levels because of the construction village will differ from person to person. Griffiths (1983) is of the opinion that as long as a stimulus remains the same, the impact of noise would not decrease. He referred to studies on noise pollution where habituation (people getting used to the noise in an area) had not taken place approximately 2 years after a new road had been opened. De Jong (1990) is further of the opinion that people's resistance to noise levels seems to be decreasing, despite the fact that there was no change in their environment that could add to the noise levels. He termed this finding "psychological sensitisation".

An assessment of these category 1 impacts was conducted through the use of the assessment criteria to determine the significance of each of the identified issues, as per table 14a below.

TABLE 76: CONSTRUCTION & DECOMMISSIONING PHASE: SOCIO-CULTURAL CHANGE PROCESSES CATEGORY 1 IMPACT ASSESSMENT

<	*Significance*		*Spatial*		*Duration*		*Degree of Probability*		*Degree of Certainty*	*Risk*		*Status*
PRE-MITIGATION												
Integration with local community	*Moderate*	*3*	*Local*	*3*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*1.38*	*Low*	*Negative*
Health	*High*	*4*	*National*	*5*	*Long term*	*4*	*Could happen*	*3*	*Possible*	*2.58*	*Moderate*	*Negative*
Safety and security	*Low*	*2*	*Local*	*3*	*Short term*	*2*	*Could happen*	*3*	*Possible*	*1.38*	*Low*	*Negative*
Construction noise	*Moderate*	*3*	*Study area*	*2*	*Short term*	*2*	*Could happen*	*3*	*Possible*	*1.38*	*Low*	*Negative*
POST MITIGATION												
Integration with local community	*Low*	*2*	*Local*	*3*	*Incidental*	*1*	*Unlikely*	*2*	*Possible*	*0.8*	*Very low*	*Negative to Neutral*
Health	*Moderate*	*3*	*National*	*5*	*Long term*	*4*	*Could happen*	*3*	*Possible*	*2.4*	*Moderate*	*Negative*
Safety and security	*Low*	*2*	*Local*	*3*	*Short term*	*2*	*Unlikely*	*2*	*Possible*	*0.92*	*Very low*	*Negative*
Construction noise	*Low*	*2*	*Study area*	*2*	*Short term*	*2*	*Unlikely*	*2*	*Possible*	*0.8*	*Very low*	*Negative*

MITIGATION MEASURES

Integration with local community:	*Health:*	*Safety and Security:*	*Construction noise:*
• *The community should be informed in advance of the influx of construction workers and the time they will spend in the community as well as the activities they will be involved in. This will enable the community to prepare for a possible (temporary) change in functioning.*	• *An aggressive STI and HIV/AIDS awareness campaign should be launched, which is not only directed at construction workers but also at the community as a whole.* • *Condoms should be distributed by placing them at centrally located points and by ensuring that construction workers and*	• *Construction workers should be clearly identifiable. Overalls should have the logo of the construction company on it and/or construction workers should wear identification cards.* • *The construction site should be fenced and access should be controlled by means of a security*	• *Construction activities should be restricted to daytime hours between 06:00 and 18:00.* • *Adjacent property owners should be consulted and notified of any construction activities that could lead to excessive noise levels.* • *Adjacent property owners should also be consulted if any night time construction activities were to take*

• *A code of conduct should be established for construction workers in their dealings with the local community. Creating of awareness on both sides (community and outsiders) is crucial for the success of the project.* • *Potential conflict situations can be reduced beforehand using a transparent recruitment process, i.e. where labourers would be sourced from the local community.* • *A labour desk should be implemented where the local community members could register. A rotary system could be used for unskilled labour to ensure that all job seekers have an equal opportunity to employment.* • *Potential conflict situations within the construction village itself can be managed by means of weekly forum meetings. During these meetings residents should have the opportunity to raise any problems experienced and make suggestions in terms of their living space. Where feasible, these problems and suggestions should be addressed as soon as possible to ensure a conflict-free environment.*	*community members are aware of the availability and location of condoms. The distribution of condoms should be approached with the necessary cultural sensitivity.* • *Access at the construction site should be controlled to prevent sex workers from either visiting and/or loitering at the construction village.* • *Local women should be empowered. This could be achieved by employing them to work on the project, which in turn would decrease their (financial) vulnerability.*	*access point.* • *Loitering of outsiders at the either the construction site or at the construction village should not be allowed. Loiterers at the site should be removed in cooperation with the local branch of the South African Police Service (SAPS).*	*place.*

10.2 Operational Phase

The main impacts during the operatational phase are the electro magnetic field associated with the power lines and the occurrence of the physical structures in the landscape. See *Electric and Magnetic Fields – A summary of Technical and Biological Aspects* (2006). for a detailed discussion regarding the impact of electro magnetic fields.

10.2.1 Geology

Once the power lines are constructed there should be no further impact to geology.

10.2.2 Topography

Once the power lines are constructed there should be no further impact to topography.

10.2.3 Soils, Land Capability and Land Use

The impact assessment does not change from that of the construction phase, refer to section 10.1.3 above.

10.2.4 Surface water

Once the power lines are constructed there should be no further impact to surface water.

10.2.5 Flora

Once the power lines are constructed there should be no further impact to flora.

10.2.6 Fauna

<u>Initial impact</u>

The initial impact remains the same as that calculated for the construction phase in section 10.1.6 above.

<u>Additional impact</u>

While there appears to be no negative impacts associated with electro magnetic fields in Eskom's document, *Transmission Bird Collision Prevention Guideline* (Ref. no.: TGL41-335), the major impact to birds or avi-fauna is in the form of collisions with power lines. In in Eskom's document, *Transmission Bird Collision Prevention Guideline* (Ref. no.: TGL41-335), it was found that the majority of birds affected are large flighted birds, which are also often endangered or threatened species.

These large flighted birds are also long lived, with low breeding rate and often mate for life. Therefore, a single mortality due to a collision with a power line should be viewed as a high impact.

The study area provides habitat or is potential to a number of mammals, birds, reptiles, amphibians and athropods. The initial impact to fauna is due to the loss of habitat and the region also contains threatened bird species such as Blue Crane, White-Bellied Korhaan and Secretary Birds.

TABLE 77: FAUNA ADDITIONAL IMPACT RATING SCALE

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	HIGH	*Regional / Provincial*	Long Term	*Could happen*	Moderate
	4	***4***	**4**	**3**	**2.4**

The additional impact to fauna is HIGH, occurs at *Regional / Provincial* spatial scale and will be Long Term and *Could happen*. This results in a rating of 2.4 and a Moderate impact class.

Cumulative impact

During the operational phase the proposed development will add approximately 100 km of high voltage power lines to the existing network of power lines in the area. The addition is relatively small in consideration of the approximately of existing high voltage powerlines in the area. The cumulative impact to fauna remains a High impact as assessed in the initial impact assessment.

Residual impact

In order to prevent power line collisions from birds, anti-collision devices can be installed to the power lines. These include static, dynamic, reflective and illuminated devices. As mentioned in (Ref bird collision) these devices have however only been reasonably successful and will not complete eliminate the impact or the risk to birds. If the mitigation measures in the reference can be implemented not only on the new lies but also on the existing lines, then the impact can be rated as illustrated in the table below.

TABLE 78: FAUNA RESIDUAL IMPACT RATING SCALE

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	HIGH	*Regional / Provincial*	Long Term	*Unlikely*	Moderate
	4	***4***	**4**	**2**	**2.6**

The residual impact as calculated in Table 78 above, will be HIGH, impact that occurs in the *Regional / Provincial* scale and will be Long Term and is *Unlikely* to occur. A rating of 2.6 is a Moderate impact class.

Once again it must be emphasised the the residual impact is most likely going to be high. Only if the proposed mitigation measures can be implemented on the existing as well as the new power lines will the impact reduce to Moderate.

10.2.7 Visual

If Alternative 1 or 3 are chosen the power lines will form part of the existing visual disturbance in the region. The impact will therefore remain as assessed above in Section 10.1.7. If Alternative 2 is chosen this will be a new impact to a large portion of the route, as the route does not have existing power lines. If this is the case the impact would also be rated as a high impact but the percieved impact would be higher than the other two alternatives.

10.2.8 Archaeology and Cultural Historical Sites

The archaeological and cultural history during the operational phase of the development remains as assessed in Section 10.1.9.

10.2.9 Socio-Economic Environment

The following changes are expected during the operational phase of the proposed project:

- Demographic change;
- Geographic change;
- Economic change;
- Institutional and empowerment change; and
- Socio-cultural change.

The expected changes are discussed below.

Demographic Change Process

The size and composition of the maintenance team will depend on the type of maintenance that would be required on the transmission power line. Maintenance on the servitude involves teams who clear the servitude of any vegetation and/or other structures which may impede on the operation of the transmission power line. Prior to servitude maintenance, the servitude is inspected, either by a ground servitude inspection team or by flying over the servitude. Again the size of the maintenance team is dependant on the actual clearing that has to be done. It is however assumed that, because of the fact that bush clearance is viewed as unskilled labour, local residents could be employed on the bush clearance teams.

In any event it is not foreseen that the presence of maintenance teams would lead to the large scale influx of people to the area as maintenance teams are normally small groups. Therefore, no demographic change processes are foreseen during the operation and maintenance phases.

Expected Geographical Change Processes

The geographical change processes that are expected to result in Category 1 impacts, which are defined as those impacts that are not expected to differ between the proposed alternatives, during this phase of the project are as follows:

- Grazing land;
- Spatial development (future land use); and
- Presence of the transmission power line.

In addition, the following change process that would result in a Category 2 impact, which are those impacts that are expected to cause significant changes between the proposed alternatives, are as follows:

- Cultivated land (including irrigation); and
- Mining.

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

Grazing land

The presence of towers and Transmission power lines on grazing land pose fewer problems, as cattle can move around towers and therefore less land is lost. The portion of land that was used for construction activities is handed back to the landowner upon completion of these activities. Cattle can move freely under Transmission power lines and around towers to graze. The permanent loss of grazing land is therefore not regarded as significant.

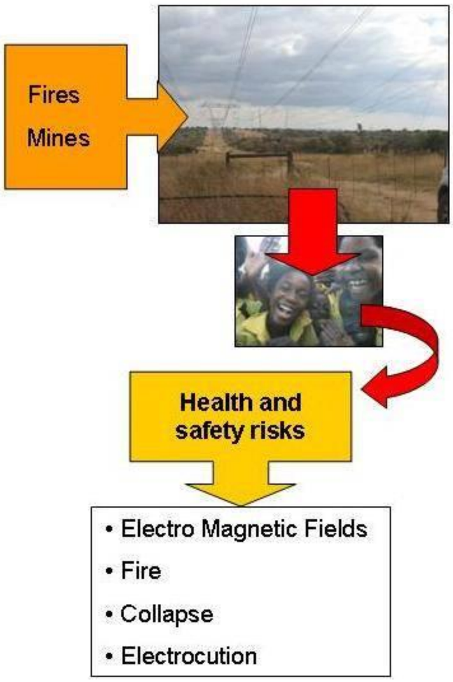
Spatial development (future land use)

Transmission power lines may impact on the development patterns in an area, because structures are not allowed within the servitude. Once a transmission power line is operational, development may occur towards and into the servitude because of normal growth, merging of villages/developments, lack of alternative space, municipal development plans or job expectations because of a project (such as the construction of a transmission power line).

The presence of towers and Transmission power lines could restrict the development plans of local municipalities, as no structures are allowed within the servitude. This would impact on the planning process as development plans would have to be revised to accommodate the presence of a Transmission power line, which would have an economic impact on the municipality. The revision of development plans would also delay developments.

Presence of the Transmission power line

The main social concerns which arise when considering the presence of a transmission power line close to human settlement and potential settlement in the servitude are health and safety aspects as illustrated in the diagram that follows. The intention is that the servitude mitigates these potential health and safety related impacts. Risks are related to Electro and Magnetic Fields (EMF), electrocution, fire and collapse. A line could cause fatal/traumatic accidents because of collapse of a tower and/or lines because of mechanical failure, fire and mining activities. Fire can be caused by of electrical malfunction or human error.



Utilities in South Africa involved in the generation and distribution of electrical energy, are bound by the Occupational Health and Safety (OHS) Act [63] to provide such services in a safe manner. There are currently no regulations (under the Hazardous Substances Act) in terms of exposure to power frequency EMF in South Africa and the International Commission for Non-Ionising Radiation

Protection (ICNIRP) guidelines are used for assessing human exposure to these fields. The guidelines for electric and magnetic field exposure set by the ICNIRP, an organisation linked to the World Health Organisation (WHO), receive world-wide support (Pretorius 2006). To manage the risks, the line runs in a servitude in which buildings, and crops higher than 2-4 meters are not allowed (depending on voltage of the line).

The results of a study commissioned by Eskom Holdings Limited (Pretorius 2006) on the possible health effects of EMF noted the following:

- The main focus of research has been on a possible association between long term exposure to magnetic fields and childhood leukaemia.
- Based on the epidemiological findings, the risk of EMF being a health hazard is small.
- Based on current understanding of the topic, EMF is regarded a possible but not proven cause of cancer.
- The suggestion for this health outcome stems mainly from a fairly consistent pattern of the increased but small risk observed from some epidemiological studies. This finding has not been confirmed by (notably all) controlled laboratory studies.
- No evidence of a causal relationship between magnetic field exposure and childhood leukaemia has been found and no dose-response relationship has been shown to exist between EMF exposure and biological effects.
- A possible explanation for the epidemiological findings may be confounding (a factor other than EMF) or bias (subjects studied are not representative of the target population for which conclusions are drawn) which render the data inconclusive and prevent resolution of the inconsistencies in the epidemiologic data.
- In general, studies of animal reproductive performance, behaviour, milk production, meat production, health and navigation have found minimal or no effects of EMF. The literature published to date has shown little evidence of adverse effects of EMF from overhead power lines on farm animals and wildlife.

It was concluded that electric and magnetic fields with levels typical of a power line environment, complying with the requirements for proper servitude management as prescribed by the electric utility, are unlikely to affect plants in terms of growth, germination and crop production.

Considering electrocution, transmission lines could pose a safety risk. Induced charges can build up on fence wires mounted on wood posts near power lines.[10] This phenomenon is generally restricted to

[10] www.greatriverenergy.com/community/power_line_safety.html

higher voltage lines (200 kV or greater). The magnitude of the build-up depends on a variety of factors:

- The size of the power line;
- The length of fence paralleling the line;
- The distance between the line and the fence;
- The amount of moisture in the fence posts and the ground; and
- The presence of grounding devices such as metal fence posts or weeds growing next to the fence.

An assessment of these category 1 impacts was conducted through the use of the assessment criteria to determine the significance of each of the identified issues, as per Table 79 below.

TABLE 79: OPERATION & MAINTENANCE PHASE: GEOGRAPHICAL CHANGE PROCESSES CATEGORY 1 IMPACT ASSESSMENT

	Significance		*Spatial*		*Duration*		*Degree of Probability*		*Degree of Certainty*	*Risk*		*Status*
PRE-MITIGATION												
Permanent loss of grazing land	*Low*	*2*	*Isolated*	*1*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*0.6*	*Very low*	*Negative to Neutral*
Spatial development (future land use)	*High*	*4*	*Isolated*	*1*	*Long term*	*4*	*Could happen*	*3*	*Possible*	*1.8*	*Low*	*Negative*
Presence of the transmission power line	*Moderate*	*3*	*Study area*	*2*	*Long term*	*4*	*Very likely*	*4*	*Possible*	*2.4*	*Moderate*	*Negative*
POST MITIGATION												
Permanent loss of grazing land	*Very low*	*1*	*Isolated*	*1*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*0.6*	*Very low*	*Neutral*
Spatial development (future land use)	*Moderate*	*3*	*Isolated*	*1*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*0.78*	*Very low*	*Negative*
Presence of the transmission power line	*Low*	*2*	*Study area*	*2*	*Long term*	*4*	*Could happen*	*3*	*Possible*	*1.62*	*Low*	*Negative to Neutral*

MITIGATION MEASURES

Grazing land:	*Spatial development:*	*Presence of the transmission power line:*
• *Where possible, towers should be located on the boundary of the farmland to lessen the loss of grazing land.*	• *Route alignment should avoid both existing and planned settlements, where possible.* • *Route alignment should take cognisance of local development plans.*	• *Education local residents on the real and perceived dangers of living close to a Transmission power line.* • *Maintenance of the servitude in terms of restrictions associated with residences within this area.*

Cultivated land (including irrigation)

Although it is still possible to cultivate land around towers, the presence of a tower does complicate the cultivation process which in some instances could lead to a loss of available land for cultivation.

The presence of a Transmission power line complicates crop spraying by aeroplane and in some instances makes crop spraying from the air impossible due to the fact that the Transmission power lines are in the way.

Furthermore, Electromagnetic Fields (EMF) seems to interfere with Global Positioning System (GPS) equipment and other advanced electronic equipment that is used when ploughing. It has also been reported that Transmission power lines or the resultant EMF interferes with two-way radio systems when these are used in the vicinity of a power line.

In terms of crop irrigation, it is preferable that 400 kV lines do not cross centre pivots, because of the proximity of the water to the Transmission power line. Also, the towers might interfere with sub surface irrigation pipes, and the space needed for the centre pivot. Centre pivots are mostly concentrated around the western alignment, with the closest centre pivot located to the south of the western alignment where the corridor exited the Kendal power station. The edge of this irrigated area is approximately 35m south of the southern edge of the western alignment. In all other instances, the centre pivots and irrigated areas are located at a distance of at least 800m or more away from the alignment.

Figure 85 below gives an indication of the location of the centre pivots. However, it should be noted that this image is *not to scale* and therefore it might appear that the some of the alignments cross through centre pivot areas, which is not the case.

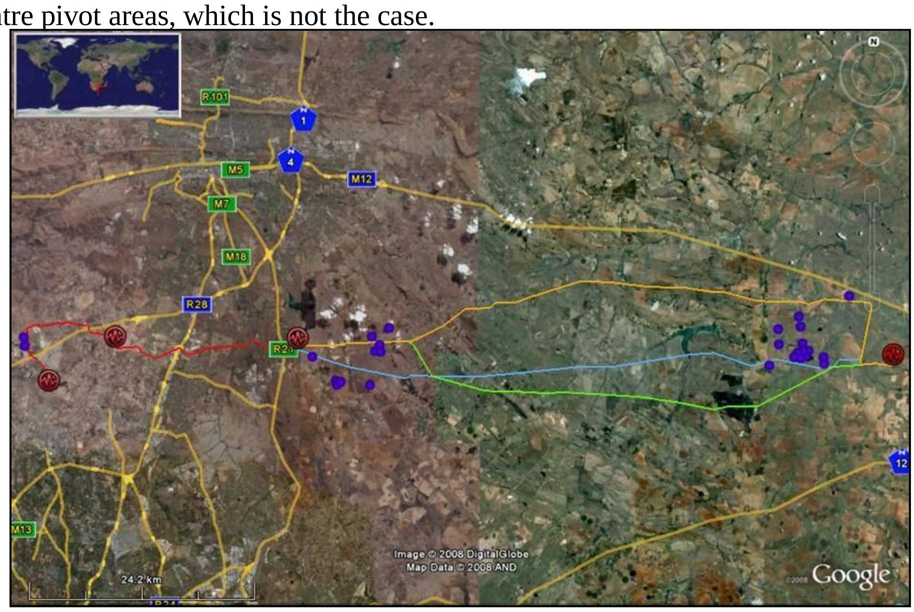


FIGURE 85: LOCATION OF IRRIGATION POINTS (CENTRE PIVOTS) IN RELATION TO CORRIDOR ALTERNATIVES

An assessment of this category 2 impact was conducted through the use of the assessment criteria to determine the significance the impact per alignment, as per Table 80 below.

TABLE 80: OPERATION & MAINTENANCE PHASE: GEOGRAPHICAL CHANGE PROCESSES CATEGORY 2 IMPACT ASSESSMENT: CULTIVATED LAND (INCLUDING IRRIGATION)

	Lulumisa – Minerva Section		Minerva – Apollo Section		Apollo – Bravo Section					
					Northern Alternative		Central Alternative		Southern Alternative	
PRE-MITIGATION										
Significance	Moderate	3	No impact	0	Moderate	3	Moderate	3	No impact	0
Spatial	Isolated	1	n/a		Isolated	1	Isolated	1	n/a	
Duration	Medium term	3	n/a		Medium term	3	Medium term	3	n/a	
Degree of Probability	Could happen	3	n/a		Could happen	3	Could happen	3	n/a	
Degree of Certainty	Possible		n/a		Possible		Possible		n/a	
Risk	1.62	Low		n/a	1.62	Low	1.62	Low		n/a
Status	Negative		n/a		Negative		Negative		n/a	
POST-MITIGATION										
Significance	Low	2	No impact	0	Low	2	Low	2	No impact	0
Spatial	Isolated	1	n/a		Isolated	1	Isolated	1	n/a	
Duration	Medium term	3	n/a		Medium term	3	Medium term	3	n/a	
Degree of Probability	Unlikely	2	n/a		Unlikely	2	Unlikely	2	n/a	
Degree of Certainty	Possible		n/a		Possible		Possible		n/a	
Risk	0.48	Very low		n/a	0.48	Very low	0.48	Very low		n/a
Status	Negative		n/a		Negative		Negative		n/a	

	Lulumisa – Minerva Section	Minerva – Apollo Section	Apollo – Bravo Section		
			Northern Alternative	Central Alternative	Southern Alternative
MITIGATION MEASURES					
• Consultation should take place between the landowner and Eskom to determine the extent of permanent loss of land for cultivation due to the presence of the tower(s). • Upon agreement between the landowner and Eskom, landowners should be compensated for the permanent loss of portions of the land that is unreachable due to the presence of the tower(s). • Where possible, pylons should be located on the border of the farmland to lessen the potential loss of cultivated land. • Alignment should be done in such a way that it is located a safe distance away from centre pivots.					
PREFERRED ALIGNMENT					
< At the time of the study, no irrigation schemes were observed along the southern alternative. There is also only one existing transmission power line along this corridor alternative, which means that less land would be lost than with the northern alternative where there are already two existing transmission power lines.					

Mining

Transmission power lines should avoid mining activities due to the possibility of slumping and underground fires. Also, towers pose a risk to mining activities in the form of towers falling over, with health and safety as well as economic impacts as a result. In turn, the mining activities might also pose a risk to the safety of the Transmission power line; if for example, blasting takes place at the mining operation.

At least 6 existing mining operations have been identified within the study area, which includes the following operations (depicted in Figure 86):

Name of Mining Operation	Type of Operation	Closest Alignment
Unknown	Open cast	Northern portion of mining operation within servitude of section between Lulumisa and Minerva substations
Unknown	Open cast	Approximately 1.4 km east and 1.2km south of section between Lulumisa and Minerva substations
Unknown	Open cast	Entire operation located within servitude of section between Lulumisa and Minerva substations
Unknown	Open cast	Approximately 460m north of section between Minerva substation and Apollo converter station
Unknown	Open cast colliery	Approximately 240m south of northern alignment
Unknown	Open cast	Approximately 680m south of northern alignment and approximately 360m north of central alignment

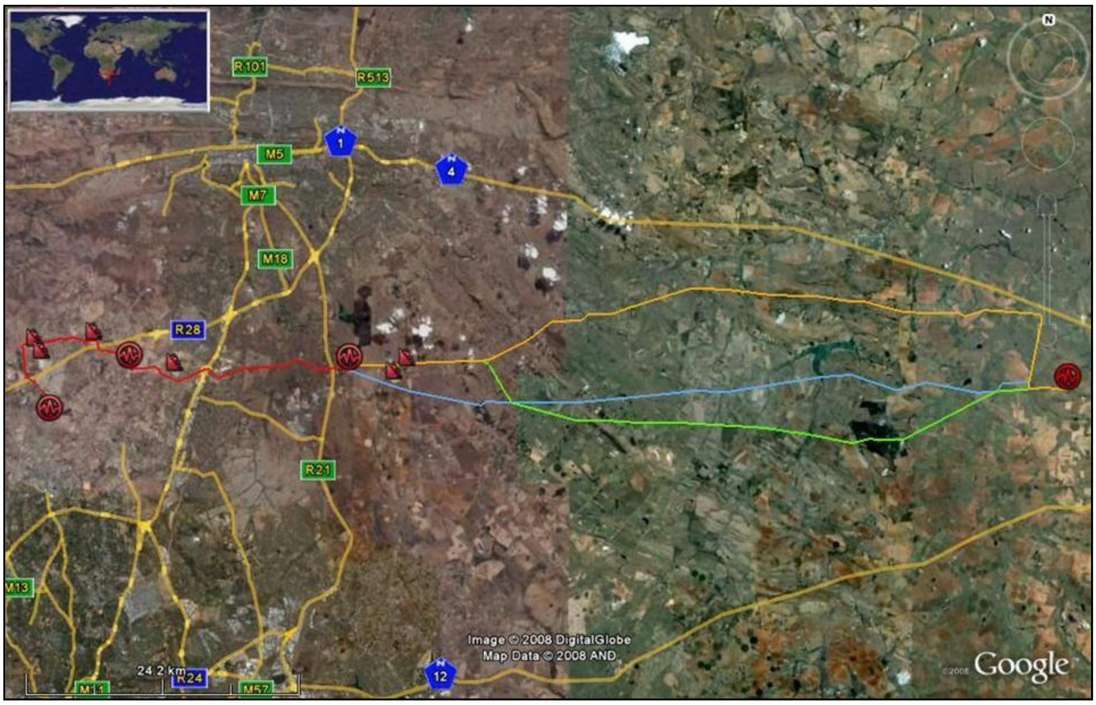


FIGURE 86: LOCATION OF MINING OPERATIONS IN RELATION TO CORRIDOR ALTERNATIVES

Mineral rights holders have rights to the surface area as well as far as they need the surface area to exercise their right to extract minerals. Therefore, any structures on the mineral rights surface areas have to be approved by the holders of these rights.

Blasting takes place on a regular basis at open cast mining areas, as is associated with many of the mines in the area. Therefore mining operations could have a negative impact on the Transmission power line itself due to blasting (i.e. flying rocks that could potentially hit the Transmission power line, leading to breakdowns and an interruption in electricity supply).

An assessment of this category 2 impact was conducted through the use of the assessment criteria to determine the significance the impact per alignment, as per Table 81 below.

TABLE 81: OPERATION & MAINTENANCE PHASE: GEOGRAPHICAL CHANGE PROCESSES CATEGORY 2 IMPACT ASSESSMENT: MINING OPERATIONS

<	*Lulumisa – Minerva Section*		*Minerva – Apollo Section*		*Apollo – Bravo Section*					
<					*Northern Alternative*		*Central Alternative*		*Southern Alternative*	
PRE-MITIGATION										
Significance	*High*	*4*	*Moderate*	*3*	*Moderate*	*3*	*Moderate*	*3*	*No impact*	*0*
Spatial	*Isolated*	*1*	*Isolated*	*1*	*Isolated*	*1*	*Isolated*	*1*	*n/a*	
Duration	*Medium term*	*3*	*Medium term*	*3*	*Medium term*	*3*	*Medium term*	*3*	*n/a*	
Degree of Probability	*Going to happen*	*5*	*Could happen*	*3*	*Could happen*	*3*	*Could happen*	*3*	*n/a*	
Degree of Certainty	*Probable*		*Possible*		*Possible*		*Possible*		*n/a*	
Risk	*2.7*	*Moderate*	*1.62*	*Low*	*1.62*	*Low*	*1.62*	*Low*	*-*	*n/a*
Status	*Negative*		*Negative*		*Negative*		*Negative*		*n/a*	
POST-MITIGATION										
Significance	*Moderate*	*3*	*Low*	*2*	*Low*	*2*	*Low*	*2*	*No impact*	*0*
Spatial	*Isolated*	*1*	*Isolated*	*1*	*Isolated*	*1*	*Isolated*	*1*	*n/a*	
Duration	*Medium term*	*3*	*Medium term*	*3*	*Medium term*	*3*	*Medium term*	*3*	*n/a*	
Degree of Probability	*Very likely*	*4*	*Unlikely*	*2*	*Unlikely*	*2*	*Unlikely*	*2*	*n/a*	
Degree of Certainty	*Probable*		*Possible*		*Possible*		*Possible*		*n/a*	
Risk	*1.84*	*Low*	*0.48*	*Very low*	*0.48*	*Very low*	*0.48*	*Very low*	*-*	*n/a*
Status	*Negative*		*Negative*		*Negative*		*Negative*		*n/a*	

<	Lulumisa – Minerva Section	Minerva – Apollo Section	Apollo – Bravo Section		
<			Northern Alternative	Central Alternative	Southern Alternative
MITIGATION MEASURES					
• Realignment on the Lulumisa-Minerva section to bypass mining operations, notably where the alignment crosses right over an open cast mining area.					
PREFERRED ALIGNMENT					
During the time of the study, no mining operations were observed along the southern alternative.					

Expected Economic Change Process

The economical change processes that are expected to result in Category 1 impacts, which are defined as those impacts that are not expected to differ between the proposed alternatives, during this phase of the project are as follows:

- Direct formal employment opportunities to local individuals;
- Electricity supply and economic growth; and
- Property values.

These change processes will be discussed separately together with a detailed assessment of the expected impact as a result of the change processes taking place. In addition, the following change process that would result in a Category 2 impact, which are those impacts that are expected to cause significant changes between the proposed alternatives, are as follows:

Direct formal employment opportunities to local individuals

It is unlikely that maintenance workers will be sourced from within the local community, due to the skilled nature of the job requirements. Also, it is more likely that Eskom would employ a maintenance team that will cover the entire length of the transmission power lines instead of fragmented maintenance teams that only cover a certain section of these lines. Furthermore, transmission power line maintenance is a highly skilled job seeing as maintenance is normally carried out on live lines to prevent a disruption in the supply.

However, some local individuals may be employed on servitude maintenance teams, but that would to a large extent depend on the appointed servitude maintenance contractor. The number of people involved in a maintenance team depends on the type of maintenance that has to be conducted.

Due to the fact that local community members are unlikely to be employed as transmission power line maintenance team members, no tangible economic impacts are foreseen. Where local community members are used as servitude maintenance workers, this could lead to an economic impact and local social upliftment.

Electricity supply and economic growth

Resources and infrastructure, such as electricity, water and fuel, enables normal economic growth as most economic activities are dependant on a sufficient and steady supply of electricity. Normal economic activities, e.g. industry and businesses, are affected when electricity is not available. The economic impact on such services increases the longer services such as electricity is unavailable.

The proposed transmission power line would enhance the electricity supply to the local area, thereby stimulating economic growth through the establishment and/or expansion of businesses and industries. This in turn creates additional employment opportunities, which further enhances economic growth, permitting a positive economic impact to filter down to a more grassroots level.

Property Values

When considering the impact of a transmission power line on property values, the following must be considered:

- The location of the transmission power line (e.g. on the border, through the middle, or cutting a corner of a property);
- The location of transmission power line towers;
- The type of towers used;
- The presence of existing transmission power lines; and
- The presence of any visual mitigation.

In the case of the section between the Minerva substation and the Apollo converter station, the proposed transmission power line will follow an existing corridor that currently contains either 5 existing transmission power lines depending on location along the route. The corridor runs between residential property estates, but it is however, envisaged that lines will not cross properties and that there is no requirement for towers to be located on residential properties. The current proximity of transmission power lines also means that the value implications of their presence will in general already be reflected in values for residential properties in proximity to the transmission power line.

An exception may be applied to a number of properties bordering the corridor on the south as the proposed transmission line will be placed on the southern side of the corridor. This will decrease the distance between a transmission power line and adjacent properties from approximately 100-60m to approximately 60-30m, which may cause a slight decrease in property value for the bordering properties of approximately 5-10%.

An assessment of these category 1 impacts was conducted through the use of the assessment criteria to determine the significance of the identified issue, as per Table 82 below.

TABLE 82: OPERATION & MAINTENANCE PHASE: ECONOMICAL CHANGE PROCESSES CATEGORY 1 IMPACT ASSESSMENT

	Significance		*Spatial*		*Duration*		*Degree of Probability*		*Degree of Certainty*	*Risk*		*Status*
PRE-MITIGATION												
Direct formal employment opportunities to local individuals	*Low*	*2*	*Study area*	*2*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*1.02*	*Low*	*Positive*
Electricity supply and economic growth	*High*	*4*	*Regional*	*4*	*Medium term*	*3*	*Very likely*	*4*	*Probable*	*2.96*	*Moderate*	*Positive*
Property values	*High*	*4*	*Study area*	*2*	*Medium term*	*3*	*Very likely*	*4*	*Probable*	*2.4*	*Moderate*	*Negative*
POST MITIGATION												
Direct formal employment opportunities to local individuals	*Moderate*	*3*	*Study area*	*2*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*1.2*	*Low*	*Positive*
Electricity supply and economic growth	-	-	-	-	-	-	-	-	-	-	-	-
Property values	*Moderate*	*3*	*Isolated*	*1*	*Medium term*	*3*	*Could happen*	*3*	*Probable*	*1.38*	*Low*	*Negative*

MITIGATION MEASURES		
Employment opportunities: • ***Individuals with the potential to develop their skills should be afforded training opportunities. Eskom should be involved in this process.*** • ***Make use of local labour on unskilled maintenance components, such as servitude***	***Electricity supply and economic growth:*** < ***None.***	***Property values:*** • ***Implementation of visual mitigation measures as proposed in the Visual Impact Assessment.***

maintenance. • ***Where local labourers are employed on a more permanent basis, cognisance should be taken of the Labour Law in terms of registering the worker with the Unemployment Insurance Fund (UIF), Pay as you earn (PAYE), workman's compensation and all other official bodies as required by law. This would enable the worker to claim UIF as a means of continuous financial support when the worker's position on the construction team has either become redundant or once the construction phase comes to an end.***		

Expected Institutional and Empowerment Change Process

An increase in the availability of electricity to the local area has been identified as an institutional and empowerment change process that can be expected during the operational and maintenance phase of the project. This issue has been assessed under "electricity supply and economic growth".

Expected Socio-cultural Change Process

The geographical change processes that are expected to result in Category 1 impacts, which are defined as those impacts that are not expected to differ between the proposed alternatives, during this phase of the project are as follows:

- Movement of maintenance workers;
- Physical splintering; and
- Third party tampering.

In addition, the following change process that would result in a Category 2 impact, which are those impacts that are expected to cause significant changes between the proposed alternatives, are as follows:

- Sense of place.

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

Movement of maintenance workers

As is the case with construction workers, a lack of control over the movement patterns of maintenance workers is a source of concern to landowners. Furthermore, landowners are concerned about the fact that they seem to lose control over who has access to their property and who has not. Again, there is perception that crime increases in an area the moment that maintenance workers arrive on site, more so in terms of servitude maintenance workers as with actual Transmission power line maintenance workers. Because of this perception, occurrences of crime during the operational lifetime of the project are likely to be ascribed to the maintenance workers.

Physical splintering

It is unlikely that the presence of a Transmission power line would splinter communities, seeing as people can still move freely underneath a Transmission power line. However, the perception that a Transmission power line is dangerous might prohibit people from moving around or underneath the line, but it is foreseen that this would mostly be on an individual basis based on personal perception and would therefore not affect the collective community.

Third party tampering

If third party tampering occurs, it would most probably be in the form of cable theft, which is an extremely high risk criminal activity with the probability and occurrences of accidental electrocution. Although cable theft, from a technical point of view, is not possible on a 400 kV line, the possibility that someone would attempt cable theft out of ignorance cannot be excluded. An uninformed person only sees a Transmission power line and does not necessarily take cognisance of the size of the Transmission power line.

According to the Opportunity Model of Cohen, Kleugel and Land (in Snyman, 2007), there are five factors that indicate the probability of risk of victimisation. The basic underlying principle of the Opportunity Model is that the daily operations and physical location of the Transmission power line not only brings it into direct contact with potential offenders, but that capable guardians are also absent. To curb such vulnerability it is further important that Eskom establish a trusting relationship with residents as these residents can act as informants and social protectors of the Transmission power line.

The Opportunity Model moves away from the characteristics of the potential offender and his/her motivation, to the characteristics of the situation in which the crime may occur. The risk rate is not dependent on the number of factors that are present or absent, but rather on the combination of factors that are present or absent. The five factors are:

- **Exposure**: The physical visibility and accessibility of the Transmission power lines to persons who may vandalise or sabotage it. On the other hand the Transmission power line is also visible to informers and social protectors (residents).
- **Proximity**: The physical distance between the Transmission power line and potential offenders. Some sections of the Transmission power line on the western alternative pass in close proximity to settlements, both formal and informal.
- **Guardianship**: Guardianship is determined by the number of persons and devices that prevent contact between the Transmission power line and potential offenders. However, it is important to note that guardianship does not relate to the quantity of the guardian elements, but to the quality and surety of response. Again it is not only important for Eskom to have a fully operational and effective Disaster Management Plan, but also to establish a trusting relationship with the residents to act as “informal” guardians of the Transmission power lines.
- **Target attractiveness**: The inherent value and symbolism of the target have a direct bearing on the risk of the target.
- **Property of committing the offence**: The specialisation in skills level to commit the crime decreases the risk of victimisation. Despite this, it does not decrease the risk of an opportunistic (or ignorant) offender to attempt cable theft.

Any third party tampering on the Transmission power lines could increase the vulnerability of communities in close proximity to the Transmission power lines, which in turn would impact on their health and safety. Sabotage will have an immediate impact on safety and security as it is a wilful act intended to deliberately damage or destroy the Transmission power line. Cable theft will also compromise the functionality of the Transmission power line, resulting in power failures possibly at a national level.

Apart from the impact on safety on the surrounding area, there will also be an immediate safety impact on the offender, resulting in possible death as a result of high voltage electrocution.

An assessment of these category 1 impacts was conducted through the use of the assessment criteria to determine the significance of each of the identified issues, as per Table 83 below.

TABLE 83: OPERATION & MAINTENANCE PHASE: SOCIO-CULTURAL CHANGE PROCESSES CATEGORY 1 IMPACT ASSESSMENT

<	*Significance*		*Spatial*		*Duration*		*Degree of Probability*		*Degree of Certainty*	*Risk*		*Status*
PRE-MITIGATION												
Movement of maintenance workers	*Moderate*	*3*	*Isolated*	*1*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*1.02*	*Low*	*Negative*
Physical splintering	*Low*	*2*	*Isolated*	*1*	*Incidental*	*1*	*Unlikely*	*2*	*Possible*	*0.52*	*Very low*	*Negative*
Third party tampering	*Moderate*	*3*	*Isolated*	*1*	*Incidental*	*1*	*Could happen*	*3*	*Possible*	*1.02*	*Low*	*Negative*
POST MITIGATION												
Movement of maintenance workers	*Low*	*2*	*Isolated*	*1*	*Incidental*	*1*	*Unlikely*	*2*	*Possible*	*0.52*	*Very low*	*Negative to Neutral*
Physical splintering	*Very low*	*1*	*Isolated*	*1*	*Incidental*	*1*	*Unlikely*	*2*	*Possible*	*0.4*	*Very low*	*Negative to Neutral*
Third party tampering	*Low*	*2*	*Isolated*	*1*	*Incidental*	*1*	*Unlikely*	*2*	*Possible*	*0.52*	*Very low*	*Negative to Neutral*

MITIGATION MEASURES

Movement of maintenance workers:

- ***Maintenance workers should be clearly identifiable, either by wearing overalls and/or identification cards.***
- ***Consult with local landowners prior to maintenance work taking place, to inform them of when the maintenance team will be on site, for how long, and approximately how many persons the team will consist of.***
- ***Supply landowners with a contact number to report suspicious persons or persons who loiter around the maintenance team, but that does not form part of the maintenance team. (For example: If Eskom indicated that the maintenance team would consist of 20 people, but the landowner notices that there are 30 people on his property, he should be able to inform Eskom of this fact.)***

Physical splintering:

- ***Community awareness on the safety mechanisms of a Transmission power line and potential dangers.***
- ***Such an awareness campaign should be based on and address Frequently Asked Questions (FAQs) regarding a Transmission power line, e.g. is it safe to walk underneath a Transmission power line if the surrounding area is wet or it is raining?***
- ***The awareness campaign should also focus on standard operating procedures when there is a breakdown in the line, e.g. people should steer clear of the area, who to contact, etc.***

Third party tampering:

- ***Conduct a vulnerability assessment to identify essential portions and dimensions of the Transmission power line that is particularly vulnerable to wilful damage.***
- ***Ensure that physical security systems and emergency tactical response measures are adequate and effective.***
- ***Increase random aerial and ground surveillance of the entire length of the Transmission power line or sections thereof.***
- ***Fence off and control access to towers and other key facilities on the Transmission power line.***

Sense of place

Much of what is valuable in a culture is embedded in place, which cannot be measured in monetary terms. It is because of a sense of place and belonging that some people loath to be moved from their dwelling place, despite the fact that they will be compensated for the inconvenience and impact on their lives.

The potential impact on socio-cultural behaviour and the related perception of environmental changes could either have a positive or a negative impact on sense of place (i.e. peace of mind or frustration/anger). It could be viewed as a positive impact if people perceive the project as a means of job creation, which is true in the case of the tribal authorities, and infrastructural and/or economic development, which is not intrusive on their lives and do not cause them immediate danger. Potential negative impacts include the visual impact and the resultant intrusion on sense of place.

Research on the psychological experience of sense of place suggests that people rapidly discount a landscape as soon as the first scar occurs, rather like a stain ruining a favourite garment (Petrich 1993). Thereafter, any additional impacts on the landscape have a correspondingly smaller effect. Hence, the aesthetic impact of placing a transmission line in a landscape that already bears the marks of development would be less than that of placing it in a relatively unspoilt environment. People overwhelmingly prefer "nature scenes" to urban and built environments, according to research. Zadik (1985) explains "people seem to respond to environments as natural if the areas are predominantly vegetation and do not contain human artefacts such as roads or buildings (Relf 1992)."

Steven Kaplan (1992) attributes the restorative value of participation with nature, particularly wilderness experiences, to the ability to fulfil several criteria: Being away, Extent, Fascination, and Compatibility which is established by an environment that is conducive to meeting personal goals; that is, in a compatible environment, what you want to do and are inclined to attempt are needed and feasible.

In some instances the potential presence of the Transmission power lines might affect residents' sense of place. In the past they might have felt safe and secure in the area and therefore stayed in the area for those specific reasons. As the proposed Transmission power lines might impact on people's *perception* of safety, these people might now feel unsafe in the area knowing that the lines are located within the area. Furthermore, the visibility of the transmission power line might impact on people's quality of life in terms of the aesthetics of the area that they have grown accustomed to.

It is important to note that sense of place has been assessed from a social point of view, which relates to people's perception of the project in relation to the area. Due to the fact that large segments of the affected area live in poverty, have fairly low educational levels coupled with unemployment, it is expected that their expectation of the project would mostly relate to positive impacts (the expectation of being employed), whereas the private landowners (farmers) are more aware of the potential negative impacts that the installation might have on their current and future land use. Private landowners have described the area as 'pristine' and 'unique' and therefore a change in the environment brought about by the introduction of the proposed project might influence this perception. People who are, for example, unemployed and living in poverty have different needs than preserving the area or the environment and are therefore less likely to oppose the proposed project as they believe it will bring about change in the area in terms of employment and upliftment.

Lulumisa to Minerva section: In addition to scattered households, the closest human settlements to this section of the corridor include the following areas:

Settlement	***Proximity of proposed transmission line to settlement***	***Potential changes***
Diepsloot	***Approximately 80m west***	***Might limit future development towards the line***
Laezonia AH	***Encroachment upon servitude to north and south***	***Might limit future development towards the line***
Olievenhoutbosch	***Approximately 80m west***	***Might limit future development towards the line***

Minerva to Apollo section: In addition to scattered households, the closest human settlements to this corridor include the following areas:

Settlement	***Proximity of proposed transmission line to settlement***	***Potential changes***
Olievenhoutbosch	***Encroachment upon servitude to north and south***	***Might limit future development towards the line***
Mountain Farm AH	***Approximately 280m north***	***Might limit future development towards the line***
Randjesfontein AH	***Encroachment upon servitude to north***	***Might limit future development towards the line***
Elandsfontein development	***Approximately 200m to the south***	***Might limit future development towards the line***

Apollo to Bravo section: In addition to scattered households, the closest human settlements to this corridor include the following areas:

Settlement	***Proximity of proposed transmission line to settlement***	***Potential changes***

Settlement	***Proximity of proposed transmission line to settlement***	***Potential changes***
Balhewa AH	***Approximately 120m south of northern alternative and approximately 140m east of southern alternative***	***Might limit future development towards the line***
Tierpoort AH	***Approximately 140m north of northern alternative***	***Might limit future development towards the line***

An assessment of this category 2 impact was conducted through the use of the assessment criteria to determine the significance the impact per alignment, as per Table 84 below.

TABLE 84: OPERATION & MAINTENANCE PHASE: SOCIO-CULTURAL CHANGE PROCESSES CATEGORY 2 IMPACT ASSESSMENT: SENSE OF PLACE

<	Lulumisa – Minerva Section		Minerva – Apollo Section		Apollo – Bravo Section					
<					Northern Alternative		Central Alternative		Southern Alternative	
PRE-MITIGATION										
Significance	Moderate	3	High	4	Moderate	3	High	4	Low	2
Spatial	Study area	2	Study area	2	Study area	2	Local	3	Study area	2
Duration	Long term	3	Long term	3	Long term	3	Long term	3	Long term	3
Degree of Probability	Very likely	4	Very likely	4	Could happen	3	Very likely	4	Could happen	3
Degree of Certainty	Probable		Probable		Probable		Probable		Probable	
Risk	2.16	Moderate	2.4	Moderate	1.62	Low	2.64	Moderate	1.38	Low
Status	Negative		Negative		Negative		Negative		Negative	
POST-MITIGATION										
Significance	Low	2	Moderate	3	Low	2	Moderate	3	Very low	1
Spatial	Study area	2	Study area	2	Study area	2	Local	3	Study area	2
Duration	Long term	3	Long term	3	Long term	3	Long term	3	Long term	3
Degree of Probability	Could happen	3	Could happen	3	Could happen	3	Could happen	3	Could happen	3
Degree of Certainty	Probable		Probable		Probable		Probable		Probable	
Risk	1.38	Low	1.62	Low	1.38	Low	1.8	Low	0.72	Very low

<	*Lulumisa – Minerva Section*	*Minerva – Apollo Section*	*Apollo – Bravo Section*		
<			*Northern Alternative*	*Central Alternative*	*Southern Alternative*
Status	*Negative to Neutral*	*Negative to Neutral*	*Negative to Neutral*	*Negative to Neutral*	*Negative to Neutral*
MITIGATION MEASURES					
• *Sufficient and transparent information should be supplied to local residents within the area to enhance their sense of safety and thereby reducing the negative impact on sense of place.* • *Due consideration should be given to any visual screening mitigation measures identified and suggested by the Visual Impact Assessment.*					
PREFERRED ALIGNMENT					
< *The southern alternative, followed by the northern alternative.*					

10.3 Decommissioning Phase

During the decomissioning phase the power lines will be removed from the servitude. For the sake of the assessment it is assumed that the exisitng power lines will remain.

10.3.1 Geology

There will be no impacts to geology during the decomissioning phase.

10.3.2 Topography

The impacts to topography during the decomissioning phase of the development remain as assessed in the construction phase in Section 7.1.2 above.

10.3.3 Soils, Land Capability and Land Use

The impacts to soils, land capability and land use during the decomissioning phase of the development remain as assessed in the construction phase in Section 7.1.3 above.

10.3.4 Surface water

The impacts to surface water during the decomissioning phase of the development remain as assessed in the construction phase in Section 7.1.4 above.

10.3.5 Flora

The impacts to flora during the decomissioning phase of the development remain as assessed in the construction phase in Section 7.1.5 above.

10.3.6 Fauna

Even though the removal of the 100 km of proposed power lines will reduce the number of power lines in the area that could impact on fauna, the impact after decomissioning will remain as assessed in Section 6.2.6 above due to the remaining network if high voltage power lines.

10.3.7 Visual

Even though the removal of the 100 km of proposed power lines will reduce the number of power lines in the area that impact on the visual landscape, the impact after decomissioning will remain as assessed in Section 6.2.7 above due to the remaining network if high voltage power lines.

10.3.8 Archaeological and Cultural Historical Sites

The archaeological and cultural history during the decommissioning phase of the development remains as assessed in Section 10.1.9.

10.3.9 Socio – Economic Environment

The socio-economic environment remains as assessed in Section 10.1.10.

10.4 Impact Assessment Summary

The environmental impacts for each phase of the proposed 400 kV overhead powerline from Bravo to Lulamisa have been summarised in Table 85 and able 86. The following broad conclusions can be drawn from the impact assessment.

- Sections of the current baseline environment at the site earmarked for development is highly impacted by the Bravo Power Station construction;
- The receiving environment is not of a sensitive nature with the exception of the wetlands and seepage zones.
- There are sensitive fauna, flora and wetlands on site.
- The most significantly impacted baseline elements in the area are Fauna, Flora, Visual aspects and Wetlands depending on the Alternative utilised.
- During the Construction Phase of the powerline the impacts will range from VERY LOW to HIGH. The most significant impacts will be to soil, vegetation, fauna, flora as well visually. Mitigation measures employed will adequately reduce the significance of impacts that may be sustained by the by-pass lines construction activities.
- Additional impacts sustained during the construction phase will not result in a more significant cumulative impact to the environment.
- During the operational phase negative impacts sustained will be in the VERY LOW to HIGH range. The most significant impact will be to fauna.
- Cumulative negative impacts to the physical environment are nominal, and with proper mitigation it is possible to minimise impacts.

TABLE 85: SUMMARY OF THE CONSTRUCTION PHASE IMPACTS

		Construction Phase											
		Initial	Additional			Residual	Cumulative	Initial	Additional			Residual	Cumulative
GEOLOGY	Significance	-	Very Low			Very Low	Very Low	-	1			1	1
	Spatial	-	Isolated Sites			Isolated Sites	Isolated Sites	-	1			1	1
	Temporal	-	Long Term			Long Term	Long Term	-	4			4	4
	Probability	-	Probability			Probability	Probability	-	4			4	4
	CLASS	-	**Low**			**Very Low**	**Low**	-	**1.6**			**0.8**	**1.6**
TOPOGRAPHY	Significance	-	Very Low			Very Low	Very Low		1			1	1
	Spatial	-	Isolated Sites			Isolated Sites	Isolated Sites		1			1	1
	Temporal	-	Long Term			Long Term	Long Term		4			4	4
	Probability	-	Practically impossible			Unlikely	Practically impossible		1			2	1
	CLASS	-	**Very Low**			**Very Low**	**Very Low**	-	**0.4**			**0.8**	**0.4**
			Alt 1	**Alt 2**	**Alt 3**				**Alt 1**	**Alt 2**	**Alt 3**		
SOILS & LAND CAPABILITY	Significance	Moderate	Very Low	Moderate	Very Low	Moderate	Moderate	3	1	3	1	3	3
	Spatial	Study Site	Isolated Site	Study Site	Isolated Site	Study Site	Study area	2	1	2	1	2	2
	Temporal	Long Term	Long Term	Long Term	Long Term	Long Term	Long Term	4	4	4	4	4	4
	Probability	Is occurring	Its going to happen	Its going to happen	Its going to happen	Is occurring	Its going to happen	5	5	5	5	5	5
	CLASS	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**3**	**2**	**3**	**2**	**3**	**3**
VEGETATION	Significance	Moderate	Low	Low	Low	Very Low	Low	3	2	2	2	1	2
	Spatial	Study Site	Study Site	Study Site	Study Site	Study Site	Study area	2	2	2	2	2	2
	Temporal	Long Term	Short Term	Long Term	Short Term	Medium Term	Long Term	4	2	4	2	3	5
	Probability	Is occurring	Its going to happen	Its going to happen	Its going to happen	Unlikely	Its going to happen / has occurred	5	5	5	5	2	5
	CLASS	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Very Low**	**Moderate**	**3**	**2**	**2.6**	**2**	**0.8**	**3**
FAUNA	Significance	High	Moderate			High	High	4	3			4	4
	Spatial	Region	Isolated Site			Region	Region	4	1			4	4
	Temporal	Long Term	Short Term			Long Term	Long Term	4	2			4	4
	Probability	Likely	Will occur			Likely	Likely	4	5			4	4
	CLASS	**High**	**Low**			**High**	**High**	**3.2**	**2**			**3.2**	**3.2**
SURFACE WATER	Significance	Very low	Very low			Very low	Low	1	1			1	2
	Spatial	Study Site	Study Site			Study Site	Study area	1	1			1	2
	Temporal	Medium Term	Mediumt Term			Medium Term	Long Term	3	3			3	4
	Probability	Could happen	Could happen			Could happen	Could happen	3	3			3	3
	CLASS	**Very Low**	**Very Low**			**Very Low**	**Low**	**1**	**1**			**1**	**1.6**
			Alt 1	**Alt 2**	**Alt 3**				**Alt 1**	**Alt 2**	**Alt 3**		
CULTURAL HISTORICAL	Significance	-	Very Low	-	Very Low	-	Very Low	0	1		1	0	1
	Spatial	-	Isolated Sites	-	Isolated Sites	-	Isolated Sites	0	1		1	0	1
	Temporal	-	Long Term	-	Long Term	-	Long Term	0	2		2	0	2
	Probability	-	Unlikely	-	Unlikely	-	Unlikely	0	2		2	0	2
	CLASS	**No Impact**	**Very Low**	**-**	**Very Low**	**No Impact**	**Very Low**	**0**	**0.5**		**0.5**	**0**	**0.5**

		Construction Phase												
		Initial	Additional			Residual	Cumulative	Initial	Additional			Residual	Cumulative
VISUAL	Significance	High	Low			High	High	4	2			4	4
	Spatial	Local	Local			Local	Local	3	3			3	3
	Temporal	Long Term	Short Term			Long Term	Long Term	4	2			4	4
	Probability	Has occurred	Is going to happen			Has occurred	Has occurred	5	5			5	5
	CLASS	**High**	**Low**			**High**	**High**	**3.6**	**2**			**3.6**	**3.6**
			Alt 1	**Alt 2**	**Alt 3**				**Alt 1**	**Alt 2**	**Alt 3**		
SOCIO-ECONOMIC	Significance	Moderate	Low	Low	Low	Moderate	Moderate	3	2	2	2	3	3
	Spatial	Study Site	Study Site	Study Site	Study Site	Study Site	Study Site	2	2	2	2	2	2
	Temporal	Long Term	Short Term	Short Term	Short Term	Long Term	Long Term	4	2	2	2	4	4
	Probability	Is occurring	Its going to happen	Its going to happen	Its going to happen	Is occurring	Is occurring	5	5	5	5	5	5
	CLASS	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**3**	**2**	**2**	**2**	**3**	**3**

ABLE 86: SUMMARY OF THE OPERATIONAL PHASE IMPACTS

		Construction Phase													
		Initial	Additional			Residual	Cumulative		Initial	Additional			Residual	Cumulative
GEOLOGY	Significance	-	-			-	-		-	-			-	-
	Spatial	-	-			-	-		-	-			-	-
	Temporal	-	-			-	-		-	-			-	-
	Probability	-	-			-	-		-	-			-	-
	CLASS	-	-			-	-		-	-			-	-
TOPOGRAPHY	Significance	-	-			-	-		-	-			-	-
	Spatial	-	-			-	-		-	-			-	-
	Temporal	-	-			-	-		-	-			-	-
	Probability	-	-			-	-		-	-			-	-
	CLASS	-	-			-	-		-	-			-	-
			Alt 1	Alt 2	Alt 3					Alt 1	Alt 2	Alt 3		
SOILS & LAND CAPABILITY	Significance	Moderate	Very Low	Moderate	Very Low	Moderate	Moderate		3	1	3	1	3	3
	Spatial	Study Site	Isolated Site	Study Site	Isolated Site	Study Site	Study area		2	1	2	1	2	2
	Temporal	Long Term	Long Term	Long Term	Long Term	Long Term	Long Term		4	4	4	4	4	4
	Probability	Is occurring	Its going to happen	Its going to happen	Its going to happen	Is occurring	Its going to happen		5	5	5	5	5	5
	CLASS	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**		**3**	**2**	**3**	**2**	**3**	**3**
VEGETATION	Significance	-	-	-	-	-	-		-	-	-	-	-	-
	Spatial	-	-	-	-	-	-		-	-	-	-	-	-
	Temporal	-	-	-	-	-	-		-	-	-	-	-	-
	Probability	-	-	-	-	-	-		-	-	-	-	-	-
	CLASS	-	-	-	-	-	-		-	-	-	-	-	-
FAUNA	Significance	High	High			High	High		4	4			4	4
	Spatial	Region	Region			Region	Region		4	4			4	4
	Temporal	Long Term	Long Term			Long Term	Long Term		4	4			4	4
	Probability	Likely	Could happen			Unlikely	Likely		4	3			2	4
	CLASS	**High**	**Moderate**			**High**	**High**		**3.2**	**2.4**			**2.6**	**3.2**
SURFACE WATER	Significance	-	-			-	-		-	-			-	-
	Spatial	-	-			-	-		-	-			-	-
	Temporal	-	-			-	-		-	-			-	-
	Probability	-	-			-	-		-	-			-	-
	CLASS	-	-			-	-		-	-			-	-
CULTURAL HISTORICAL	Significance	-	-			-			-	-			-	-
	Spatial	-	-			-	-		-	-			-	-
	Temporal	-	-			-	-		-	-			-	-
	Probability	-	-			-	-		-	-			-	-
	CLASS	-	-			-	-		-	-			-	-

		Construction Phase								
		Initial	Additional	Residual	Cumulative		Initial	Additional	Residual	Cumulative
VISUAL	**Significance**	High	Low	High	High		4	2	4	4
	Spatial	Local	Local	Local	Local		3	3	3	3
	Temporal	Long Term	Short Term	Long Term	Long Term		4	2	4	4
	Probability	Has occurred	Is going to happen	Has occurred	Has occurred		5	5	5	5
	CLASS	**High**	**Low**	**High**	**High**		**3.6**	**2**	**3.6**	**3.6**
SOCIO-ECONOMIC	**Significance**	-	-	-	-		0	0	0	0
	Spatial	-	-	-	-		0	0	0	0
	Temporal	-	-	-	-		0	0	0	0
	Probability	-	-	-	-		0	0	0	0
	CLASS	**No Impact**	**No Impact**	**No Impact**	**No Impact**		**0**	**0**	**0**	**0**

11 ENVIRONMENTAL MANAGEMENT PLAN

11.1 Introduction

This section, Section 11, constitutes the Environmental Management Plan (EMP) for the construction and operation of the Bravo – Lulamisa 400 kV overhead power line. The proposed 5 400 MW coal fired Power Station will be located near Witbank on approximately 2 500 ha of the Farm Hartebeesfontein 537 JR and the Klipfontein 566 JR, the proposed power line will be approximately 100 km from Bravo to Lulamisa.

The Department of Environmental Affairs and Tourism (DEAT) provided Environmental Authorisation for the construction of the new coal fired Power Station (Bravo [Kusile] Power Station) (DEAT Ref No: 12/12/20/807) on 5 June 2007.

11.2 Purpose of this EMP

This EMP has been compiled in order to address the potential environmental impacts that the proposed powerline of the above mentioned project could have on the surrounding environment. The EMP serves as the environmental specification to Eskom staff and outside contractors with regards to addressing environmental issues identified prior to the implementation of this project. It is the overall responsibility of the Project Manager and Contractor to ensure compliance with all the environmental specifications in this section as well as the relevant legislation.

This EMP should also ensure the sustainable management (to avoid and/or minimise environmental damage) of the environment whilst the construction is being undertaken. This EMP must be viewed as a contract document to which all Eskom employees and outside contractors involved in the proposed construction must be committed to.

Thus the aim of this EMP is to:

- Ensure that the team are familiar with the environmental procedures to be followed and comply with all the recommendations made within it;
- Ensure that a list of environmental representatives involved in the project are given to the construction team;
- Ensure that an environmental incident register is implemented and maintained to address environmental impacts;
- Ensure that the mitigatory measures are implemented to avoid and/or minimise the identified negative environmental impacts and to enhance the positive impact of the project on the environment; and
- Ensure that a monitoring programme is in place that tracks the effectiveness of the implemented mitigatory measures.

11.3 Objectives of the EMP

The EMP has a long-term objective to ensure that:

- Appropriate Environmental Management measures and requirements are implemented from the start of the project;
- Precautions against damage and claims arising from damage are taken timeously; and
- The completion date of the contract is not delayed due to problems with landowners arising during the course of construction.

11.4 Legal Context

A growing awareness of the environment and an increase in the number of environmental laws and regulations, present company management with a daunting task of monitoring, interpreting and implementing systems to produce a workable plan to comply with legal requirements.

The list below was compiled to ensure that the person responsible for the construction of the proposed power line is aware of their legal responsibilities and liabilities. Complying with these laws and regulations will minimise the risks in terms of legal, financial (claims) and rehabilitation costs.

Non compliance to environmental law is a criminal offence and if prosecuted Eskom will be liable for any environmental damage incurred.

TABLE 87: LEGAL REQUIREMENTS FOR THIS EMP.

ACT NAME	ACT NO	NOTES/REMARKS
National Environmental Management Act	107 of 1998	**List of activities and competent authorities identified in terms of Sections 24 and 24D**
Conservation of Agricultural Resources Act	43 of 1983	**Control of utilisation and protection of wetlands; soil conservation; control and prevention of veld fires; control of weeds and invader plants**.
Environment Conservation Act	73 of 1989	**Controls for the effective protection and utilisation of the environment, littering, waste disposal, noise and various other activities, which may have a detrimental effect on the**

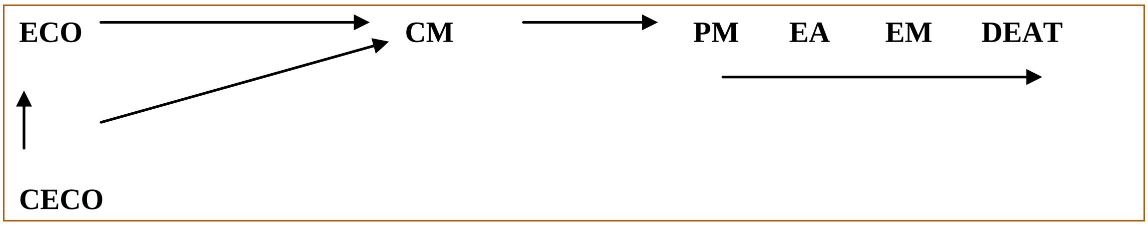
ACT NAME	ACT NO	NOTES/REMARKS
		environment Φ *Waste management* Φ *Application of waste disposal permit*
Fencing Act	31 of 1963	**Prohibition of damage to a property owner's gates and fences** Φ *Climbing or crawling over or through fences without permission* Φ *Closing gates*
Veld and Forest Fires Act	101 of 1998	**Prevention of unauthorised veld and forest fires**
Transvaal Nature Conservation Ordinance	12 of 1938	**Endangered plants and wild animals.** **Protected fauna and flora**
Occupational Health and Safety Act	85 of 1993	**Prescribes health and safety measures necessary to adhere to for all construction workers**
National Water Act	36 of 1998	**All aspects relating to pollution of surface and ground water.**

11.5 Eskom and Contractor Commitment

Eskom requires a commitment from the Eskom Project Manager and the Contractor on the following issues:

- To underwrite Eskom Transmission's Environmental Policy TRMPBAAX3 Rev 2 at all times;
- Ensure that environmental conditions that are applicable in transmission lines, and are stipulated in the Power Station Record of Decision (Environmental Authorisation) are implemented;
- Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations;
- To implement this EMP for the benefit of all involved; and
- To preserve the natural environment by limiting destructive actions on site.

11.6 Reporting Structure



ECO: Environmental Control Officer (Can be the Eskom Site Supervisor depending on the size of the project)

CM: Contract Manager (Eskom)

CECO: Contractor Environmental Control Officer (Dedicated person)

PM: Project Manager (Eskom)

EA: Environmental Advisor (Eskom)

EM: Environmental Manager (Eskom)

RA Relevant Authority (e.g. DEAT)

11.7 Responsibilities and Duties

11.7.1 Responsibility Matrix

FUNCTION	NAME / CELL NUMBER	RESPONSIBILITY
Project Manager (PM) Eskom		Overall management of project and EMP implementation
Site Supervisor/ Contract Manager (CM) Eskom		Oversees site works, liaison with Contractor, PM and ECO
Environmental Control Officer (ECO) Eskom		Implementation of EMP and liaison between Eskom, Contractor and Landowners/stakeholders
Contractor (C)		Implementation and compliance with recommendations and conditions of the EMP, Appoints dedicated person (CECO) to work with ECO
Contractor Environmental Control		Implementation of EMP, landowner interaction, environmental control of site actions, re-mediation

FUNCTION	NAME / CELL NUMBER	RESPONSIBILITY
Officer (CECO)		and rehabilitation work.
Tx Services Environmental Advisor (Eskom)		Environmental advice and auditing

(Table to be completed upon Contract award)

11.7.2 Project Manager

The primary responsibility of the Project Manager is to ensure that the Contractor complies with the environmental specifications in this EMP. In addition the Project Manager shall:

- Assume overall responsibility for the effective implementation and administration of the EMP;
- Ensure that the EMP is included in the Contractor's contract;
- Ensure that the EMP is given to the applicable Construction Supervisor and the contractors;
- In conjunction with the Construction Supervisor; undertake regular inspections of the Contractor's site as well as the installation works in order to check for compliance with the EMP in terms of the specifications outlined in this EMP. Inspections shall take place at least once a week and copies of the monitoring checklist contained in the file (see Appendix M for copy of the audit inspection protocol);
- Keep a register of all incidents (spills, injuries, complaints, legal transgressions, etc) and other documentation related to the EMP;
- Report to the Senior Environmental Advisor (Vuledzani Thanyani) any problems (or complaints) which cannot first be resolved in co-operation with the Contractor(s);
- Implement recommendations of possible audits; and
- Ensure that construction staff is trained in accordance with requirements of the EMP.

11.7.3 Construction Contractor

The Contractor shall:

- Ensure that the environmental specifications of this document (including any revisions, additions or amendments) are effectively implemented. This includes the on-site implementation of steps to mitigate environmental impacts;
- Discuss implementation of and compliance with this document with staff at routine site meetings;

- Preserve the natural environment by limiting any destructive actions on site;
- Monitor environmental performance and conformance with the specifications contained in this document during site inspections;
- Report progress towards implementation of and non-conformances with this document at site meetings with the Project Manager;
- Ensure that suitable records are kept and that the appropriate documentation is available to the Project Manager;
- Advise the Project Manager of any incidents or emergencies on site, together with a record of action taken;
- Report and record all accidents and incidents resulting in injury or death;
- Take into consideration the legal rights of the individual Landowner, Communities and Eskom Regional staff;
- Ensure quality in all work done, technical and environmental;
- Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations;
- Underwrite Eskom's Environmental Policy at all times, and
- Use this EMP for the benefit of all involved.

11.8 Training

- The SHECO shall be appropriately trained in environmental management and shall possess the skills necessary to impart environmental management skills to all personnel involved in the construction, rehabilitation and operation of the proposed Bravo-Lulamisa power line corridor;
- Eskom, together with the Environmental and Safety Manager and the SHECO, shall ensure that the employees (including construction workers, engineers, and long-term employees) are adequately trained on the EMP; and
- All employees shall have an induction presentation on environmental awareness. The cost, venue and logistics shall be for the Eskom’s account;

Where possible, training must be conducted in the language of the employees. The induction and training shall, as a minimum, include the following:

- The importance of conformance with all EMP and other environmental policies and procedures;
- The significant environmental impacts, actual or potential, of their work activities;
- The environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving conformance with the EMP and other environmental policies and procedures;

- The potential consequences of departure from specified operating procedures; and
- The mitigation measures required to be implemented when carrying out their work activities.

11.9 Commissioning of Tenders for the Project

- All tendering Contractors / Sub-contractors will be made aware of the contents of this EMP and any penalties arising from non-compliance; and
- All appointed Contractors / Sub-contractors will be required to attend the EMP training and induction as detailed in Section 11.7 above.

11.10 Environmental Authorisation

The construction of power lines can have a major impact on the environment. It is thus imperative that precautions be taken to ensure that environmental damage is minimised. This will take a concerted effort from the Contractor and proper planning is of the utmost importance.

The Environmental Control Officer (ECO) shall convey the contents of this EMP and the conditions of the Record of Decision (Environmental Authorisation) from the DEAT and discuss the contents in detail with the Eskom Project Manager and Contractor at a pre-construction meeting. This formal induction training is a requirement of ISO 14001 and shall be done with all main and sub-contractors. Record of the training dates, people who attended and discussion points shall be kept by the ECO.

Most landowners / adjacent landowners will see the construction period as interference with their daily activities. Good relations with adjacent landowners need to be established and sustained. Landowners shall therefore be informed timeously of the construction programme, duration and all interference with their daily activities. This will help in the solving of problems and the prevention thereof. Lines of communication should always be open to ensure proper and timeous reaction to complaints. The contact numbers of the ECO and CECO shall be made available to adjacent landowners. The reputation of both the Contractor and Eskom Transmission is at stake and should be the drive for everybody involved to perform in excellence.

The Contractor (TRMSCAAC1 REV 3 section 4.1.2) shall take all the necessary precautions against damage. The Contractor shall ensure that the correct equipment for construction purposes is available at all times to ensure construction proceeds without unnecessary damage to the environment. Should alternative methods be used, it requires approval from site staff and the ECO must be informed to ensure environmental issues are addressed.

During the construction period at least three (3) Environmental Audits shall be conducted to determine compliance with the recommendations of the EIA, Record of Decision (RoD / Environmental Authorisation) and EMP together with this. These will include internal audits and external by the DEAT or the ISO14001 auditors or combined audits.

11.11 Environmental Management Measures

The management measures documented in each of the sub-sections below have been compiled using the following information:

- Impact Assessment and mitigation measures documented in the Draft EIR for the Bravo-Lulamisa powerline.
- The standard EMP utilised by Eskom: Transmission for the construction of power lines.

In addition to the abovementioned information sources, the EMP will be updated to include the conditions documented in the Environmental Authorisation (RoD) to be received upon approval of the EIA.

11.11.1 Construction Initiation

TABLE 88: ENVIRONMENTAL MANAGEMENT MEASURES DURING CONSTRUCTION INITIATION.

Objectives

- Ensure that all necessary legal obligations and contractual conditions have been met prior to the commencement with construction;
- To ensure that all role players and stakeholders are aware of the pending construction activities and have received timeous notice; and
- To ensure that power outages are avoided wherever possible during the construction phase.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Labour Issues	Eskom must appoint a suitably qualified Environmental Control Officer (hereafter referred to as ECO) who would act on behalf of the applicant, on a daily basis, monitor project compliance with the conditions of environmental authorisation, environmental legislation and the recommendations of the revised EMP. This role will be fulfilled by the appointed ECO and CECO.	Throughout Project	Daily	PM	EA	EM	C
		The ECO / CECO must be appointed prior to the commencement of construction and pre-construction related activities and the authorities must be notified of such and appointment.	Throughout Project	Once off	PM	EA	EM	C / RA
		The ECO / CECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site is handed over to Eskom by the contractor for operation;	Throughout Project	Daily	PM	EA	EM	C
		The ECO shall maintain the following on site: • A daily site dairy; • A non-conformance register; and • A public complaint registers.	Throughout Project	Daily	CECO	ECO	EA SM	EM PM

2	Initiation	The authorised activity / activities may not commence within thirty (30) days of the date of signature of the authorisation;	Prior to authorisation	Once off	PM	PM SM	EM EA ECO	RA C
		Should Eskom be notified by the minister of a suspension of the authorisation pending appeal procedures, Eskom may not commence with the activity / activities unless authorised by the minister in writing.	Throughout Project	Throughout Project / as and when necessary	PM	PM SM	EM EA ECO	RA C
		Fourteen (14) days written notice must be given to the Department that the activity will commence. Commencement for the purposes of this condition includes site preparation. The notice must include a date on which it is anticipated that the activity will commence. This notification may coincide with the period contemplated in Section 14.9.4.1 above;	Prior to commencem ent	Once - off	CECO	PM SM	EA EM ECO	RA
		Fourteen (14) days written notice must be given to the Department that the operational phase of the activity will commence.	14 days	Prior to operation commencem ent	CECO	PM SM	EA EM ECO	RA
		A copy of the authorisation must be kept at the property where the activity will be undertaken. The authorisation must be produced to any authorised official of the Department who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertake work at the property;	Throughout	Monthly Inspection	CECO	SM	EA	EM PM
		No work shall commence until permission is granted from the Environmental Advisor from Transmission Services and acceptance of this proposal and EMP from DEAT has been obtained.	Prior to commencem ent	Once-off	SM C	PM	ECO	EA EM

		Obtain a signed agreement statement from the contractor indicating their willingness to comply to the EMP.	Prior to commencement	Once - off	CECO C	SM	ECO	PM EA EM
Construction Phase								
1	Construction Initiation	Ensure that the grid is considered throughout the construction phase.	Throughout construction	Throughout construction	C	SM	ECO	PM EA EM
		Where any of the applicant's contact details change, including then name of the responsible person, the physical or postal address and/or telephonic details, the applicant must notify the Department as soon as the new details become known to the applicant;	Throughout construction	Throughout construction	SM	PM	ECO	EA EM RA
		The holder of the authorisation must notify the Department, in writing and within 24 hours, if conditions of the authorisation cannot be or is not adhered to. In all other cases, the holder of the authorisation must notify the Department, in writing, within 48 hours if a condition of the authorisation is not adhered to. Any notification in terms of this condition must be accompanied by reasons for the non-compliance; and	Prior to commencement	Once off	CECO	SM	ECO EA	PM EM RA
		Non-compliance with a condition of this authorisation may result in criminal prosecution or other actions as per the National Environmental Management Act, 1998 and the regulations.	Throughout	Throughout	CECO	SM	ECO EA	PM EM RA
2	Labour Issues	Ensure proper supervision of employees at all times.	Throughout	Throughout	C	SM	ECO EA	PM EM RA
Rehabilitation Phase								
None								
Operational Phase								
None								

11.11.2 Site Establishment and Demarcation

TABLE 89: ENVIRONMENTAL MANAGEMENT MEASURES DURING SITE ESTABLISHMENT AND DEMARCATION.

Objectives

Project Area

- Ensure proper demarcation of the project area prior to construction;
- Ensure timely notice and negotiation with stakeholders in the event that access is required for construction purposes; and
- Ensure that all areas impacted during construction are rehabilitated to suitable levels.

Gate Installation

- Properly installed gates to allow access to the servitude;
- Minimise damage to fences; and
- Limit access to Eskom and Contractor personnel with gate keys.

Servicing Vehicles

- Prevention of pollution of the environment; and
- Minimise chances of transgression of the acts controlling pollution.

Batching Plants

- To ensure all agreements with Landowners are adhered to;
- Prevention of complaints from stakeholders; and
- Successful rehabilitation of disturbed areas.

Wet Areas

- Avoid impact to wet areas.

Sanitation

- Ensure that proper sanitation is received.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Gate Installation and Control	No new gate construction is anticipated, however, if needed the contractor must refer to the Fencing Act, Act no 31 of 1963.	Not anticipated	Throughout Project	C CECO	SM	ECO	EA EM PM
		Gate installation shall be according to TRMSCAAC1 REV 3 section 4.5 and the drawing 0.00/10261 Rev 2 as stated in the specifications.	Not anticipated	Once -off	C CECO	SM	ECO	EA EM PM
		All gates installed in electrified fencing shall be re-electrified.	Not anticipated	Once -off	C CECO	SM	ECO	EA EM

								PM
		The Environmental Control Officer shall approve gate positions.	Not anticipated	Once -off	C CECO	SM	ECO	EA EM PM
		All gate positions shall be three (3) metres off centre to allow for continued access when stringing takes place.	Not anticipated	Once -off	C CECO	SM	ECO	EA EM PM
2	Batching Plants	The sitting, if necessary, of batching plants shall be done in conjunction with the Eskom PM and the ECO.	Not anticipated	Once -off	C CECO	SM	ECO	EA EM PM
		Refer to TRMSCAAC1 REV 3 section 4.8 for specifications regarding batching plants.	Pre-Construction	Once off	C CECO	SM	ECO	EA EM PM
		Ensure all agreements reached with the Landowner are fulfilled.	Pre-Construction	Once -off	C CECO	SM	ECO	EA EM PM
3	Sanitation	The Contractor shall install mobile chemical toilets on site (TRMSCAAC1 REV 3). The Contractor camp shall have the necessary ablution facilities with chemical toilets where such facilities are not available at commencement of construction.	Throughout	Weekly	C CECO	SM	ECO	EA EM PM
		The Contractor will be responsible for the provision of and proper utilisation, maintenance and management of toilet, wash and waste facilities. Toilet facilities supplied by the contractor for the workers shall occur at a maximum ratio of 1 toilet per 15 workers. All temporary / portable toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause.	Throughout construction	Daily	C CECO	SM	ECO	EA EM PM
		Prior to the establishment of the ablution facilities, the Site Manager must approve an appropriate location.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		The entrances to the ablution facilities shall be	Pre-	Once-off	C	SM	ECO	EA

		adequately screened from public view.	Construction		CECO			EM PM
4	Site Establishment – Contractors camp, wastewater management, Shower facilities	The contractor's camp shall be sited so as to cause the least amount of disturbance to adjacent landowners.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		The contractor's camp shall be fenced and the contractor shall maintain in good order all fencing for the duration of the construction activities.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		Site establishment shall take place in an orderly manner and all amenities shall be installed at Camp sites before the main workforce move onto site.	Pre-construction	Monthly	C CECO	SM	ECO	EA EM PM
		The Contractor shall supply a wastewater management system that will comply with legal requirements and be acceptable to Eskom. A septic tank system is recommended to ensure the best practice environmental solution.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		Where Eskom facilities are available the Contractor shall make use of such facilities where it is viable and negotiated with the Grid.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		Should shower facilities be provided for the use by staff staying on site, the following controls must be imposed: • Positioning of the shower, and specifically its discharge point, will be carried out to ensure that erosion and build up detergents does not occur; • All discharge from the shower and other washing facilities must pass through a suitable filter to reduce the load of detergents to the environment; • Filtered water discharge may thereafter be released to the environment, but mechanisms will be investigated to ensure	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM

		that the water is evenly dispersed so as to lead to "greening up" and / or swampy conditions in one limited area; • Use of the shower facilities must be limited to staff or authorised persons only.						
		The cooking area will be positioned such that no vegetation is in close proximity thereto, including overhanging trees. An area around the cooking area will be cleared such that any escaping embers will not start an uncontrolled fire.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
5	Eating Areas	Eating areas shall be designated and demarcated.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		Sufficient bins shall be present in this area for all waste material.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		Dish washing facilities shall be provided. These may be very basic, but a process must be put in place to ensure that wastewater is disposed of appropriately (see Site Establishment - showers).	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Gate Installation and Control	All gates shall be fitted with locks and be kept locked at all times.	Throughout	Throughout	C CECO	SM	ECO	EA EM PM
		Gates shall only be left open on request of the Landowner if he accepts partial responsibility for such gates in writing.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
		Claims arising from gates left open shall be investigated and settled in full by the Contractor.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
		If any fencing interferes with the construction process, such fencing shall be deviated / protected until construction is completed.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
2	Project Area	Construction activities are limited to the area as demarcated by EA / EM within the site identified	Throughout Project	Monthly	C CECO	SM	ECO	EA EM

		for the construction of the Power Station.						PM
		Any area outside the construction area, required to facilitate access, construction activities, construction camps or material storage areas, where necessary, shall be negotiated with the affected stakeholders and written agreements shall be obtained.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		All construction areas shall be cleared in accordance with the EA / EM Standard for Bush clearing ESKASABG3.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Any extra space to be cleared outside the construction area shall be negotiated and approved by EA / EM. All areas marked as no go areas inside the substation parameters shall be treated with the utmost care and responsibility.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
3	Batching Plants	The batching plant area shall be operated in such a way as to prevent contaminated water to run off the site and polluting nearby streams or water bodies. To this effect diversion berms can be installed to direct all wastewater to a catchments area.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
4	Sanitation	Staff shall be sensitised to the fact that they should use these toilets at all times. The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
		No use of the veld shall be allowed, as this always creates problems with the landowners and may lead to claims for problems with stock diseases.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
		Toilet paper is also a source of littering, and the Contractor shall be forced to clean up any litter.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM

		Ablution facilities must be maintained in a hygienic state and serviced regularly. Toilet paper will be provided.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
		The Contractor will ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed provider removes the contents from the site.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		Disposal of such waste is only acceptable at a licensed waste disposal facility.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
5	Site Establishment	The site must be kept tidy and hygienic at all times with special reference to sanitation & water management.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		Open uncontrolled fires will be forbidden at the site camp. Rather "contained" cooking mechanisms will be used – e.g. gas stoves or an enclosed braai facility.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		Where possible and practical all maintenance of vehicles and equipment shall take place in the workshop area.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		Workshop areas shall be monitored for oil and fuel spills and such spills shall be cleaned and remediate to the satisfaction of the ECO.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		The Contractor shall be in possession of an emergency spill kit that must be complete and available at all times on site.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		No equipment shall be used which may cause irreparable damage to wet areas. The contractor shall use alternative methods of construction in such areas. **Refer to TRMSCAAC1 REV 3 section 4.4.1 regarding access through seasonally wet areas.**	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
6	Eating areas	The feeding of, or leaving of food for animals, is strictly prohibited.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM

		No fires for the purpose of cooking or warming purposes will be permitted other than within designated areas, for instance, at the site camp.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Batching Plants	All areas used as batching areas must be rehabilitated once construction is completed. Should any claim be instituted against EA / EM, due to the actions of the Contractor at a batching plant site, EA / EM shall hold the Contractor fully responsible for the claim until such time that the Contractor can prove otherwise with the necessary documentation.	Once Construction is completed – during rehabilitation	Monthly	C CECO	SM	ECO	EA EM PM
2.	Site Decommissioning	All areas where site infrastructure or camp sites are established must be rehabilitated to their original state in which they were found.	Once Construction is completed – during rehabilitation	Monthly	C CECO	SM	ECO	EA EM PM
		Prior to the removal of structures an assessment of the end land use will be undertaken to determine which structures will be removed or retained.	Once Construction is completed – during rehabilitation	Monthly	C CECO	SM	ECO	EA EM PM
		Any specific requirements to prevent pollution during demolition of structures must be identified prior to the commencement of rehabilitation activities.	Prior to rehabilitation	Once - off	C CECO	SM	ECO	EA EM PM
		Disposal requirements must be identified prior to the commencement of rehabilitation or structure removal.	Prior to rehabilitation	Once - off	C CECO	SM	ECO	EA EM PM
		Equipment, structures and building material that can be reused will be identified prior to the commencement of rehabilitation activities.	Prior to rehabilitation	Once - off	C CECO	SM	ECO	EA EM PM
		Scrap metal and equipment will be sold as scrap	Once	Monthly	C	SM	ECO	EA

		or disposed of at a suitably licensed facility.	Construction is completed – during rehabilitation		CECO			EM PM
		Vegetation that was removed for the establishment of site infrastructure shall be reinstated into the area.	Once Construction is completed – during rehabilitation	Monthly	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Gate Control	Gates must be fitted with Eskom locks.	Permanent	Throughout	C CECO	SM	ECO	EA EM PM
		Such gates shall be clearly marked by painting the posts green.	After construction – once off	Once off	C CECO	SM	ECO	EA EM PM

11.11.3 Water Management (including Storm water, Water Sources, Wet Areas)

TABLE 90: ENVIRONMENTAL MANAGEMENT MEASURES FOR WATER MANAGEMENT.

Objectives

Storm-water Management

- Effectively control storm water runoff to ensure that impacts to surface water resources are controlled, and erosion is not present on site.

River Crossings

- Minimise damage to river and stream embankments;
- No access roads through river and stream banks;
- No visible erosion scars on embankments once construction is completed; and
- Minimise erosion of embankments and subsequent siltation of rivers, streams and dams.

Wetlands

- No construction activities within designated wetland areas as identified in the EIA; and
- No pollution or effluent is to come in contact with wetland areas.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Water Sources	Should water be required from sources other than Eskom supply, a written agreement shall be reached between the Contractor and the stakeholder involved.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Should the Contractor be required to use water from a natural source, the Contractor shall supply a method statement to that effect and obtain the required permits. No construction shall take place	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

		in the wetland, streams and other river courses without the necessary water license form the Department of Water Affairs and Forestry;						
Construction Phase								
1	Water Sources	Strict control shall be maintained and the ECO shall regularly inspect the abstraction point and methods used.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
2	Wetlands	No construction is to take place in wetland areas. Including no vehicular traffic in wet areas / wetlands.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Only existing roads through such areas may be used with the approval of Eskom.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		The contractor shall use alternative methods of construction in such areas. **Refer to TRMSCAAC1 REV 3 section 4.4.1 regarding access through seasonally wet areas.**	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Berms should be created not closer than 10m from identified wetland areas, so as to ensure that no construction material and/or waste flow into wetland systems.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
3	Dust control	The dust control measures, such as watering, chemical stabilisation and the reduction of	During	Monthly	C CECO	SM	ECO	EA EM PM

		surface wind speed through the use of windbreaks and source enclosures must be put in place during construction activities. Emission control efficiencies of 50% can readily be achieved through the implementation of effective watering programme for unpaved roads and material handling points.	construction					
4	Storm water Management	Storm water shall be channelled away from construction activities.	Prior to commencement of Construction	Once-off	C CECO	SM	ECO	EA EM PM
		No storm water may be discharged into areas where construction is taking place.	Prior to commencement of Construction	Once-off	C CECO	SM	ECO	EA EM PM
		Storm water flowing from the footprint of the proposed development may not be contaminated by any substances, whether the substance is solid, liquid or vapour or any combination thereof.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		During construction, the Contractor will protect areas susceptible to erosion by installing necessary temporary and / or permanent drainage works as soon as possible and by taking suitable measures to prevent surface water concentration	Prior to commencement of Construction	Once-off	C CECO	SM	ECO	EA EM PM

		into nearby roadways or river courses.						
		Silt trap mechanisms will be installed on all temporary storm water channels. These silt traps will be regularly checked and serviced as required.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		All excavated and filled slopes and stockpiles must be of a stable angle and capable of accommodating normal expected flows.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Stabilisation of cleared areas to prevent and control erosion will be actively managed. The method chosen (e.g. watering, planting, retaining structures, commercial anti-erosion compounds) will be selected according to specifics and ensure acceptable rehabilitation.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Traffic and movement over stabilised areas will be restricted. Any damage to stabilised areas will be repaired and maintained to the satisfaction of the Site Manager.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Where erosion and sedimentation occur, rectification will be carried out in accordance with details specified by the Site Manager.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								

1	Storm water Management	Any runnels or erosion channels will be backfilled and compacted, and the areas restored to a proper condition.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
Operational Phase								
None								

11.11.4 Hazardous Substance Spills

TABLE 91: ENVIRONMENTAL MANAGEMENT MEASURES FOR HAZARDOUS SUBSTANCE SPILLS.

Objectives	• To ensure that spills occurring during the construction phase a suitably managed to reduce potential impacts on the environment.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Hazardous Spills	Ensure that potential hazardous materials on site are identified and documented in a register.	Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM
		Ensure that suitable spill kits and absorption materials are purchased prior to commencement with construction, and stored suitably in places where there is a high risk of hazardous spills occurring.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Hazardous	All contaminated soil / yard stone shall be	Throughout	When-	C	SM	ECO	EA

	Spills	removed and be placed in containers. Contaminated material can be taken to one central point where bio-remediation can be done.	Project	necessary	CECO			EM PM
		Smaller spills can be treated on site. (ESKASABTO)	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
		A specialist Contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site.	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
		All spills of hazardous substances must be reported to the ECO and appointed Transmission Engineering Environmental Advisor (Tx Key Performance Indicator requirement).	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Hazardous Spills	Ensure that rehabilitated areas are free of visible spills and are suitably vegetated.	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
Operational Phase								
None								

11.11.5 Delivery of Materials

TABLE 92: ENVIRONMENTAL MANAGEMENT MEASURES FOR THE DELIVERY OF MATERIALS.

Objectives

- To ensure that all sub-contractors responsible for delivering materials to site operate in an environmentally friendly manner whilst on site; and
- To ensure that the activities related to material deliveries do not create an unnecessary impact on the environment.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Heavy machinery	All drivers and operators must be appropriately licensed.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Heavy machinery	No vehicles coming on sites must spill oil.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		No construction equipment, vehicles or unauthorised personnel will be allowed onto areas that have been re-vegetated.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Heavy Machinery	All areas where heavy machinery has access must be rehabilitated in terms of soil pollution.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Heavy	No oil/ petrol spills / leaks may occur.	Throughout	Monthly	C CECO	SM	ECO	EA EM PM

	Machinery		construction					

11.11.6 Building, Civil's and Structural Steel Work

TABLE 93: ENVIRONMENTAL MANAGEMENT MEASURES FOR BUILDING, CIVIL'S AND STRUCTURAL STEEL WORK

Objective	• To ensure that all construction related activities including civils, building erection, and structural steel work is undertaken in such a manner that it reduces unnecessary impact to the environment.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
None								
Construction Phase								
1	Excavate foundations	During excavations no oil leaks from heavy vehicles may occur.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		PPE must be used by all workers using hand tools during the excavations of foundations.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Spoil must be evenly spread.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
2	Excavate earth moving materials	During the excavation of earth materials no oil leaks may occur from heavy vehicles.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM

3	Mixing concrete	During the mixing of concrete, concrete dust is emanated. Workers mixing concrete must wear PPE.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Cement bags must not become litter after use. They must be disposed of in bins/skips (see Waste Management).	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
4	Trenches	All workers using hand tools must make use of PPE.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		No spills may occur. All spills should be reinstated into foundations as backfill.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
5	Cast Blinding Layer	No concrete spills may occur. All spills should be reinstated into foundations as backfill.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
6	Place Copper Earthing	All copper off-cuts must be collected for recycling purposes.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
7	Construct Cable	No concrete spills may occur. All spills should be reinstated into foundations as backfill.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
8	Place steelwork on foundations	All steel off-cuts must be collected for recycling purposes.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		During steel cutting and grinding, all old discs	Throughout	Monthly	C CECO	SM	ECO	EA EM PM

		must be managed and must not become litter.	construction					
9	Connect earthing to steelwork	During welding and brazing, all old welding rods must be managed and must not become litter.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
10	Reinstate yard stone	No oils spills may occur as a result of heavy vehicles.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Workers with rakes must use PPE at all times.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	De-establish contractors yard / store	All waste, garbage, surplus materials and oils spills to be cleared and site must be rehabilitated.	During Rehabilitation	Weekly	C CECO	SM	ECO	EA EM PM
2	Final inspection	During site inspection the site is to be cleared and rehabilitated back to its original state.	During Rehabilitation	Weekly	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Take over works	During site take / hand over the site must be accepted from the contractor and handed over.	Operations	Once - off	C CECO	SM	ECO	EA EM PM

11.11.7 Circuit Breakers and Current Transformers

TABLE 94: ENVIRONMENTAL MANAGEMENT MEASURES FOR CIRCUIT BREAKERS AND CURRENT TRANSFORMERS.

Objective	• See deliveries, site establishment, and civils and structural steel work.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Supply and delivery of new circuit breakers and current transformers	All drivers and operators delivering new circuit breakers and current transformers must be licensed to obey all road and local by-laws.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Establish contractor on site	(See Site Establishment).						
2	Install new cables, clamps and conductors	The crane operators must be licensed in accordance with the OHS Act.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Clear site	The site must be cleared and rehabilitated so that there is no damage to the surrounding	Post construction	Weekly	C CECO	SM	ECO	EA EM PM

		infrastructure.						
		All personal must be suitably accredited to perform duties.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		All cable cut offs must be collected and sent for recycling.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		All waste, garbage, scrap and oil spill must be disposed of (see Waste Management). The site must be cleared and rehabilitated.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
2	Final Inspection	During site inspection the site is to be cleared and rehabilitated back to its original state.	On termination of construction	Weekly	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Take over works	During site take / hand over the site must be accepted from the contractor and handed over.	On termination of construction	Once-off	C CECO	SM	ECO	EA EM PM

11.11.8 Access Roads

TABLE 95: ENVIRONMENTAL MANAGEMENT MEASURES FOR ACCESS ROADS.

Objectives								
	• Minimise damage to existing access roads; • Minimise damage to environment due to construction and rehabilitation of new access roads; and • Minimise loss of topsoil and enhancement of erosion.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Access Roads	If required, planning of access routes must be done in conjunction between the Contractor and Eskom.	Once off	As necessary	C CECO	SM	ECO	EA EM PM
		All agreements reached shall be documented in writing and no verbal agreements should be made.	Throughout Project	Throughout Project	C CECO	SM	ECO	EA EM PM
		The condition of existing access / private roads to be used shall be documented with photographs.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		The Contractor shall properly mark all access roads.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Markers shall show the direction of travel.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM

		Roads not to be used shall be marked with a "**NO ENTRY** "sign (refer also TRMSCAAC1 REV 3).	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Where required, speed limits shall be indicated and speed control measures applied on the roads.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Water diversion berms shall be installed from the start of the contract in accordance with TRMSCAAC1 REV 3 Section 4.6.	Prior to construction	When necessary	C CECO	SM	ECO	EA EM PM
		Where berms are installed on severe slopes the outflow shall be suitably stone pitched to prevent erosion from starting at the base of the berm.	Prior to construction	When necessary	C CECO	SM	ECO	EA EM PM
		All structures shall be properly designed and drawings shall be available for reference purposes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Permanently wet areas are shown on the profiles. No vehicular traffic shall be allowed in such areas. Only existing roads through such areas may be used with the approval of Eskom and the Landowner.	Throughout construction		C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Access Roads	All speed limits shall be strictly adhered to at all	Throughout	Daily	C CECO	SM	ECO	EA EM PM

		times.	Project					
		Where new access roads are constructed, this must be done in accordance with TRMSCAAC1 REV 3 Section 4.4.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		These berms shall be maintained at all times.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
		No roads shall be constructed on slopes of more than 20% unless such roads follow contours.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
		In such areas the Contractor shall only use existing roads or alternative methods of construction. The Contractor shall take such areas into consideration during the tender.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
		The installation of concrete pipes and drifts, to facilitate access, shall be at the discretion of the Environmental Control Officer on site.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Any dangerous crossings shall be marked as such and where necessary, speed limits shall be enforced.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
		All existing private access roads used for construction purposes, shall be maintained at all times to ensure that the local people have free	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM

		access to and from their properties.						
Rehabilitation Phase								
1	Access Roads	Berms must be repaired at the end of the contract.	End of contract	Once off	C CECO	SM	ECO	EA EM PM
		Upon completion of the project all roads shall be repaired to their original state.	End of contract	Once off	C CECO	SM	ECO	EA EM PM
Operational Phase								
None.								

11.11.9 Waste Management

TABLE 96: ENVIRONMENTAL MANAGEMENT MEASURES FOR WASTE MANAGEMENT.

Objectives								
	• To keep the construction site and servitude neat and clean. • Disposal of rubble and refuse in an appropriate manner • Minimise litigation • Minimise neighbour complaints • No visible concrete spillage on the servitude							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Refuse and Rubble Removal	A method statement is required from the Contractor that includes the layout of the camp, management of ablution facilities and waste management.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		The Contractor camp shall have the necessary ablution facilities with chemical toilets where such facilities are not available at commencement of construction.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		The Contractor shall provide a wastewater management system that will comply with legal requirements and be acceptable to Eskom.	Prior to construction	Weekly inspection	C CECO	SM	ECO	EA EM PM
		The Contractor will supply waste collection bins where such is not available and all solid waste	Throughout	Once-off	C CECO	SM	ECO	EA EM PM

		collected shall be disposed of at a registered waste disposal facility.	Project					
		A certificate of disposal shall be obtained by the Contractor and kept on site. All waste generated during construction and operation of the facility must be removed and disposed of at a waste disposal facility permitted in terms of Section 20 of the Environment Conservation Act, 1989 (Act 73 of 1989);	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		In the case where a registered waste site is not available close to the construction site, the Contractor will be responsible to provide a method statement with regard to waste management.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Under no circumstances may solid waste be burned on site unless a suitable incinerator is available.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor shall supply waste collection bins where such is not available, as approved by the Environmental Control Officer, and all solid waste collected shall be disposed of at a registered waste dump.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		A certificate of disposal shall be obtained by the	Prior to	Monthly	C CECO	SM	ECO	EA EM

		Contractor and kept on file.	construction					PM
		Where a registered waste site is not available close to the construction site, the Contractor shall provide a method statement with regard to waste management.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		The disposal of waste shall be in accordance with all relevant legislation.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Refuse and Rubble Removal	The Contractor shall dispose of all excess material on site in an appropriate manner and at a designated place.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		All packaging material shall be removed from site and disposed of and not burned on site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		No landfill may be used without the consent from the Landowner.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Should a landfill be used for biodegradable materials only, the rubble shall be compacted and at least 1m of soil shall cover the waste material.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		No hazardous material, e.g. oil or diesel fuel shall be disposed of in any unregistered waste site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM

		No material shall be left on site that may harm man or animals.	Throughout Project	Weekly inspection	C CECO	SM	ECO	EA EM PM
		Any broken insulators shall be removed and all shards picked up.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		Broken, damaged and unused nuts, bolts and washers shall be picked up and removed from site.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		Surplus concrete may not be dumped indiscriminately on site, but shall be disposed of in designated areas as agreed by the Landowner. Concrete trucks shall not be washed on site after depositing concrete into foundations. Any spilled concrete shall be cleaned up immediately.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Under no circumstances may solid waste be burned on site unless a suitable incinerator is available.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		The Contractor shall dispose of all excess material on site in an appropriate manner and at a designated place.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		All packaging material must be removed from the site and disposal of and not burned on site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM

		No material shall be left on site that may harm man or animals.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Any broken insulators shall be removed and all shards picked up.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		Broken, damaged and unused nuts, bolts and washers shall be gathered and removed from site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Surplus concrete may not be dumped indiscriminately on site and will be disposed of in designated areas as agreed by the Landowner.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The washing of concrete trucks on site is prohibited. Any spilled concrete shall be cleaned up immediately.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor must provide DEAT with proof of confirmation of service provision from waste service providers for the removal of wastes.	Throughout Project		C CECO	SM	ECO	EA EM PM
		A general site-wide litter clean up will occur at least once a week.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Waste will be collected from site by a licensed contractor and removed to an appropriate waste disposal facility.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM

		Wherever possible, materials will be recycled via a "Greens waste site". To this end, containers for glass, paper, metals, plastics, organic waste and hazardous wastes (e.g. oil rags, paint containers, thinners) will be provided in sufficient quantity on the site.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Waste will be removed during off-peak traffic periods to minimise impacts on local traffic patterns.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		All waste generated during construction and operation of the facility must be removed and disposed of at a waste facility permitted in terms of Section20 of the Environmental Conservation Act, 1989 (Act 73 of 1989).	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Littering by the employees of the Contractor shall not be allowed (TRMSCAAC1 REV 3 section 4.1.2).	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		All potentially hazardous and non-degradable waste shall be collected and removed to a registered waste site.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Refuse and Rubble	Same as construction phase.						

	Removal	
Operational Phase		
1	Refuse and Rubble Removal	Same as construction phase.

11.11.10 Fire Prevention

TABLE 97: ENVIRONMENTAL MANAGEMENT MEASURES FOR FIRE PREVENTION.

Objectives	• No veld fires started by the Contractor's work force. • No claims from Landowners for damages due to veld fires. • No litigation.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Fire Prevention	The Contractor shall have fire-fighting equipment available on all vehicles working on site, especially during the winter months.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor will document a fire reduction management plan. The plan will identify sources of fire hazard, and appropriate management measures to reduce the identified risk. The relevant authority will be notified of such	Prior to commencement of construction	Monthly	C CECO	SM	ECO	EA EM PM

		potential fire hazards.						
Construction Phase								
1	Fire Prevention	Preferentially no fires will be lit on the site, if however required, fires must be limited to use for cooking and heating use only within a designated area. This area will be a suitable distance from fuel sources. A fire will be constantly monitored while present.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		In terms of the Atmospheric Pollution Prevention (APPA), burning is not permitted for waste disposal.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Suitable precautions will be taken (e.g. suitable fire extinguisher, welding curtains) when working with welding or grinding equipment near potential sources of combustion.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		All fire control mechanisms (fire fighting equipment) will be routinely inspected by a qualified investigator for efficacy thereof and be approved by local fire services. Such mechanisms will be present and accessible at all times.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		All staff on site will be made aware of general fire prevention and control methods, and the name of the responsible person to alert to the	Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM

		presence of a fire.						
		The Contractor will advise the relevant authority of a fire outside of a demarcated area as soon as it starts and will not wait until he can no longer control it.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Fire Prevention	None.						
Operational Phase								
1	Fire Prevention	None.						

11.11.11 Designated Storage Areas

TABLE 98: ENVIRONMENTAL MANAGEMENT MEASURES FOR DESIGNATED STORAGE AREAS.

Objective	To ensure that cognisance is taken of proper storage of dangerous goods and hazardous materials so as to avoid accidents, spillage, and impacts to the environment.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Workshop, equipment	Where possible and practical all maintenance of vehicles and equipment shall take place in the	During	Monthly	C CECO	SM	ECO	EA EM PM

	maintenance and storage	workshop area, on a paved or concrete lined surface.	construction					
		All hazardous substances shall be stored in suitable containers and storage areas shall be bunded. This includes all carbon substances like fuel and oil as well as herbicides and battery acid.	During construction	Monthly	C CECO	SM	ECO	EA EM PM
		A register shall be kept on all substances and be available for inspection at all times.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Workshop, equipment maintenance and storage	Servicing of vehicles within Power Station perimeters is strictly prohibited.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Only emergency repairs shall be allowed on site and a drip tray shall be used to prevent oil spills.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		In the event of a breakdown within the substation perimeter, any oil spills shall be cleaned up immediately and appropriate environmental investigations undertaken and recorded.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		The following shall apply:						
		• All contaminated soil shall be removed and be placed in containers. Contaminated soil can be taken to one	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

		central point at the Contractors campsite where bio-remediation can be done; • Smaller spills can be treated on site; • A specialist Contractor shall be used for the bio-remediation of contaminated soil; • The area around the fuel storage drum at the Contractor's campsite shall also be re-mediated upon completion of the contract; and • All oil spills must be reported to ECO immediately.						
		Under no circumstances shall such waste be buried on site indiscriminately.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		No maintenance or repair of construction vehicles or machinery will occur on site during the construction phase. Maintenance of equipment and vehicles will be preformed off-site at a suitably designed workshop.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Movement of construction vehicles and machinery must be restricted to areas outside of sensitive areas on site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		No washing of plant may occur on the site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM

		The contractor will ensure that if emergency plant maintenance occurs on site, that there is no contamination of soil or vegetation (e.g. use of drip trays).	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Drip trays will be provided for the stationary plant and for the "parked" plant.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		All vehicles and equipment will be kept in good working order and serviced regularly. Leaking equipment will be repaired immediately or removed from the site.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		The relevant contractor must ensure that facilities for the collection of hydraulic and other vehicle oils are provided within the hard park area.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		The repair of construction vehicles must be done on a paved surface to avoid leaking oils sipping into the ground.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
2	Materials use, handling and storage	The Contractor will ensure that delivery drivers are informed of all procedures and restrictions required by this document. Such drivers will be supervised during off-loading, by a person knowledgeable of the requirements.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

		Materials will be appropriately secured to ensure safe passage between destinations. Loose loads (e.g. sand, stone chip, fine vegetation, refuse, paper and cement) will be covered.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor will be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		All material lay-down areas and stockpiles will be subject to the Site Manager's approval.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Imported fill / soil / sand materials will be free of weeds, litter and contaminants.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Storage areas will be roofed in an impervious material, with a suitable overhang or side cladding. Rainwater run-off will be channelled away from the storage area as required.	Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM
		Hydraulic fluids are stored in concrete lined surfaces with bund walls and must be designated in such a manner that any spillages can be contained and reclaimed without any impact on the surrounding environment.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Hazardous and flammable substances must be stored and used in compliance with applicable	Throughout	Monthly	C CECO	SM	ECO	EA EM PM

		regulations and safety instructions.	Project					
		During servicing of vehicles or equipment, a suitable drip tray shall be used to prevent spills onto the soil, especially where emergency repairs are effected outside the workshop area.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Leaking equipment shall be repaired immediately or be removed from site to facilitate repair.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Areas shall be monitored for spills and any spills shall be contained, cleaned and rehabilitated immediately.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Any leaking containers shall be repaired or removed from site.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Servicing of Vehicles	None.						
Operational Phase								
1	Servicing of Vehicles	None.						

11.11.12 Tower Positions

TABLE 99: ENVIRONMENTAL MANAGEMENT MEASURES FOR TOWER POSITIONING.

Objectives

- Minimise damage to topsoil and environment at tower positions
- Successful rehabilitation of all damaged areas
- Prevention of erosion and no visible erosion scars three months after completion of the contract

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Tower positioning	Refer to TRMSCAAC1 REV 3 SECTION 4.4.5 for specifications concerning tower sites on slopes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Tower Positioning	Disturbance of topsoil on tower sites with severe slopes shall be minimised at all costs.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		At any tower sites where conventional foundations are installed, the Contractor shall remove the topsoil separately and store it for later use during rehabilitation of such tower sites.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		During backfilling operations, the Contractor shall take care not to dump the topsoil in the bottom of the foundation and then put spoil on top of that.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

		In accordance with the Conservation of Agricultural Resources Act, No 43 of 1983, slopes in excess of 2% must be contoured and slopes in excess of 12% must be terraced.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Contour banks shall be spaced according to the slope on tower sites. The type of soil shall also be taken into consideration.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Tower Positioning	Re-seeding shall be done on disturbed areas as directed by the Environmental Control Officer.	Post construction	When necessary	C CECO	SM	ECO	EA EM PM
		Other methods of rehabilitation of tower sites may also be used at the discretion of the Environmental Control Officer, e.g. stone pitching, logging, etc.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
		A mixture of seed can be used provided the mixture is carefully selected to ensure the following: • Annual and perennial plants are chosen; • Pioneer species are included;	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM

		• All the plants shall not be edible; • Species chosen will grow in the area without many problems; • Root systems must have a binding effect on the soil; and • The final product should not cause an ecological imbalance in the area.						
		To get the best results in a specific area, it is a good idea to consult with a vegetation specialist or the local extension officer of the Dept of Agriculture. Seed distributors can also give valuable advice as to the mixtures and amount of seed necessary to seed a certain area. Re-seeding, as well as fencing in of badly damaged areas, will always be at the discretion of the Environmental Control Officer, unless specifically requested by a Landowner.	Post construction	When necessary	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Tower	None.						

	Positioning	

11.11.13 Claims from Damages

TABLE 100: ENVIRONMENTAL MANAGEMENT MEASURES FOR CLAIMS FROM DAMAGES.

Objectives	• Minimise complaints from Landowners • Prevent litigation due to outstanding claims by ensuring that claims are settled within one (1) month. • Successful completion of the contract and all Landowners signing release forms within 6 months of completion of the project.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Claims from Damages	None.						
Construction Phase								
1	Claims from Damages	All damage to Eskom property shall be recorded immediately.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		The Environmental Control Officer should also keep a photographic record of such damage.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
		The date, time of damage, type of damage and reason for the damage shall be recorded in full to ensure the responsible party is held liable.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

		All claims for damage should be directed to the Environmental Control Officer for appraisal.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		The Contractor shall be held liable for all unnecessary damage to Eskom property.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		A register shall be kept of all complaints from Landowners.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		All claims shall be handled immediately to ensure timeous rectification / payment.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Claims from Damages	None.						
Operational Phase								
1	Claims from Damages	None.						

11.11.14 Erosion, Donga and River Crossings

TABLE 101: ENVIRONMENTAL MANAGEMENT MEASURES FOR EROSION, DONGA AND RIVER CROSSINGS.

Objectives	
	• Minimise erosion damage on donga crossings and embankments. There should be no visible damage caused by construction activities. • Minimise impeding the natural flow of water • Minimise initiation of erosion through donga embankments

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Erosion and donga Crossings	Crossing of dongas and eroded areas shall be thoroughly planned in accordance with TRMSCAAC1 REV 3 Section 4.4.1.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		All structures shall be properly designed and drawings shall be available for reference purposes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
2	River Crossings	Existing drifts and bridges may be used if the Landowner gives his consent. Such structures shall then be thoroughly examined for strength and durability before they are used.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		New drifts and bridges shall only be constructed with the approval of Eskom and the Landowner and at the discretion of the Environmental Control Officer.	Prior to construction	Monthly	C CECO	SM	ECO	EA EM PM

		All structures constructed for access purposes shall be properly designed and drawings of such structures shall be available for record purposes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Erosion and Donga Crossings	Water diversion berms shall be installed at donga crossings to ensure runoff water on the servitude does not run into dongas and cause an erosion hazard.	Throughout construction	Monthly	C			
		Suitable erosion containment structures shall be constructed at donga crossings where required and viable.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		No unplanned / improperly planned cutting of donga embankments is allowed as this leads to erosion and degradation of the environment.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
2	River Crossings	No roads shall be cut through river and stream banks as this may lead to erosion causing siltation of streams and downstream dams.	Prior to construction	Throughout	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Erosion and Donga Crossings	None.						

Operational Phase		
1	Erosion and Donga Crossings	None.

11.11.15 Flora Management (including Vegetation Clearing, General, and Herbicides)

TABLE 102: ENVIRONMENTAL MANAGEMENT MEASURES FOR FLORA MANAGEMENT.

Objective

- Minimise damage to vegetation by only clearing 8m vegetation along the centre of the servitude for access purposes.
- Keep servitude as natural looking as possible.
- No vegetation interfering with structures and statutory safety requirements upon completion of the contract.
- Minimise possibility of erosion due to removal of vegetation by not de-stumping vegetation on river and stream embankments.
- Minimise removal of plant material on river and stream embankments.
- Eradication of alien invader and densifier species that cause a fire hazard.
- No visible herbicide damage to the vegetation along the servitude one year after completion of the contract due to incorrect herbicide use.
- No litigation due to unauthorised removal of vegetation.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Vegetation Clearing	Vegetation clearing shall be done in accordance with ESKASABG3 REV 0 (Standard for bush clearance and maintenance within overhead power line servitudes) and the Vegetation	Prior to construction	Monthly	C CECO	SM	ECO	EA EM PM

		Management Guideline.						
		The removal of all economically valuable trees or vegetation shall be negotiated with the Landowner before such vegetation is removed.	Prior to construction	When necessary	C CECO	SM	ECO	EA EM PM
		The Contractor will remove plants containing any diseases and /or pests fro the site.	Prior to construction	Weekly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Vegetation Clearing	Only an 8m strip may be cleared flush with the ground to allow vehicular passage during construction.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		The removal of indigenous plant material from the site or surrounding and adjacent land will not be allowed.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		No scalping shall be allowed on any part of the servitude road unless absolutely necessary.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		All trees and vegetation cleared from the site shall be cut into manageable lengths and neatly stacked at regular intervals along the line.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		No vegetation shall be pushed into heaps or left	Throughout	Throughout	C CECO	SM	ECO	EA EM PM

		lying all over the servitude.	construction					
		Vegetation clearing on tower sites must be kept to a minimum.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Big trees with large root systems shall be cut manually and removed, as the use of a bulldozer will cause major damage to the soil when the root systems are removed.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Stumps shall be treated with herbicide.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Smaller vegetation can be flattened with a machine, but the blade should be kept above ground level to prevent scalping.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Any vegetation cleared on a tower site shall be removed or flattened and not be pushed to form an embankment around the tower.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		No vegetation clearing in the form of de-stumping, scalping or uprooting shall be allowed on river and stream banks.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		Vegetation shall only be cut to allow for the passage of the pilot-cables and headboard.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		No vegetation clearing shall be allowed across ravines and gullies, as this vegetation will very rarely interfere with the clearance to the strung conductor.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Trees and vegetation not interfering with the statutory clearance to the conductors can be left under the line.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Dense vegetation under the line which could cause a fire hazard, particularly in the middle third of the span in the vicinity of the lowest point of the conductors, will be considered as a separate case.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		With permission of the landowner, the total servitude under the line and up to 5m outside the outer phases can be cleared.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Protected or endangered species of plants shall not be removed unless they are interfering with a	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		structure.						
		Where such species have to be removed due to interference with a structure, the necessary permission and permits shall be obtained from Provincial Nature Conservation.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		All protected species not to be removed must be clearly marked and such areas fenced off if required.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. Eskom's approval for the use of herbicides is mandatory (Contact Dr. Eugene van Rensburg—Vegetation Management).	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the supplier’s specifications.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM

		Upon completion of the stringing operations and before handover, the servitude must be inspected and all vegetation interfering with the safe operation of the line shall be removed / cut down.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		All alien vegetation in the total servitude and densifiers creating a fire hazard shall be cleared and treated with herbicides. (Refer to the Vegetation Management Guideline attached). • The application shall be according to set specifications and under supervision of a qualified technician. • The possibility of leaching into the surrounding environment shall be properly investigated and only environmentally friendly herbicides shall be used.	Throughout construction	Weekly	C CECO	SM	ECO	EA EM PM
		It is recommended that a contractor for vegetation clearing should comply with the following parameters: • The contractor must have the necessary	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		knowledge to be able to identify protected species as well as species not to be interfering with; • The operation of the line due to their height and growth rate; • The contractor must also be able to identify declared weeds and alien species that can be totally eradicated; and • The contractor must be in possession of a valid herbicide applicators license.						
		The removal of protected vegetation and medicinal plants during construction must be done in consultation with the provincial environmental authorities, and the appropriate post-construction rehabilitation measures must be implemented in cooperation with the provincial environmental authorities.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
2	Harvesting of Medicinal	The removal of protected vegetation and medicinal plants during construction must be	Throughout	When	C CECO	SM	ECO	EA EM PM

	Plants	done in consultation with the provincial environmental authorities, and the appropriate post-construction rehabilitation measures must be implemented in cooperation with the provincial environmental authorities.	construction	necessary				
		Should Medicinal Plants be found on site, these plants will be demarcated and cordoned off.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Once demarcated, they will be removed and translocated to an established nursery. The plants shall be removed by a certified Nursery with experience in the handling and translocation of plants. The South African National Biodiversity Institute (SANBI) shall be contacted for assistance should a certified nursery not be available.	Throughout construction	When necessary				
3	Protection of Indigenous Vegetation	Removal of indigenous plant material from the site or surrounding and adjacent land will not be allowed;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Only indigenous vegetation is to be used in any landscaping which may be undertaken;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
4	Search and Rescue of Endangered Plant Species	Should Protected or Endangered Plant Species be found on site they will be demarcated and cordoned off. An Ecological Management Plan will be compiled and submitted to DEAT for approval. The Ecological Management Plan will	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

		include the following: • Ensure the persistence of the plant species; • Include a monitoring programme that monitors the size, stage structure and vigour of the plant species population and threats to the population; • Facilitate/augment natural ecological processes such as fire and herbivory; • Provide for the habitat and life history needs of important pollinators; • Minimise artificial edge effects (e.g. water runoff from developed areas and application of chemicals; • Include an ongoing monitoring and eradication programme for non-indigenous/alien invasive species; • Result in a Report to be submitted to the relevant authority (GDACE, DEAT, etc) • Where feasible, appropriate genetic material such as seeds or propagules of the plant species shall be collected and stored at a licensed facility.						

		• In situ conservation of Protected and Endangered Plant Species is preferable to ex situ conservation. Thus, should the plant species not "interfere" with the construction of a structure, the area surrounding the plant species shall be declared a "no-go" area as outlined in the Ecological Management Plan; and	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		• The area surrounding the plant species shall be declared a "No-go" area and a buffer zone will be applied as outlined in the Ecological Management Plan;						
5	Alien Plant Control and Monitoring	The Developer will be responsible for controlling all alien invasive species, as per the requirements of the Conservation of Agricultural Resources Act (CARA), during the contract and vegetation establishment period;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		All exotic trees will be identified and marked;	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Alien invasive plant material will be preferentially removed in entirety through mechanical means (e.g. chainsaw, bulldozer, hand-pulling of smaller specimens);	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		The exotic trees must be cut down leaving the stumps behind to ensure that soil erosion is	Throughout	Throughout	C CECO	SM	ECO	EA EM PM

		prevented; The trees can be chipped on site and the chips seeded with indigenous vegetation and spread over the site to allow for re-growth and to reduce erosion potential;	construction					
		Immediately after being cut, a herbicide solution must be applied to the exotic trees to ensure no further growth. The person applying the herbicide must have read and understood the instructions. Care must be taken that there is no spillage of solution in the wetland and that the correct protective equipment must be used;	After being cut - immediately	Throughout	C CECO	SM	ECO	EA EM PM
		If plants are not removed in entirety but cut-back and systematically treated with approved herbicides, then remaining plant will be monitored for re-growth / re-establishment;	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Herbicides used must be approved by authorities and as per the supplier's specifications;	When necessary	Once-off	C CECO	SM	ECO	EA EM PM
		Alien invasive plant material will not be stockpiled. All such material removed will be removed from the site and dumped at an approved disposal site;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		If during the establishment period any noxious or excessive weed growth occurs, such vegetation	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

		will be removed; and						
		It is the developer's responsibility to implement a monitoring programme that will be instituted to ensure that re-growth of alien invasive plants species does not occur, or that such re-growth is controlled.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Traffic on rehabilitated areas.	If disturbed areas are left to rehabilitate naturally, they must be frequently monitored and interventions put in place immediately should it become necessary. Special attention must be given to the potential for soil erosion and the associated environmental degradation. It is also essential to undertake alien vegetation control and management.	Post construction	Monthly	C CECO	SM	ECO	EA EM PM
		No construction equipment, vehicles or unauthorised personnel will be allowed onto areas that have been re-vegetated	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Only persons / equipment required for maintenance thereof will be allowed to operate on such areas.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
2	Plant Material	All plant material used on site will be obtained from an approved nursery;	Post construction	Throughout	C CECO	SM	ECO	EA EM PM

		The Contractor will remove plants containing any diseases and/or pests from the site;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Propagation of suitable indigenous vegetation that is quick to establish such as grasses, should be encouraged in areas where vegetation has been removed	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		On planting, there will be sufficient topsoil around each plant to prevent desiccation of the root system. Where plants are stored on site prior to planting they will be maintained to ensure that the root systems remain moist; and	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Each plant brought onto site will be handled and packed in an approved manner for that species or variety, and that all necessary precautions are taken to ensure that the plants arrive on the site in a proper condition for successful growth (e.g. good plant specimens chosen, disease and/or pest free, potting material weed free, plants covered during transportation, containers in good condition);	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
3	Reseeding of Disturbed Areas	All reseeding activities will be undertaken at the end of the dry season (middle to end September) to ensure optimal conditions for germination and rapid vegetation establishment;	Throughout construction	Wet Season	C CECO	SM	ECO	EA EM PM
		The seed mix will be approved by the ECO prior	Throughout	Wet Season	C CECO	SM	ECO	EA EM

		to seeding;	construction	once-off				PM
		Seeds should be covered by use of an agricultural roller or similar mechanism;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Inspect rehabilitated area at three monthly intervals during the first and second growing season to determine the efficacy of rehabilitation measures; and	Throughout construction		C CECO	SM	ECO	EA EM PM
		Take appropriate remedial action where vegetation establishment has not been successful or erosion is evident within the first two growing seasons.	Throughout construction		C CECO	SM	ECO	EA EM PM
4	Alien Plant Control and Monitoring	Alien plant control will be conducted as described in Section 5.14, for a period of two years after the rehabilitation phase is completed.	Throughout construction		C CECO	SM	ECO	EA EM PM
5	Soil and Land Capability	All excess building material and rubble must be collected and disposed of at a suitably registered landfill site.	Throughout construction		C CECO	SM	ECO	EA EM PM
		Soils must be ripped to refusal or a minimum of 300mm prior to seeding.	Throughout construction		C CECO	SM	ECO	EA EM PM
		All areas must be profiled to tie in with adjacent terrain. Where necessary suitable soil must be imported obtain a suitable profile.	Throughout construction		C CECO	SM	ECO	EA EM PM

		Suitable erosion control measures must be installed in areas where erosion may occur;	Throughout construction		C CECO	SM	ECO	EA EM PM
		Apply a suitable mixture of N:P:K fertiliser prior to seeding;	Throughout construction		C CECO	SM	ECO	EA EM PM
		Harrow the disturbed areas after spreading the topsoil and fertilizer uniformly;	Throughout construction		C CECO	SM	ECO	EA EM PM
		Rehabilitated and profiled areas must be inspected for erosion every three months for the first two years. Additional measures must be implemented to remediate erosion where it is observed.	Throughout construction		C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Vegetation Clearing	None						

11.11.16 Fauna Management

TABLE 103: ENVIRONMENTAL MANAGEMENT MEASURES FOR FAUNA MANAGEMENT.

Objectives								
• Minimise disruption of farming activities (No stock losses where construction is underway); • Minimise disturbance of animals, especially protected birds in the area; • Minimise interruption of breeding patterns of birds; and • No litigation concerning stock losses and animal deaths.								
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Planning	Construction planning must be undertaken prior to construction to ensure that it does not conflict with breeding seasons.	One week	Once off	C CECO	SM	ECO	EA EM PM
		The breeding sites of raptors and other wild bird species shall be taken into consideration during the planning of the construction programme.	One week	Once off	C CECO	SM	ECO	EA EM PM
		There are many instances where protected and endangered species of birds are nesting on our transmission towers without causing any problems to the flow of electricity or network stability. These birds are highly territorial and some have been using the same nests for many years, I.e. Black Eagle (Witkruisarend). They are guarded jealously by the landowners and are	When necessary	When necessary	C CECO	SM	ECO	EA EM PM

		monitored by many groups involved with ensuring their continued existence, including Nature Conservation officials at National and Provincial level. It is therefore imperative that the breeding sites of these birds are kept intact and that the breeding pairs are not disturbed especially where there are young nestlings. The Contractor shall take all the necessary precautions and it is recommended that sites on parallel existing lines be noted, i.e. tower numbers. This information must then be given to the avian specialist via the Environmental Advisor so that the necessary action can be taken timeously.						
2	Fencing	Ensure that suitable fencing is erected prior to the commencement of construction to ensure that live stock does not wonder into dangerous areas.	Throughout the project.	Weekly inspections.	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Construction	The Contractor's workforce will have to be very careful not to disturb the animals as this may lead to fatalities which will give rise to claims from the Landowners.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM

		The Contractor shall under no circumstances interfere with livestock without the Landowner being present. This includes the moving of livestock where they interfere with construction activities.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
		Should the Contractors workforce obtain any livestock for eating purposes, they must be in possession of a written note from the Landowner.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
		Should any new sites or nests be found, during the construction process, that was not known or have been noted before, each site shall be assessed for merit and the necessary precautions be taken to ensure the least disturbance.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
		Bird collision prevention measures (Bird Flappers) should be installed on all the lines that form part of the application.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Construction	Same as construction phase.						
Operational Phase								
1	Construction	Same as construction phase.						

11.11.17 Interaction with adjacent landowners

TABLE 104: ENVIRONMENTAL MANAGEMENT MEASURES FOR INTERACTION WITH ADJACENT LANDOWNERS.

Objectives	• Maintain good relations with Landowners; • No delays in the project due to Landowner interference; and • Landowner signs final release form.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Interaction with Land Owners	All negotiations for any reason shall be between Eskom, the landowners and the Contractor.	When necessary	Throughout	C CECO	SM	ECO	EA EM PM
		No verbal agreements shall be made. All agreements shall be recorded properly and all parties shall co-sign the documentation. It is proposed that a photographic record of access roads be kept.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
		It is required that the Contractor will supply one person to be the liaison officer (CECO) for the entire contract, and that this person shall be available to investigate all problems arising on the work sites concerning adjacent landowners (TRMSCAAC1 REV 3).	Throughout project	Ongoing.	C CECO	SM	ECO	EA EM PM
Construction Phase								

1	Interaction with Land Owners	The construction process will use the services of the Power Station Environmental Monitoring / Management Committee (EMC) for communication with the land owners.	Throughout the project	Monthly				
		Any claims instituted by the Landowners shall be investigated and treated promptly. Unnecessary delays should be avoided at all costs.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
		Landowners shall always be kept informed about any changes to the construction programme should they be involved. If Eskom's Environmental Control Officer is not on site the Contractor's Environmental Control Officer should keep the Landowners informed.	Throughout the project	Monthly	C CECO	SM	ECO	EA EM PM
		The contact numbers of the Contractor's ECO officer and the Eskom ECO shall be made available to the Landowners.	Throughout the project	Once-off	C CECO	SM	ECO	EA EM PM
		All contact with the Landowners shall be courteous at all times.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
		The rights of the Landowners shall be respected at all times and all staff shall be sensitised to the effect that we are working on private property.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								

1	Interaction with Land Owners	Same as for construction phase above.						
Operational Phase								
1	Interaction with Land Owners	The rights of the Landowners shall be respected at all times and all staff shall be sensitised to the effect that we are working on private property.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM

11.11.18 Noise / Working Hours

TABLE 105: ENVIRONMENTAL MANAGEMENT MEASURES FOR NOISE MANAGEMENT.

Objective	• To ensure that noise is managed in such a manner that no complaints are received.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
None								
Construction Phase								
1	Noise	In order to prevent noise impacts resulting from construction activities, working hours are to be limited to weekdays between 7h00 to 17h00.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
		If certain construction requires work outside of these hours, all adjacent landowners have to be	When	Once – off, if	C CECO	SM	ECO	EA EM PM

		informed prior to any construction outside of the specified hours commencing.	necessary	necessary				
		If there are complaints about low frequency noise after the refurbishment, Eskom would have to get a noise expert to do measurements and recommend mitigation.	When necessary	If necessary				
Rehabilitation Phase								
1	Noise	Same as Construction Phase.						
Operational Phase								
1	Noise	Same as Construction Phase						

11.11.19 Infrastructure

TABLE 106: ENVIRONMENTAL MANAGEMENT MEASURES FOR INFRASTRUCTURE.

Objectives	• Ensure that existing infrastructure is taken into account during planning and project execution to eliminate impacts to existing infrastructure; and • To avoid claims and litigation.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Planning	Demarcate all existing infrastructure on site layout plans. Document condition of existing	One day	Monthly	C CECO	SM	ECO	EA EM PM

		infrastructure prior to construction.		Inspections				
Construction Phase								
1	Construction activities	All existing private access roads used for construction purposes, shall be maintained at all times to ensure that the local people have free access to and from their properties.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Speed limits shall be enforced in such areas and all drivers shall be sensitised to this effect.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Re-instate all roads and infrastructure.	Upon completion of the project all roads and infrastructure shall be repaired to their original state.	Post construction	Once-off	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Re-instate all roads and infrastructure.	Same as rehabilitation phase.						

11.11.20 Archaeology

TABLE 107: ENVIRONMENTAL MANAGEMENT MEASURES FOR ARCHAEOLOGY.

Objective								
	• Protection of archaeological sites and land considered to be of cultural value; • Protection of known sites against vandalism, destruction and theft; and • The preservation and appropriate management of new archaeological finds should these be discovered during construction.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Planning	Ensure all known sites of cultural, archaeological, and historical significance are demarcated on the site layout plan, and marked as no-go areas.	Throughout Project	Weekly Inspection	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Emergency Response	Should any heritage resources be exposed during excavation for the purpose of construction, construction in the vicinity of the finding must be stopped.	When necessary	Throughout	C CECO	SM	ECO	EA EM PM
		Should any heritage resources be exposed during excavation or be found on site, a registered heritage specialist must be called to site for inspection.	When necessary	Throughout	C CECO	SM	ECO	EA EM PM
		Should any heritage resources be exposed during excavation or be found on site, the relevant heritage resource agency must be informed about the finding;	When necessary	Throughout	C CECO	SM	ECO	EA EM PM

		Under no circumstances may any heritage material be destroyed or removed form site;	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Should remains and/or artefacts be discovered on the site during earthworks, all work will cease in the area affected and the Contractor will immediately inform the Construction Manager.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Should any remains be found on site that is potentially human remains, the South African Police Service should also be contacted.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
		Same as construction phase.						
Operational Phase								
		Same as construction phase.						

11.11.21 Residential Property

TABLE 108: ENVIRONMENTAL MANAGEMENT MEASURES FOR MANAGEMENT OF RESIDENTIAL PROPERTY.

Objectives	• Control actions and activities in close proximity to inhabited areas; • No complaints from Landowners; • No damage to private property.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Planning	All private residences will be demarcated on a site layout plan prior to construction phase commencing.	One day	Weekly Inspections	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Construction execution	The Contractor shall under no circumstances interfere with the property of adjacent landowners.	Throughout project	Weekly Inspections	C CECO	SM	ECO	EA EM PM
		If water is required, the Contractor shall negotiate with the relevant Landowner and a written agreement shall be drawn up (TRMSCAAC1 REV 3 section 4.8).	Throughout Project	Weekly Inspections	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Rehabilitation execution	Same as construction phase.						

Operational Phase		
1	Maintenance of the power line	Same as construction phase.

11.12 General Requirements during Construction

- Proper and continuous liaison between Eskom, the contractor and Landowners to ensure everyone is informed at all times.

- A physical access plan shall be compiled and the contractor shall adhere to this plan at all times. Proper planning when the physical access plan is drawn up by the Environmental Control Officer in conjunction with the Contractor shall be necessary to ensure access to all construction areas within the route corridor parameter.

- The adjacent landowners shall be informed of the starting date of construction as well as the phases in which the construction shall take place.

- The Contractor must adhere to all conditions of contract, including the Environmental Management Plan.

- Proper planning of the construction process to allow for disruptions due to rain and very wet conditions.

- Where existing private roads are in a bad state of repair, such roads' condition shall be documented before they are used for construction purposes. If necessary, some repairs should be done to prevent damage to equipment and plant.

- All manmade structures shall be protected against damage at all times and any damage shall be rectified immediately.

- Proper site management and regular monitoring of site works.

- Proper documentation and record keeping of all complaints and actions taken.

- Regular site inspections and good control over the construction process throughout the construction period.

- Appointment of an Environmental Control Officer on behalf of the Contractor to implement this EMP as well as deal with all Landowner related matters.

- Environmental Audits to be carried out during and upon completion of construction (at least three for the project).

- The Contractor shall not be released from site until all Landowners have signed off the release documentation to the satisfaction of the Eskom Environmental Control Officer.

11.13 Scheduling of Management Measures

The construction programme, showing the upfront management measures, and regular audit schedule is attached in Appendix M. It should be noted that the majority of the management measures are incident and control based. Therefore they will not occur in a management schedule but will rather occur in day to day operations. Where such measures occur these will be inspected during the audit activities provided for in the schedule.

11.14 Site Documentation / Monitoring / Reporting

The standard Eskom site documentation shall be used to keep records on site, in addition all non-compliances to the environmental authorisation will be reported to the Director: Environmental Impact Evaluation within 48 hours. All documents shall be kept on site and be available for monitoring and auditing purposes. Site inspections by an Environmental Audit Team may require access to this documentation for auditing purposes. The documentation shall be signed by all parties to ensure that such documents are legitimate. Regular monitoring of all site works by the Environmental Control Officer is imperative to ensure that all problems encountered are solved punctually and amicably. When the Environmental Control Officer is not available, the Contract Manager/Site Supervisor shall keep abreast of all works to ensure no problems arise. The following checklist shall be used as an environmental performance monitoring tool.

TABLE 109: CHECKLIST FOR MONITORING ENVIRONMENTAL PERFORMANCE ON SITE.

Person responsible for this deviation is:
Name:
Designation:
Reporting of environmental performance, problems and priorities are as follows:

Environmental monitoring of the deviation is according to the following schedule:

The following negative environmental impacts have been identified at the site:

Environmental Problem	**Location**

In order to solve (mitigate) the above identified negative environmental impacts, the following plan of action is to be implemented:

Problem	**Solution**	**Date to be Completed**

Monitoring (follow-up) plan of implemented remedial action: **Person responsible for environmental monitoring (follow-up) is:**
Name:
Designation:

Substation Name:
Monitoring Date:

Problem	**Solution as implemented**	**Has the solution worked, if not, what actions are still to be taken**

11.15 Environmental Contact Persons

- Vuledzani Thanyani (Land and Rights: Senior Environmental Advisor)

  Tel: 011 800 5601

- Joyce Mashiteng (Land and Rights: EIA Manager)

  Tel: 011 800 4623

- Vishnu Gopal: Project Manager

  Tel: 011800418

11.16 Emergency Numbers

- Eskom Control 0800 037566
- Police 10111

11.17 Oil Spill Contact Numbers

- Drizit Cell: 082 455 7832

APPENDIX A: LIST OF ABBREVIATIONS

APPENDIX B: EIA APPLICATION FORM

APPENDIX C: LIST OF POTENTIALLY AFFECTED LANDOWNERS

APPENDIX D: PROJECT LOCALITY MAP

APPENDIX E: DEAT AUTHORISATION REQUIREMENTS FROM FSR

APPENDIX F: INTERESTED AND AFFECTED PARTIES DATABASE

APPENDIX G: BACKGROUND INFORMATION DOCUMENT

APPENDIX H: SITE NOTICES

APPENDIX I: NEWSPAPER ADVERTISEMENTS

APPENDIX J: PERSONALISED LETTERS TO ALL INDIVIDUALS AND ORGANISATIONS ON THE MAILING LIST

APPENDIX K: ISSUES AND RESPONSE REPORT

APPENDIX L: MINUTES OF PUBLIC MEETING

APPENDIX M: EMP AUDIT INSPECTION PROTOCOL

APPENDIX N: EMP SCHEDULE

APPENDIX O: TRANSMISSION ENVIRONMENTAL POLICY (TPL41-435)

APPENDIX P: TRANSMISSION LINE TOWER AND LINE CONSTRUCTION

APPENDIX Q: STRINGING OF CONDUCTORS AND CONNECTION OF DROPPERS

APPENDIX R: SPECIALIST STUDIES