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EIA AND EMPr FOR THE PROPOSED SOLAR CSP INTEGRATION PROJECT:

PROJECT 2 – 400 kV POWER LINE FROM FERRUM TO THE SOLAR SUBSTATION

Proponent:

Eskom Holdings SOC Limited
Megawatt Park
Maxwell Drive, Sunninghill

DEA Reference Number: 12/12/20/2607

NEAS Reference Number: DEA/EIA/0000778/2011

November 2013 12726

REVISED FINAL ENVIRONMENTAL IMPACT REPORT

Directors : S Pillay (Managing Director); N Rajasakran (Director); Dr RGM Heath (Director)

PURPOSE OF THIS DOCUMENT

An Environmental Impact Assessment (EIA) consists of several phase as shown below:

This report constitutes the Revised Final Environmental Impact Report (FEIR) and is compiled after the Impact Assessment Phase of the project. The FEIR consolidates all the findings and impact assessment studies that have been undertaken and the presents the findings of the route layouts for the proposed power lines from the Solar Park substation to Ferrum substation.

According to South African EIA Regulations (2010), interested and affected parties must have the opportunity to comment on the proposed project and verify that all the issues raised during the Draft EIR phase have been addressed by the Impact Assessment and adequately recorded for the decision-maker. The Revised FEIR collates all the required information in terms of the EIA regulations for informed decision making by the Competent Authority, and that forms the main purpose of this FEIR.

SUMMARY OF THE CONTENTS OF THE REVISED FEIR:

This report contains the following:

- The background and description to the proposed project;
- An overview of the EIA process, including the public participation process;
- A description of the existing environment in the project area;
- A description of the route layouts for the Ferrum to Solar Park line.
- The impact assessment rating or ranking methodology;
- The potential environmental issues and impacts which have already been identified and assessed;
- The proposed mitigation measures to be implemented in the construction and operational phases of the project in order to minimise negative impacts and enhance positive impacts;
- A list of comments raised to date; and
- The preferred or recommended power line alternative.

ANY CONCLUDING COMMENT ON THE REVISED FEIR IS WELCOME

The Environmental Assessment Practitioner (EAP) collated all your comments during the Scoping and Final EIR phases to gauge whether or not the scope of the specialist studies undertaken and subsequent EIA has appropriately addressed all issues and concerns raised and documented during the FEIR Phase of the Project. This report is available for comment from **5 December 2013 to 24 January 2014**. Any further concluding comment on the Revised FEIR is welcome.

WHERE THE FEIR IS AVAILABLE

This report has been distributed to the authorities and all key stakeholders. Copies of the report are available at strategic public places in the project area (see below) to all registered Interested and Affected Parties.

List of public places where the FEIR is available:

CONTACT	LOCATION	CONTACT
Printed Copies		
Ms Theodora Tsalao	Kathu Public Library, Civic Centre, Cnr Frikkie Meyer & Hendrik Van Eck, Kathu	(053) 723 2261
Ms Ellen Visser	Olifantshoek Public Library, Lanham Straat 1, Olifantshoek	(053) 331 0002
Ms Inga Engelbrecht	Upington Public Library, Mutual Street, Upington	(053) 338 7157
Ms Geene Einam	Kenhardt Public Library, Park Street, Kenhardt	(053) 651 6508
Ms Manda Yough	Kakamas Public Library, 28 Voortrekker Street, Kakamas	(054) 431 6303
Ms Yvonne Booysen	Keimoes Public Library, Hoof Straat Keimoes	(054) 461 6406
Electronic Copies		
Mr Mfundo Maphanga	www.eskom.co.za/eia /Solar Park Integration	011 800 4892
Ms Nicolene Venter	www.zitholele.co.za/eskom-solar	011 207 2077
Ms Nicolene Venter	Available on CD on request via email from Zitholele Consulting	Phone 011 207 2077, or email nicolenev@zitholele.co.za

The report is also available electronically from the Public Participation office or on the Zitholele web site: http://www.zitholele.co.za

HOW TO COMMENT ON THE FEIR:

You can provide comment on this report by:

- Writing a letter, or producing additional written submissions to the Zitholele Public Participation Office.

SEND YOUR COMMENTS TO:

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1 INTRODUCTION

1.1 WHO IS THE PROPONENT?

Eskom Holdings SOC Limited (Eskom) is the main South African utility that generates, transmits and distributes electricity. Eskom was established in 1923 by the South African government and today supplies ~95 % of the country's electricity. The utility is the largest producer of electricity in Africa, is among the top seven utilities in the world in terms of generation capacity and among the top nine in terms of sales. Eskom plays a major role in accelerating growth in the South African economy by providing a high-quality and reliable supply of electricity.

1.2 ELECTRICITY GENERATION AND DISTRIBUTION IN SOUTH AFRICA

1.2.1 Electricity Generation by Eskom

Figure 1-1: Camden coal fired power station.

Electricity provided by Eskom is generated through a variety of means, including coal fired power stations (~90 %)[1], as shown in Figure 1-2, nuclear power stations (6.5 %)[2], hydro-electric plants (2.3 %)[2], and gas fired plants. Coal fired power stations are located near the coal deposits, mostly in the Mpumalanga and Limpopo Provinces, the nuclear power plant Koeberg is located in the Western Cape province, the hydro-electric and gas turbine plants are located in a variety of locations across South Africa. A map showing the location of the power plants and some of the proposed expansion projects is shown in Figure 1-2.

Since the commencement of Eskom's Capacity Expansion programme started in 2005, an additional 4 453.5 MW has already been commissioned. The plan is to deliver an additional 16 304 MW in power station capacity by 2017. Eskom's capacity expansion budget is R 385 billion up to 2013 and is expected to grow to more than a trillion rand by 2026. Ultimately Eskom will double its capacity to 80 000 MW by 2026.

Eskom intend to generate the additional electricity by implementing demand side interventions in conjunction with the construction of a variety of power plants, including: open cycle gas turbine power stations (commissioned in 2007 and subsequently expanded in 2009), hydro-electric pump-storage schemes, solar energy power plants; wind turbine power plants, nuclear power plants, and coal fired power stations. This project aims to integrate one of the new solar stations in the Northern Cape with the existing power grid.

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[1] http://www.eskom.co.za/c/37/electricity-technologies/

[2] http://www.southafrica.co.za/about-south-africa/environment/energy-and-water/

Figure 1-2: Eskom power stations (May 2008).

1.2.2 How Electricity is distributed in South Africa

Figure 1-3: Example of 400 kV Tower.

Transmission lines and towers (Figure 1-3) called pylons link power stations all over South Africa. Transmission lines send the electricity through thick aluminium and copper wires. The network of transmission lines is called the National Grid.

In order for the electricity generated by these power stations to be transmitted safely and efficiently, it must be at a high voltage and a low current. If the current is too high, the cable would heat up and melt, and if the voltage were too low, hardly any energy would be carried. Higher voltages are required to transmit electricity over larger distances. The transmission grid carries the electricity from source (power stations) to consumption areas at 132 kV, 275 kV, 400 kV, and 765 kV, depending on where the electricity needs to be transmitted to.

Figure 1-4: Example of a substation.

Electricity delivered by the transmission grid is then stepped down in facilities called substations (Figure 1-4) 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.

1.3 THE SOLAR PARK INTEGRATION PROJECT

Whilst Eskom's reliance on coal fired power stations has allowed for the generation of some of the cheapest electricity in the world at ~R 10/W, it has resulted in South Africa being the largest producer of greenhouse gases in Africa, and one of the Top 20 greenhouse gas producing countries in the world.

South Africa being committed to reducing Carbon emissions, is a signatory to the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, and is in the process of implementing strategies aimed at reducing the countries carbon emissions.

Furthermore, Eskom is committed to supporting the government’s renewable energy efforts and aims to deliver 2 400 GWh towards the Department of Minerals and Energy’s (DME’s) renewable energy target by 2013[3]. Eskom has committed to reducing coal's current ~90 % share of its primary energy mix to 78 % by the year 2012 and to 70 % by the year 2025[4] through various projects.

Demonstration projects and research, undertaken by Eskom, have shown that both solar and wind energy show great potential in South Africa. As a result (and in view of reducing their carbon footprint) Eskom is looking to increase the renewable energy component of its supply mix to at least 1 600 MW by 2025.

The power supply crisis has also accelerated the need to diversify Eskom's energy mix and its move towards alternative energy sources such as nuclear power and natural gas, as well as various forms of renewable energy.

Until now solar power has been one of the least utilised renewable energy technologies. Solar power provides less than 1 % of the world’s energy, according to the global financial services firm UBS[5]. However, it appears that the potential of solar energy is growing, with UBS calculating 50 % year-on-year growth in the sector[5]. And figures released in 2011, by the Earth Policy Institute, show solar electricity generation is now the fastest-growing electricity source[5]. The main deterrent to the use of solar power has been its cost, estimated at about R 22,00/Watt[5].

The Upington area has been identified as one of the highest solar radiation locations in the world, providing the best opportunities for using the sun to generate electricity. In an effort to utilise renewable energy resources to meet the growing demand for electricity, the South African Government proposes the establishment of a R 150 billion Solar Park at Klipkraal / Olyvenhoutsdrift, ~15 km west of Upington in the Northern Cape. The Solar Park will use the sun’s energy to eventually generate 5 000 MW of electricity.

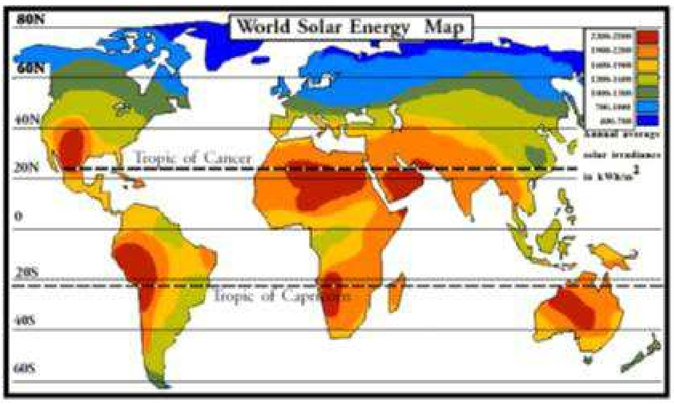

Figure 1-5: Model of solar radiation patterns.

[3] Eskom (November 2008): Renewable Sources of Primary Energy Revision 2. Eskom Fact Sheet: RW0001.

[4] http://www.safrica.info/business/economy/infrastructure/energy.htm

[5] http://www.enn.com/energy/commentary/33779

Figure 1-6: CSP in Seville, Andalusia, Spain.

Eskom is planning to construct a 100 MW Concentrating Solar Power (CSP) plant on the farm Olyvenhoutsdrift. This employs an array of mirrors controlled by tracking systems to focus a large area of sunlight into a small beam. The resulting heat is used to generate electricity. CSP also has the backing of the World Bank[6], which views it as the only zero-emission technology that could potentially rival coal-fired power. Eskom received a positive Record of Decision (RoD), approving a 100 MW CSP facility for this project in August 2007, and is currently underway with an amendment application due to changes in technology and footprint. The expansion of the CSP plant footprint will require an Environmental Authorisation (EA), for which a separate study has been undertaken.

The Department of Energy as well as several Independent Power Producers (IPPs) are busy with investigations to construct solar plants at the Solar Park, which should source sufficient electricity to make up the 5 000 MW planned for the solar park. No technologies have been selected for these plants as yet.

The electricity generated at the Upington Solar Park (by IPP's and Eskom) will need to be integrated into the National Grid. The purpose of this Solar Park Integration Project is to address the major infrastructural investments that Eskom will need to make in order to tie the Upington Solar Park into the National Grid. The proposed Solar Park Integration Project entails the construction of a substation at the Upington Solar Park, 400 kV transmission lines to the east and south of Upington to feed the electricity into Eskom's National Grid as well as the construction of a number of 132 kV power lines inter-linking the IPP solar plants with the Eskom Grid and distributing the power generated to Upington. A more comprehensive list of the project components is given in below and is represented graphically in Figure 1-7.

1.4 APPROACH TO AUTHORISATION

The major infrastructural investments of the Solar Park Integration Project are listed activities in terms of the National Environmental Management Act ([NEMA] No 107 of 1998) and Environmental Impact Assessment (EIA) Regulations (Government Notice Regulation [GNR] 543 to 546, June 2010) and therefore require Environmental Authorisation (EA) from the Department of Environmental Affairs (DEA). In terms of the aforementioned legislation an EIA must be undertaken to obtain an EA. In South Africa provision is made for two types of EIA's; either a Basic Assessment (BA) or a full Scoping and Environmental Impact Reporting (S&EIR) can be undertaken. This is determined by the EIA Regulations (June 2010).

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[6] WORLD BANK GEF, 2006. Assessment of the World Bank/GEF Strategy for the Market Development of Concentrating Solar Thermal Power

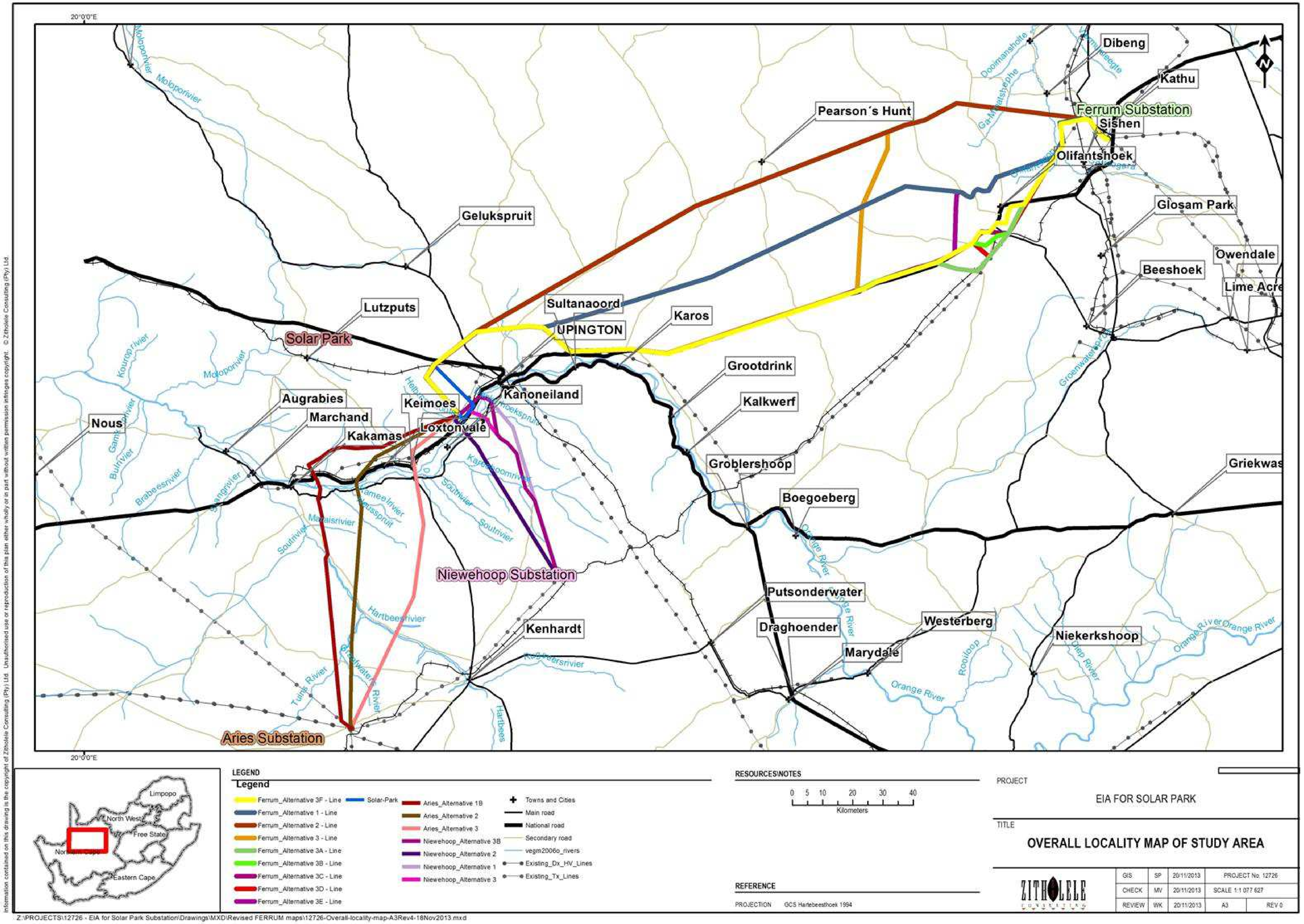

Figure 1-7: Location of the overall integration project.

Some of the activities proposed for the Solar Park Integration Project trigger the requirement for a BA, whilst others require a full S&EIR process be undertaken. In some instances it is possible to logically combine activities into a single application. A summary of the proposed activities, how they have been logically combined into joint applications and the corresponding EA process for these combined applications is shown in Table 1-1.

Table 1-1: Proposed activities according to EA application process.

EA APPLICATION PROCESS	DESCRIPTION OF THE PROPOSED ACTIVITIES
S&EIR No 1	• Solar Park substation (400 kV and 132 kV); • 2 x (±) 125 km of 400 kV lines from Aries substation to Solar Park (southwest of Kenhardt) and associated feeder bays; • 1 x (±) 70 km of 400 kV line from Nieuwehoop substation (northeast of Kenhardt) to Solar Park and associated feeder bays; • Deviation of a road within the property earmarked for the CSP plant; and • Water Use License Application.
S&EIR No 2	• 1 x (±) 200 km of 400 kV line from Ferrum substation (Kathu) to Solar Park and associated feeder bays.
BA No 1	• 3 x 132 kV lines for the Eskom CSP Site and 2 x 20 MVA Transformers at Solar Park site.
BA No 2	• 3 x 132 kV lines for the IPP in Solar Park.
BA No 3	• 5 x 132 kV lines for the DoE Solar Park; and • 2 x (±) 25 km of 132 kV lines to Gordonia Substation (Upington).

1.5 CONTEXT AND OBJECTIVES OF THIS REPORT

This report has been compiled in terms of the **S&EIR No 2** application procedure and addresses the following components of the Solar Park Integration Project (a detailed description of these projects components is given in Section 5):

- 1 x (±) 200 km of 400 kV line from Ferrum substation (Kathu) to Solar Park, and associated feeder bays.

This is the Revised Final Environmental Impact Report (FEIR), a key component of the authorisation process. This report is compiled for stakeholder consumption; for the purposes of review and comment; and to addresses the requirements of Environmental Impact Reporting as outlined in the NEMA EIA Regulations (2010). The aim of this Revised FEIR is to:

- Provide information to the Interested and Affected Parties (I&APs) on the proposed project; including details on the:
  - Alternatives that are being considered;
  - Receiving environment; and
  - Assessing and ranking methodology.

- Indicate how I&APs have been, and are still being, afforded the opportunity to contribute to the project, verify that the issues they raised to date have been considered, and comment on the findings of the impact assessments;
- Provide proposed mitigation measures in order to minimise negative impacts and enhance positive impacts; and
- Present the findings of the Impact Assessment Phase in a manner that facilitates decision-making by the relevant authorities.

The FEIR is hereby made available to all stakeholders for concluding remarks.

1.6 ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP) DETAILS

In terms of the National Environmental Management Act ([NEMA] No 107 of 1998) and Environmental Impact Assessment (EIA) Regulations (Government Notice Regulation [GNR] 543 to 546, June 2010) the proponent must appoint an Environmental Assessment Practitioner (EAP) to undertake an EIA and / or PPP for listed activities regulated in terms of the aforementioned Act. In this regard, Eskom appointed Zitholele Consulting (Pty) Ltd. (Zitholele) to undertake the PPP and complete the Amendment Application for the proposed project, in accordance with the aforementioned regulations.

Zitholele is an empowerment company formed to provide specialist consulting services primarily to the public sector in the fields of Water Engineering, Integrated Water Resource Management, Environmental and Waste Services, Communication (public participation and awareness creation) and Livelihoods and Economic Development.

Zitholele Consulting has no vested interest in the proposed project and hereby declares its independence as required by the EIA Regulations. The details of the EAP representatives are listed below.

The details of the key individuals representing Zitholele, and acting as the EAP on these projects are given below.

<u>Warren Kok, as Project Director</u>

Name:	Warren Kok
Company Represented:	Zitholele Consulting (Pty) Ltd.
Address:	P O Box 6002, Halfway House, 1685
Telephone:	071 250 5371
Fax:	086 674 6121
E-mail:	WarrenK@zitholele.co.za

Warren Kok will be the designated Project Director on behalf of Zitholele. Warren will ensure regulatory compliance, quality assurance and overseeing the Technical

Environmental Team. Warren holds a B.Hon degree in Geography and Environmental Management from Rand Afrikaans University (2000) and a Higher Certificate in Project Management from Damelin. He is a certified Environmental Assessment Practitioner (EAP) who is registered with EAPASA. Warren has in excess of 11 years' experience in environmental consulting in South Africa. His experience spans both the public and private sector. Warren has successfully undertaken countless integrated EIA processes that require integration of the MPRDA, NEM:WA, WULA and NEMA regulatory processes. Many of these projects are considered landmark projects in South Africa's environmental mining sector and included several hazardous waste facilities. He is ideally skilled and experienced to manage this project to its conclusion.

2 LEGAL REQUIREMENTS

The environmental legislation applicable to the project components documented for **S&EIR No 2** (as described in detail in Section 3) is discussed below.

2.1 THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA ACT (NO 108 OF 1996)

Section 24 of the Constitution states that:

Everyone has the right

ii) to an environment that is not harmful to their health or well-being; and

iii) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that-

- *prevent pollution and ecological degradation;*
- *promote conservation; and*
- *secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development*

The current environmental laws in South Africa concentrate on protecting, promoting, and fulfilling the Nation's social, economic and environmental rights; while encouraging public participation, implementing cultural and traditional knowledge and benefiting previously disadvantaged communities.

2.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NO 107 OF 1998)

The NEMA provides a framework for environmental law reform in South Africa 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.

2.2.1 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.

2.2.2 Environmental Impact Assessment Regulations: 543-546 of 18 June 2010

In June 2010, an amended set of NEMA EIA Regulations was promulgated, GNR.543 – 546. These regulations govern amongst others the listing of activities that require EA, the authorisation procedures themselves, and the public participation process for authorisation procedures.

<u>Listed Activities</u>

The project components and the corresponding listed activities that may potentially be triggered are listed in Table 2-1.

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Table 2-1: Relevant NEMA Listed Activities

NOTICE NUMBER AND DATE:	ACTIVITY NUMBER (ito the relevant or notice) :	DESCRIPTION OF THE LISTED ACTIVITY
Upgrade of a 400 kV / 132 kV substation.		
GN R. 545 of 2010	Activity 8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kV or more, outside an urban area or industrial complex. *The project will entail the upgrade of a substation infrastructure outside an urban area which will include the construction of infrastructure (transformers) for the transmission of electricity with a capacity of 400 kV. The substation footprint will not be expanded.*
Construction of two 400 kV power lines from the Ferrum substation to Solar Park.		
GN R. 545 of 2010	Activity 8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kV or more, outside an urban area or industrial complex. *The project will entail the construction of power lines (conductors and pylons) outside urban areas for the transmission of electricity with a capacity of 400 kV.*
GN R. 544 of 2010	Activity 24	The transformation of land bigger than 1000 square metres in size, to residential, retail commercial, industrial or institutional use, where at the time of coming into effect of this Schedule such land was zoned as open space, conservation or has en equivalent zoning. *The construction of the proposed power lines from the proposed CSP substation to the Ferrum substations is expected to result in the transformation of land larger than 1000m to commercial or industrial use where the zoning of the land (i.e. Agricultural Zoning – mostly grazing) can be considered an equivalent zoning to Open Space.*
The construction of access roads for the construction and or long term servicing of all planned infrastructure for the project and/or the realignment and expansion of existing roads.		

NOTICE NUMBER AND DATE:	ACTIVITY NUMBER (ito the relevant or notice) :	DESCRIPTION OF THE LISTED ACTIVITY
GN R. 544 of 2010	Activity 11	The construction of (iii) bridges where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction occur behind the development setback line. *The establishment of new access routes may require the construction of small pipe or culvert bridges to prevent damage and erosion of the road service through submersion of the road service during heavy rains.*
The clearance of indigenous vegetation from the 55 m servitude of the proposed power line.		
GN R. 546 of 2010	13	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation (c) in Northern Cape ii. Outside urban areas (ff) areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve. *The establishment of the 55 m wide servitude for the 400 kV line may require the clearance of more than 1 hectares of indigenous vegetation outside an urban area. The presence of the Kathu Forest which is nationally protected is located within 5 km from the eastern extent of the power line at the Ferrum substation.*
GN R. 546 of 2010	14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation (a) In Northern Cape, i. All areas outside urban areas. *The establishment of the 55 m wide servitude for the 400 kV line may require the clearance of more than 5 hectares of indigenous vegetation outside an urban area. The proposed power line does not fall below the thresholds set in Notice 544 of 2010 therefore this activity is not exempted based on the fact that it is a linear activity.*

Authorisation Procedure in terms of NEMA EIA Regulations

The NEMA EIA Regulations define two broad categories for an EIA, namely: **Basic Assessment (BA) and Scoping and Environmental Impact Reporting (S&EIR)**.

S&EIR 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 comparison, a **BA** is required for projects with less significant impacts or impacts that can easily be mitigated.

The difference between the two procedures relates to the nature of the proposed development in terms of its potential impact on the environment, and this is reflected in the level of detail that information is collected in as well as the level of interaction with I&APs. Based on the aforementioned list of activities that may be triggered by the project a full S&EIR authorisation procedure is required in terms of the NEMA Regulations as amended (June 2010) and published in GNR 543 - 546. A breakdown of the S&EIR procedure and its activities is shown graphically in Figure 2-1.

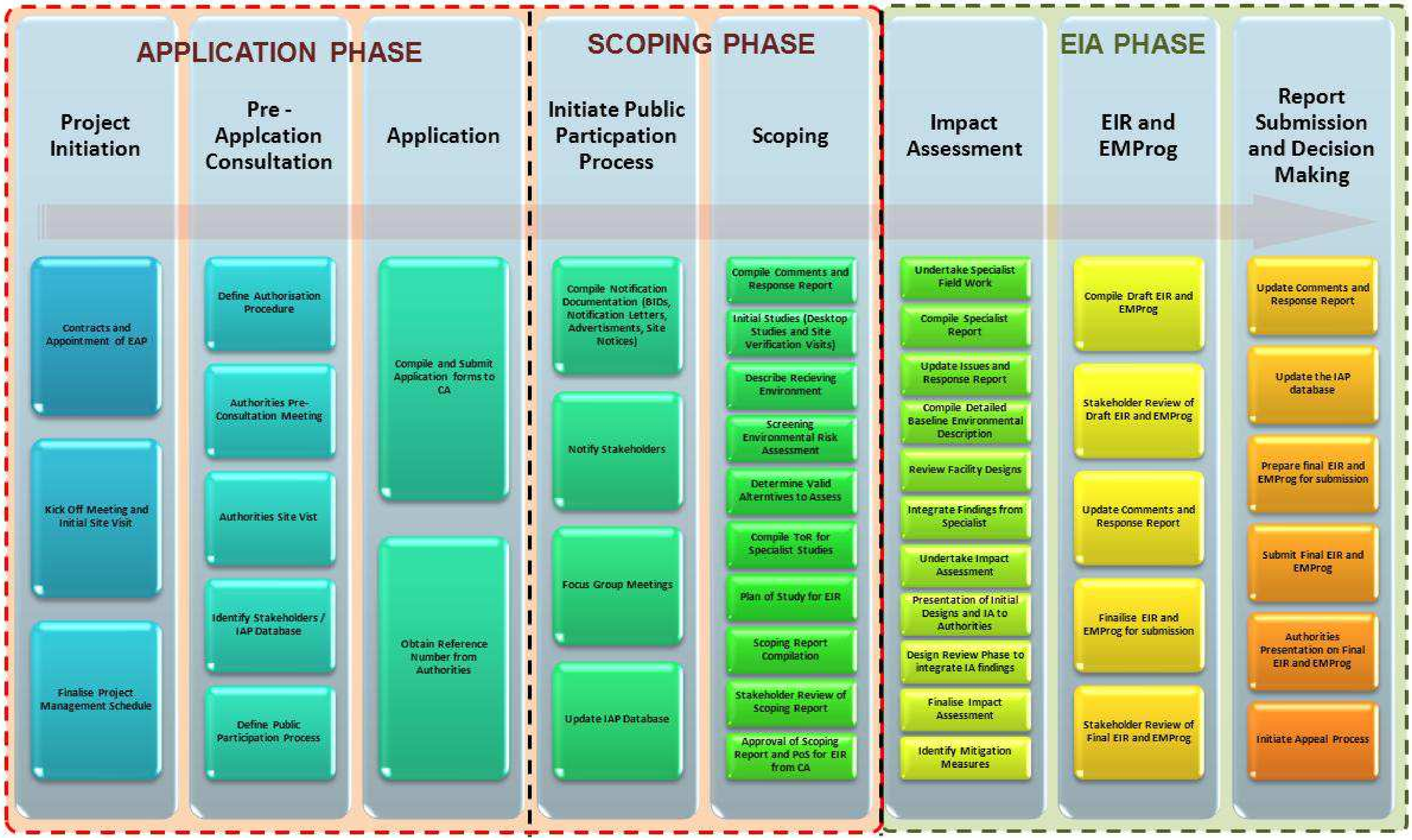

Figure 2-1: Scoping and Environmental Impact Assessment Procedure.

2.3 THE NATIONAL WATER ACT (NO. 36 OF 1998)

In terms of Section 21 of the NWA a Water Use License (WUL) is required for where the power line impacts on a water body. The only perennial water body in the area is the Orange River, which the Ferrum to Solar Park line does not cross. The likely water uses that by law requires a license and may be triggered by the proposed development is given in the table below. Once the final route alignment has been determined and the tower positions have been determined a Water Use License Application (WULA) will be submitted to the Department of Water Affairs for authorisation of the identified water uses as per section 21 of the NWA.

Table 2-2: Section 21 Water Uses.

Water Use	Description
Section 21(a)	Taking of water from a water resource.
Section 21 (c)	Impeding or diverting the flow of water in a water course.
Section 21 (i)	Altering the bed, banks, course, or characteristics of a watercourse. This includes altering the course of a watercourse (previously referred to as a river diversion).

2.4 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT 10 OF 2004

The Act, amongst others, provides the framework for biodiversity management and planning. Section 52 provides for the listing of threatened (critically endangered, endangered or vulnerable) and protected ecosystems (of high conservation value or of high national or provincial importance although not listed as threatened) and for activities or processes within those ecosystems to be listed as 'threatening processes', thus triggering the need to comply with the NEMA EIA regulations. The Act establishes the South African National Biodiversity Institute (SANBI), with a range of functions and powers (Chapter 2 Part 1). It also provides for the listing, control and eradication of invasive species (currently the responsibility of the Conservation of Agricultural Resources Act, 1983).

The development of the ash disposal facility will impact on the riparian and wetland areas next to existing streams and rivers. This may trigger requirements and regulations of the National Environmental management: Biodiversity Act.

2.5 ENVIRONMENT CONSERVATION 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;
- Special nature reserves;
- Limited development areas;
- Regulations on noise, vibration and shock; and
- EIA.

2.6 THE NATIONAL HERITAGE RESOURCES ACT (NO. 25 OF 1999)

The objectives of the National Heritage Resources Act ([NHRAA] No 25 of 1999) are to:

- Introduce an integrated and interactive system for the management of the national heritage resources; to promote good government at all levels, and empower civil society to nurture and conserve their heritage resources so that they may be bequeathed to future generations;
- Lay down general principles for governing heritage resources management throughout the Republic;
- Introduce an integrated system for the identification, assessment and management of the heritage resources of South Africa;
- Establish the South African Heritage Resources Agency (SAHRA) together with its Council to co-ordinate and promote the management of heritage resources at national level;
- Set norms and maintain essential national standards for the management of heritage resources in the Republic and to protect heritage resources of national significance;
- Control the export of nationally significant heritage objects and the import into the Republic of cultural property illegally exported from foreign countries;
- Enable the provinces to establish heritage authorities which must adopt powers to protect and manage certain categories of heritage resources; and
- Provide for the protection and management of conservation-worthy places and areas by local authorities; and to provide for matters connected therewith.

The proposed construction of this project comprises certain activities (e.g. changing the nature of a site exceeding 5 000m2 and linear developments in excess of 300m) that require authorisation in terms of Section 38 (1) of the NHRA. Section 38 (8) of the NHRA 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 this EIA process, specifically by the inclusion of a Heritage Assessment.

2.7 ADDITIONAL RELEVANT ACTS, POLICY DOCUMENTATION AND GUIDELINES

2.7.1 Other relevant acts to take cognisance of

Other acts that will be taken cognisance of are included in the Table 2-3 below

Table 2-3: List of relevant acts that will be considered

Act name	Act no	Notes/remarks
National Environmental Management: protected Areas Act	57 of 2003	Provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity, natural landscapes and seascapes.
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.
Atmospheric Pollution Prevention Act	45 of 1964	Provides for control of dust control and air pollution.
Fencing Act	31 of 1963	Prohibition of damage to a property owner's gates and fences ❖ *Climbing or crawling over or through fences without permission* ❖ *Closing gates* Any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 metres on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to protection of flora.
National Forest Act	84 of 1998	No person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23.
Veld and Forest Fires Act	101 of 1998	Prevention of unauthorised veld and forest fires
Occupational Health and Safety Act	85 of 1993	Prescribes health and safety measures necessary to adhere to for all construction workers
Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act	36 of 1947	Control of the use of registered pesticides, herbicides (weed killers) and fertilisers. Special precautions must be taken to prevent workers from being exposed to chemical substances in this regard.
All relevant Provincial and Municipal bylaws		

2.7.2 Department of Environmental Affairs and Tourism[7] Integrated Environmental Management Information Series

The Department of Environmental Affairs (DEA) Information Series of 2002 and 2006 comprise 23 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 the 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. This information series will be taken into account throughout the EIA process to inform amongst others methodology, assessment of alternatives, impact assessment, and public participation practice. It should be noted that this information series does not supersede legislation or regulations and will be read in context of the most recent regulations as they apply.

2.8 THE COMPETENT AUTHORITY (CA) AND CO-OPERATIVE GOVERNANCE

The Competent Authority (CA) for issuing an EA when dealing with state owned companies such as Eskom is the Department of Environmental Affairs (DEA).

Key commenting authorities will include the local and district municipalities as well as the provincial government of the Northern Cape Province.

[7] The Department of Environmental Affairs and Tourism is now referred to as the Department of Environmental Affairs.

3 AUTHORISATION PROCESS

An EA authorisation process is being followed as outlined in Figure 2-1 and discussed in more detail below. For discussion purposes, ease of understanding, and reference purposes the technical and public participation activities are grouped together and discussed separately.

3.1 TECHNICAL PROCESS

3.1.1 Project Inception Phase

On appointment, Zitholele arranged a project meeting between Eskom and the Zitholele project team. During the inception meeting the following was discussed:

- Project Scope and Requirements;
- Project Schedule;
- Identification of key stakeholders and role players; and
- Analysis of the preliminary power line routes.

A site visit was also conducted on the 19th October 2011 with the objective of familiarising the project team with the area.

3.1.2 Pre-application consultation with relevant authorities

A pre-application meeting was held with the DEA (6th October 2011) in order to determine the grouping of the project applications for the overall integration project as well as to identify the public participation requirements from the department.

3.1.3 Route Selection and Screening

This phase consisted of:

- The identification of alternatives routes for each of the lines;
- Identification of potential environmental and technical sensitivities; and
- A route selection and screening process.

The results of this phase have been discussed in Section 4. A description of the methodology and results of the route selection process is attached in Appendix G.

This phase of the project relied strongly on available desktop information, which was analysed by the Zitholele project team in addition to a route fly-over undertaken by Eskom technical and environmental team and the Zitholele environmental team on the 19th October

2011. The result from the site visit was a fine tuning of the routes to avoid sensitivities such as houses, koppies and other infrastructure.

3.1.4 Compilation and submission of application forms

The EIA application form (attached as Appendix B) for the proposed project was submitted to the DEA on 3rd November 2011. A revised application form indicating relevant and confirmed listed activities is included with the Revised FEIR to DEA and is attached as Appendix B. Copies of the application form and notification of this application form were forwarded to all the commenting authorities.

3.1.5 Scoping Phase

The Scoping Phase of the project consisted of, the:

- Compilation of a project description;
- Identification of all legislation and guidelines;
- Identification of all the stakeholders (i.e. proponent; consulting team; EAP; land owners; CA; consulting authorities; and a list of I&AP's);
- Identification of alternatives for further consideration;
- Screening of the receiving environment;
- Identification of issues and concerns for further investigation during the impact assessment phase;
- Identification of alternatives for further investigation;
- Compilation of a Plan of Study for EIA;
- Compilation of a Terms of Reference for Specialist Studies;
- Compilation and approval of the Scoping Report (SR);

The aforementioned was all documented in the SR. The Draft SR was made available for stakeholder review prior to finalisation and submission to authorities for decision-making. Using the comments received from the review of the draft report the Final SR was compiled and submitted on 30 March 2012 to the CA for review and acceptance. The Final SR was accepted by the CA on 14 June 2012. The acceptance letter is attached in Appendix B3.

3.1.6 Specialist Studies

The primary objective of this phase of the project is to undertake specialist studies at a sufficient level of detail to be able to determine the environmental and social impacts of the proposed development and all its components. Specialist studies must also be undertaken at such a level of detail that it can be used to inform the design phase, assisting to eliminate environmental impacts wherever possible early in the project, reducing the need for costly mitigation at a later stage. Based on the available data, the issues raised by stakeholders and the sensitivities identified the following specialist studies were conducted:

- Biophysical Study (including):
  - Soils and Land Capability Assessment;
  - Terrestrial Ecology Assessment (Fauna and Flora);
  - Surface Water Assessment and Wetland Delineation; and
  - Aquatic Ecology Assessment;
- Avifauna Assessment;
- Heritage Impact Assessment;
- Social Impact Assessment; and
- Visual Impact Assessment.

The findings of these studies have been documented in the Revised FEIR and are attached as Appendices H. The specialist studies undertaken have been undertaken and reported in two phases:

- Phase 1: Initial Specialist Studies – used in the compilation of the Draft EIR; and
- Phase 2: Final Specialist Studies – used in the compilation of the Final EIR, updated with more detailed information, and including the comments from stakeholders who have reviewed the Draft EIR.

3.1.7 Impact Assessment

The primary objectives of this phase are to:

- inform the design of the project in order to eliminate negative impacts and plan for positive impacts prior to implementation of project;
- consider project alternatives in order to determine if there are feasible alternatives that can implemented to eliminate or avoid negative impacts or accentuate positive impacts;
- where impacts cannot be eliminated or avoided to assess these potential negative and positive impacts;
- identify potential mitigation measures that can reduce the significance of negative impacts or accentuate positive impacts; and
- develop management plans that are designed to give effect to the impact assessment and identified mitigation measures.

The impact assessment was not a discrete process happening in isolation, but rather was conducted throughout the entire process, most especially during the phase of design review and planning. Once the final preferred layout and design was selected, the final impact assessment statement for the various environmental elements was written up.

A standard environmental impact assessment methodology was utilised by the EAP and specialist consultant to ensure uniformity of assessment and reporting, thus ensuring that a vast range of impacts can be compared.

The impact assessment methodology utilised is compliant with the NEMA and associated regulations, considers all phases of the development from construction through to decommissioning, and takes into consideration cumulative impacts. Furthermore impacts are assessed prior to mitigation and with mitigation measures implemented.

The environmental impacts have been ranked according to the methodology described below. 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 3-1.

Table 3-1: Quantitative rating and equivalent descriptors for the impact assessment criteria

Rating	Significance	Extent Scale	Temporal Scale
1	VERY LOW	*Isolated sites / 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.

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 (1 000 km2) 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 3-2 below.

Table 3-2: 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 are 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.

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 3-3.

Table 3-3: 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 10 km from the proposed route.
2	Study Area	The impact will affect an area not exceeding the Eskom servitude.
1	Isolated Sites / proposed route	The impact will affect an area no bigger than the power line pylon footing.

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 3-4.

Table 3-4: 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 facility.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

Degree of Probability

Probability or likelihood of an impact occurring will be described as shown in Table 3-5 below.

Table 3-5: Description of the degree of probability of an impact occurring

Rating	Description
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	It's going to happen / has occurred

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 3-6. 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 3-6: 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.
Don't know	The consultant cannot, or is unwilling, to make an assessment given available information.

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:

Impact Risk = (SIGNIFICANCE **+** *Spatial* **+** Temporal) X Probability

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

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

Table 3-7: 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 five classes as described in the table below.

Table 3-8: 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.

Cumulative Impacts

It is a requirement of the EIA Regulations that the impact assessment takes cognisance of cumulative impacts. In fulfilment of this requirement the impact assessment will take include the assessment of any existing impact sustained by the operations, any mitigation measures already in place, any additional impact to environment through continued and proposed future activities, and the residual impact after mitigation measures.

It is important to note that cumulative impacts at the national or provincial level will not be considered in this assessment, as the total quantification of external companies / projects on resources is not possible at the project level due to the lack of information and research documenting the effects of existing activities. Such cumulative impacts that may occur across industry boundaries can also only be effectively addressed at Provincial and National Government levels.

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
- Temporal Scale – in <u>underline</u>
- Probability – in <u>*italics and underlined*</u>
- Degree of certainty - in **bold**
- Spatial Extent Scale – in *italics*

3.1.8 Environmental Impact Reporting

Once the impact assessment phase is completed, the findings are recorded in the EIR and accompanying EMPr reports. The reports have been compiled in such a manner that the NEMA and NWA are both satisfied. The report includes the following:

- A detailed description of the proposed development;
- A description of the need and desirability of the proposed development and the identified potential alternatives to the proposed activity;
- A detailed description of the proposed development site;
- A description of the environment that may be affected by the activity and the manner in which physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed development;
- A summary of the methodology used in determining the significance of potential impacts;
- A description and comparative assessment of all alternatives identified during the environmental impact assessment process;
- A summary of the findings of the specialist studies;
- A detailed assessment of all identified potential impacts;
- A list of the assumptions, uncertainties and knowledge gaps;
- An opinion by the EAP as to whether the development is suitable for approval within the proposed site;
- An Environmental Management Programme that complies with NEMA and NWA;
- Copies of all specialist reports appended to the EIR;
- An environmental awareness plan; and
- Any further information that will assist in decision making by the authorities.

In addition, as required by the EIA Regulations (2010), the details of the PPP conducted are also documented in the EIR and includes *inter alia*:

- a list of all the potential interested and affected parties that were notified;
- the steps that were taken to notify potentially interested and affected parties;
- proof that notice boards, advertisements and notices notifying potentially interested and affected parties, and (if applicable) the owner or person in control of the land, of the application have been displayed, placed or given;
- a list of all persons, organisations and organs of state that were registered as interested and affected parties in relation to the application;
- Comments and Response Reports containing summaries of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues (or the reason for not addressing an issue); and
- Copies of all the comments received from interested and affected parties.

The Draft EIR will be reviewed through the PPP using the same methods as utilised for the Scoping Report (as described below). In summary stakeholders will be notified of the availability if the report and ample opportunity will be provided for stakeholders to engage with the team. A public meeting will be held and the draft report will be freely available in electronic format.

3.1.9 Environmental Management Programme

The development of mitigation and management measures has happened throughout the course of the project, from the assessment of the first alternative to the selection of a preferred design. In addition best practice has been considered when identifying mitigation and management measures for potential impacts.

An EMPr, in the context of the Regulations, is a tool that takes a project from a high level consideration of issues down to detailed workable action plan that can be implemented in a cohesive and controlled manner. The objectives of an EMPr are to minimise disturbance to the environment, present mitigation measures for identified impacts, maximise potential environmental benefits, assign responsibility for actions to ensure that the pre-determined aims are met, and to act as a “cradle to grave” document.

The Draft EMPr has been drafted according to the findings in the impact assessment, and is included in the FEIR for consultation purposes. The Final EMPr will be published as a standalone document for ease of use.

3.2 SUBMISSION OF FINAL EIR AND DECISION MAKING

Using the comments generated by the PPP the FEIR was updated and finalised. All comments received was added to the CRR and attached to the Revised FEIR as Appendix E.

The Revised FEIR once updated with additional issues raised by I&APs may contain new information. The Revised FEIR will be submitted to the DEA for decision making, and will be distributed to those I&APs who specifically request a copy. I&APs will be notified of the availability of the report.

3.3 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 NEMA (Chapter 1), South Africa's overarching environmental law. In addition, Section 24 (5), Regulation 54 - 57 of GNR 543 under the National Environmental Management Act, guides the public participation process that is required for an Environmental Impact Assessment (EIA) process.

The public participation process for the proposed integration of the Solar Concentrating Plant has been designed to satisfy the requirements laid down in the above legislation and guidelines. This section of the report highlights the key elements of the public participation process to date.

3.3.1 Objectives of public participation in an EIA

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

- During Scoping:
  - Assist the I&APs with identified issues and concerns, and providing suggestions for enhanced benefits and alternatives.
  - Contribute their local knowledge and experience.
  - Verify that their issues have been considered and to help define the scope of the technical studies to be undertaken during the Impact Assessment.
- 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.

The key objective of public participation is to ensure transparency throughout the process and to promote informed decision making.

3.3.2 Identification of interested and affected parties

The identification of stakeholders is on-going and is refined throughout the process. As the on-the-ground understanding of affected stakeholders improves through interaction with various stakeholders in the area the database is updated. The identification of key stakeholders and community representatives (land owners and occupiers) for this project is important as their contributions are valued. The identification of key stakeholders was done in collaboration with Eskom (through the I&AP database for the EIAs in the area), the local municipalities and other organisations in the study area.

The stakeholders' details are captured on Maximiser 9, an electronic database management software programme that automatically categorises every mailing 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 NEMA EIA Regulations under Section 24(5) of NEMA, a register of I&APs (Regulation 55 of GNR 543) 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 D).

3.3.3 Announcement of opportunity to become involved

The opportunity to participate in the EIA was announced in November 2011 as follows:

- Distribution of a letter of invitation to become involved, addressed to individuals and organisations, accompanied by a Background Information Document (BID) containing details of the proposed project, including a map of the project area, and a registration sheet (Figure 3-1 and Appendix F).

Figure 3-1: Background Information Documents were distributed in the area.

- Advertisements were placed in the following newspapers (See Appendix C)

Table 3-9: Advertisements placed during the announcement phase.

Newspaper	Date to announce the project	Date to announce the availability of the DSR
Gemsbok	16 November 2011	25 January 2012
Noordkaap	16 November 2011	25 January 2012
Kathu Gazette	19 November 2011	28 January 2012
Kalahari Bulletin	17 November 2011	26 January 2012
Stellalander	16 November 2011	25 January 2012
Volksblad	17 November 2011	25 January 2012
Sondag	20 November 2011	29 January 2012

- Notice boards were positioned at prominent localities during November 2011. These notice boards were placed at conspicuous places and at various public places. Site notices were placed prominently to invite stakeholder participation (Figure 3-2).

Figure 3-2: Site notice boards were put up in the study area.

3.3.4 Obtaining comment and contributions

The following opportunities were available during the Scoping phase for Interested and Affected Parties (I&APs) to contribute to the finalisation of the Scoping Report:

- Completing and returning the registration/comment sheets on which space was provided for comment.
- Providing comment telephonically or by email to the public participation office.
- Attending stakeholder meetings that has been widely advertised (see table below) and raise comments there.

Table 3-10: Stakeholder meetings have been advertised and were held as part of the public review period of the Draft Scoping Report Public Meeting Venues.

Date	Time	Venue
Monday, 6 February 2012	09:30	Namakwari Lodge, 1 Frikkie Meyer Road, Kathu
Monday, 6 February 2012	14:00	Ditloung Public Hall, Lanham Straat 1, Olifantshoek
Tuesday, 7 February 2012	09:30	Protea Hotel, 24 Schroder Street, Upington
Tuesday, 7 February 2012	14:00	Protea Hotel, 24 Schroder Street, Upington
Tuesday, 7 February 2012	18:30	Protea Hotel, 24 Schroder Street, Upington
Wednesday, 8 February 2012	09:30	Keimoes Hall, Main Road Keimoes
Wednesday, 8 February 2012	14:00	Kakamas Library Hall, 28 Voortrekker Street, Kakamas
Thursday, 9 February 2012	11:00	Kenhardt Public Hall, Park Street, Kenhardt

The minutes of the stakeholder meetings is attached to the FEIR in the form of a Comments and Response Report.

3.3.5 Comments and Response Report, and acknowledgements

All issues received in response to the notification letters and BID were captured in a Comments and Responses Report (CRR) and appended to the Draft EIR. The advantage of the CRR is that it proves that the process is transparent and open. It also stimulates people in other areas to contribute issues of concern or suggestions for mutual benefit.

The CRRs are categorised into the disciplines required for conducting specialist investigations, with a last category termed 'other issues'. The response column indicates to stakeholders how their issues will be, or have been, dealt with.

The report is updated as the process proceeds and at the end of the process is presented to the authorities (and other stakeholders) together with the FEIR as a full record of issues raised, and how the issues were reflected in the findings of the Impact Assessment. Reasons for not taking up certain issues in the Impact Assessment process are provided. The reports are instrumental in informing the compilation of the EMPr for the development and operation of the proposed project, which gives effect to the findings of the Impact Assessment and other relevant reports.

The following versions of the CRR are compiled (every version is an update of the previous version):

- Version 1 appended to the Draft Scoping Report;
- Version 2 appended to the Final Draft Scoping Report;
- Version 3 appended to the Draft EIR and EMPr;
- Version 4 appended to the Final EIR and EMPr; and
- Version 5 appended the Revised FEIR and EMPr.

3.3.6 Draft Scoping Report

The purpose of the Public Participation Process (PPP) in the Draft SR is 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 the Impact Assessment Phase of the EIA. A period of four weeks was available for public review of the Draft SR (from 30 January to 9 March 2012).

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 (November 2011).
- In advertisements published (see Table 3 9 above and Table 3-10) to advertise the proposed project.
- In a letter sent out on 18 November 2012, and addressed personally to all individuals and organisations on the stakeholder database.

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

- Left in public venues within the vicinity of the project area. (These are listed in Table 3-11 below);
- Mailed to key stakeholders.
- Mailed to I&APs who requested the report.
- Copies will be made available at the public meetings

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 3-11: List of public places where the Draft Scoping Report was available.

Contact	Location	Contact
Printed Copies		
Ms Theodora Tsalao	Kathu Public Library, Civic Centre, Cnr Frikkie Meyer & Hend rik Van Eck, Kathu	(053) 723 2261
Ms Ellen Visser	Olifantshoek Public Library, Lanham Straat 1, Olifantshoek	(053) 331 0002
Ms Inga Engelbrecht	Upington Public Library, Mutual Street, Upington	(053) 338 7157
Ms Geene Einam	Kenhardt Public Library, Park Street, Kenhardt	(053) 651 6508
Ms Manda Yough	Kakamas Public Library, 28 Voortrekker Street, Kakamas	(054) 431 6303
Ms Yvonne Booysen	Keimoes Public Library, Hoof Straat Keimoes	(054) 461 6406
Electronic Copies		
Mr Mfundo Maphanga	www.eskom.co.za/eia /Solar Park Integration	011 800 4892

Mr Andre Joubert	www.zitholele.co.za/eskom-solar	011 207 2077
Mr Andre Joubert	Available on CD on request via email from Zitholele Consulting	Phone 011 207 2077, or email andrej@zitholele.co.za

3.3.7 Final Scoping Report

The Final Scoping Report (this report) was updated with additional issues raised by I&APs and may have contained new information. The Final SR was distributed to the Authorities (DEA) and key I&APs, and to those individuals who specifically request a copy. I&APs were notified of the availability of the report in the same manner as used for the review of the Draft SR.

3.3.8 Public participation during the Impact Assessment Phase

The EIA Guidelines specify that stakeholders must have the opportunity to verify that their issues have been captured and assessed before the EIR and EMPr will be approved. The Draft EIR and EMPr were therefore distributed to the same public places used during the Scoping Phase of the project. Stakeholders were allowed a period of 30 calendar days to review the reports from 8 November to 7 December 2012.

As part of the process to review the Draft EIR and EMPr, stakeholder meetings were arranged to afford stakeholders the opportunity to obtain first-hand information from the project team members and also to discuss their issues and concerns.

Contributions at these meetings will be considered in the FEIR. The same public places were used as in the scoping phase and the stakeholder meetings were conducted at the same towns as during the scoping phase (See Table 3-14).

I&APs were advised in good time of the availability of these reports, how to access them, and the dates and venues of public and other meetings where the contents of the reports will be presented for comment.

Advertisements were placed in the same newspapers are during the announcement and draft scoping report phases.

Table 3-12: Advertisements placed to announce the Draft EIR

Newspaper	Announcement of availability of the DEIR
Gemsbok	7 November 2012
Noordkaap	7 November 2012
Kathu Gazette	3 November 2012
Kalahari Bulletin	8 November 2012
Stellalander	7 November 2012
Volksblad	7 November 2012
Sondag	4 November 2012

Draft EIR

The Draft EIR, including the CRR Version 3, was distributed for comment as follows:

- Left in public venues within the vicinity of the project area. (These are listed in Table 3-13 below);
- Mailed to key stakeholders.
- Listed on the Eskom and Zitholele Consulting websites;
- Mailed to I&APs who requested the report.
- Copies will be made available at the public meetings.

Table 3-13: List of public places where the Draft EIR was available

Contact	Location	Contact
Printed Copies		
Ms Theodora Tsalao	Kathu Public Library, Civic Centre, Cnr Frikkie Meyer & Hendrik Van Eck, Kathu	(053) 723 2261
Ms Ellen Visser	Olifantshoek Public Library, Lanham Straat 1, Olifantshoek	(053) 331 0002
Ms Inga Engelbrecht	Upington Public Library, Mutual Street, Upington	(053) 338 7157
Ms Geene Einam	Kenhardt Public Library, Park Street, Kenhardt	(053) 651 6508
Ms Manda Yough	Kakamas Public Library, 28 Voortrekker Street, Kakamas	(054) 431 6303
Ms Yvonne Booysen	Keimoes Public Library, Hoof Straat Keimoes	(054) 461 6406
Electronic Copies		
Mr Mfundo Maphanga	www.eskom.co.za/eia /Solar Park Integration	011 800 4892
Mr Andre Joubert	www.zitholele.co.za/eskom-solar	011 207 2077
Mr Andre Joubert	Available on CD on request via email from Zitholele Consulting	Phone 011 207 2077, or email andrej@zitholele.co.za

Table 3-14: Stakeholder meetings have been advertised and were held as part of the public review period of the Draft EIR Public Meeting Venues

Date	Time	Venue
Monday, 19 November 2012	09:00	Namakwari Lodge, 1 Frikkie Meyer Road, Kathu
Monday, 19 November 2012	15:00	Rooiwal Boerevereniging, Malley, near Olifantshoek
Tuesday, 20 November 2012	10:00	Kai !Garib Municipality, Park Street, Kenhardt
Tuesday, 20 November 2012	18:00	Protea Hotel Upington, 24 Schröder Street, Upington
Wednesday, 21 November 2012	08:30	Protea Hotel Upington, 24 Schröder Street, Upington
Wednesday, 21 November 2012	14:00	Kakamas Library Hall, 28 Voortrekker Street, Kakamas

Revised Draft EIR

During the PPP for the draft EIR I&APs who attended the public meetings put forth another alternative route alignment that deviated somewhat from the existing identified alternatives. These routes were thus investigated and subsequently included in a revised Draft EIR. The revised Draft EIR was made available for public review in the same manner as for the Draft EIR and was left in the same public places for review as was the Draft EIR. A revised version 3 of the CCR was included with the revised Draft EIR.

Announcing the availability of the FEIR and EMPr

After comments from I&APs have been incorporated, all stakeholders on the database will receive a personalised letter to report on where we are in the process, to thank those who commented to date and to inform them that the FEIR and EMPr have been submitted to the lead authority for consideration. They will also be provided the opportunity to comment on the final reports.

Revised FEIR

After the FEIR was submitted to DEA for consideration it became evident that further stakeholder and landowner consultation was required. The FEIR was withdrawn from the DEA and another round of landowner consultation was undertaken. During this consultation period, landowners suggested an additional alternative to those already investigated by the EIA project team. After initial assessment of the proposed additional alternative it became evident that this suggestion was feasible. New corridor Alternative 3F was further investigated which resulted in additional consultation with potentially affected communities on the eastern edge of Olifantshoek. A public meeting was held in the community hall to inform the residents of the proposed alternative addition and to record and respond to comments raised.

3.3.9 Announce authorities' decision on Environmental Authorisation

The Environmental Authorisation / Decision will be advertised through the following methods:

- Personalised letters to individuals and organisations on the mailing list; and
- Advert in local or regional newspapers.

4 ISSUES IDENTIFIED TO DATE

The proposed project is anticipated to impact on a range of biophysical and socio-economic aspects of the environment. The main purpose of the EIA process is to evaluate the significance of these potential impacts and to determine how they can be minimised or mitigated.

It should be noted that a comprehensive Environmental Management Programme (EMPr) will be developed and implemented to regulate and minimise the impacts during the construction and operational phases. The potential environmental impacts and issues identified to date is summarised in Table 4-1 below.

Table 4-1: Potential Environmental Impacts to be investigated in the EIA Phase.

Environmental element	Potential environmental impact
Topography and Land Use	Normal farming practises should not be disrupted or disturbed during and after the construction of the proposed power lines.
Soil and Land Capability	The area is severely sensitive to erosion and due consideration should be taken with the construction of roads and foundations for power lines. General maintenance of existing power lines also emerged as a major contributing factor resulting in significant erosion in some areas.
Flora	A number of tree species was identified that is protected or endangered and will require permits to trim or remove from the Department of Agriculture, Forestry and Fisheries. Some plant species occurring on the rocky slopes of hills in the vicinity of Olifantshoek was noted by the relevant study and taken into consideration
Fauna	The impacts to vegetation will negatively impact on habitat, and consequently the faunal elements of the receiving environment. Potential Avifauna impacts were identified for the route from Upington to Kathu and mitigation measures proposed.
Cultural and Historical Resources	Several gravesites and historical buildings were identified in the area during the fly over. These sites may be disturbed during the construction of the proposed infrastructure. A heritage impact assessment was undertaken to investigate the impacts of the proposed development on potential heritage resources in the area.
Socio-Economic Environment	The news of employment opportunities may result in an influx of workers to the area, thereby impacting existing community networks and perceptions of safety and crime levels. The routing of the proposed high voltage power lines across the properties of landowners was identified as a significant issue.
Water	The potential impact on water resources in the area was investigated.

5 PROJECT DESCRIPTION

As aforementioned, this EIA is being undertaken on the proposed 1 x 400 kV power line between the existing Ferrum Substation and the proposed Solar Park Substation. The **study area for each power line corridor was chosen as a 2 km wide corridor** within which the proposed power lines could be constructed. Additionally, where required it is proposed to construct and maintain access roads adjacent to the proposed power line.

In order to link the proposed new 400 kV power lines into the grid other electrical infrastructure is required at the take-off (Solar Park Substation) and end point (Ferrum Substation). These infrastructure requirements will take place within the footprint of the existing substations.

A more detailed description of the relevant project components is given in the sections below.

5.1 PROJECT MOTIVATION

The following project motivations are relevant:

- The sources of electricity generation need to be diversified to ensure security of supply, and reduction in carbon footprint created by the current heavy reliance on coal produced electricity in South Africa.
- In the light of the growing electricity demands in South Africa, the need to develop and implement renewable energy initiatives has become a national priority. Solar energy is one of the identified technologies for development and implementation.
- Studies on solar irradiance have indicated that the Upington area is one of the highest areas of irradiance in the world and would thus be a good location to develop a solar power generating facility.
- The proposed CSP is a new power station with a life in excess of 60 years that will generate electricity (100 MW) from renewable solar power.
- The DoE and IPP's in the Solar Park will generate an additional 50 MW of power using solar power.
- The energy from the solar park has to be integrated and connected with the local and provincial electricity grid to be able to provide power to the users.

5.2 PROJECT INFRASTRUCTURE / COMPONENTS

Infrastructure requirements in terms of this phase of the proposed project are as follows:

- Ferrum Substation:

- Establish 1 x 400 kV transformer feeder bay within the footprint of the existing substation;
- Addition of a 400 / 132 kV transformer.

- Transmission Line
  - Approximately 1 x ± 200 km 400 kV power line between the Ferrum and CSP Substations.

5.3 HOW POWER GRIDS WORK

In order to facilitate a better understanding of the proposed project and the electrical infrastructure requirements mentioned above a brief description on how the power grid works has been included as an extension to the introduction in Section 1.2. Figure 5-1 below provides an illustration of how a power grid operates and where exactly a 400 kV transmission power line fits into the network that distributes power.

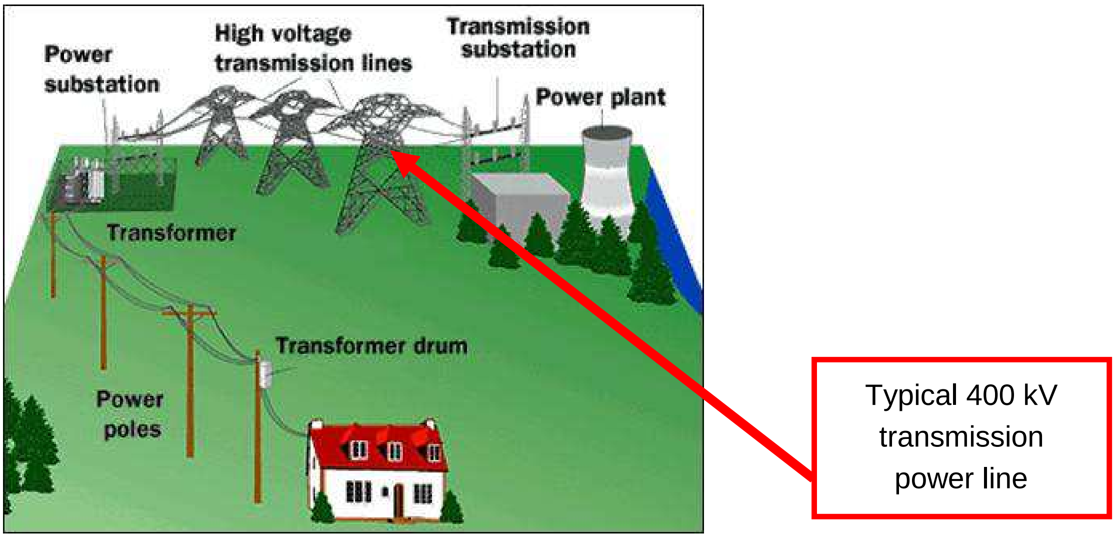

Figure 5-1: Power distribution from Power Plant to household user.

Electricity always commences at the point where power is generated. The power stations generate what is known as three-phase AC current. The three-phase AC current leaves the generator and enters a **transmission substation** near the power station.

This substation uses large transformers to convert the generator's voltage (which is at the thousands of volts level) up to extremely high voltages for long-distance transmission on the transmission grid. Typical voltages for long distance transmission in South Africa range from 132 kV to 765 kV and are usually made of huge steel pylons / towers. All pylons like this have three sets of wires for the three phases. Many pylons have extra wires running along the top of the pylons. These are ground wires and are there primarily for lightning protection.

Figure 5-2: Typical transmission power lines.

For power to be useful in a home or business, it comes off the transmission grid and is stepped-down to the distribution grid. This may happen in several phases. The place where the conversion from "transmission" to "distribution" occurs is in a substation. A substation typically does the following:

- It has transformers that step transmission voltages (in the tens or hundreds of thousands of volts range) down to distribution voltages (typically 33 kV).
- It has a "bus" that can split the distribution power off in multiple directions.
- It often has circuit breakers and switches so that the substation can be disconnected from the transmission grid or separate distribution lines can be disconnected from the substation when necessary.

Figure 5-3 provides an example of a large transformer, incoming power from the transmission grid and a set of switches for the incoming power. Toward the right is a distribution bus plus three voltage regulators.

Figure 5-3: Example of a transformer, incoming power from the transmission grid, a set of switches for the incoming power and distribution bus plus three voltage regulators.

The power goes from the transformer to the distribution bus. In this case, the bus distributes power to two separate sets of distribution lines at two different voltages. The smaller transformers attached to the bus are stepping the power down to standard line voltage (usually 7,200 volts) for one set of lines, while power leaves in the other direction at the higher voltage of the main transformer. The power leaves this substation in two sets of three wires, each headed down the road in a different direction (Figure 5-4).

Figure 5-4: Distribution bus and low voltage distribution power lines.

5.4 PROJECT PHASES

5.4.1 Construction Phase

The construction phase for the proposed project will take approximately 24 - 36 months to complete and will entail the following process post authorisation:

- *Corridor walk-down:* To ensure that all site specific sensitivities such as sensitive or protected fauna and flora or heritage resources are avoided. During this process the exact co-ordinates of the proposed pylons will be established.
- *Construction Camps:* The location of the construction camps will be determined during the Impact Assessment Phase of this EIA. During the construction phase the construction camp will be established.
- *Vegetation clearance:* A 55 metre (22.5 metres on either side of the power line) servitude is required for the proposed 400 kV power line, tall trees will be cleared where necessary along the entire length of the servitude. Vegetation within the servitude will also be maintained where necessary by Eskom in the operational phase of the project.
- *Pylon footings:* Foundations will be laid for the footings of the pylons.
- *Steelwork structures:* The pylons will be erected in segments.
- *Stringing:* Once the pylons have been erected, cables will be strung by hand and mechanically between the pylons.

- *Feeder bays and Transformers:* Feeder bays and transformers will be erected in the existing footprint of the Ferrum substation.

Since the proposed power lines will be approximately 200 km in length, the aforementioned tasks may occur simultaneous along the power line corridor.

5.4.2 Operational and Maintenance Phase

During operations, Eskom requires access to the servitude for maintenance activities. Maintenance activities are specialised and are, therefore, carried out by Eskom employees. During the operational life of the power line, there will be no people housed along the servitude.

5.4.3 Decommissioning Phase

The following are assumed:

- The physical removal of the power line infrastructure would entail the reversal of the construction process.
- A rehabilitation programme would need to be agreed upon with the landowners (if applicable) before being implemented.
- Materials generated by the decommissioning process will be disposed of according to the Waste Hierarchy i.e. wherever feasible materials will be reused, then recycled and lastly disposed of. Materials will be disposed of in a suitable manner, in a suitably licensed facility.

All of the aforementioned decommissioning activities would be subject to a separate EIA and environmental authorization at the appropriate time.

6 CONSIDERATION OF ALTERNATIVES

6.1 ALTERNATIVE ASSESSMENT

6.1.1 The "do nothing" or "No-Go" alternative

The Solar Park project is being constructed in response to several driving forces. These include among others:

1.) The demand for electricity locally and nationally in South Africa to maintain current development growth rate.

2.) The environmental conditions in Upington and surrounds make it one of the most suitable locations worldwide for a Solar Energy Power Plant.

3.) The sources of electricity generation need to be diversified to ensure security of supply, and reduction in carbon footprint created by the current heavy reliance on coal produced electricity in South Africa.

The construction of the Solar Park without the Solar Park Integration Project will be a waste as none of the electricity generated can be fed into the power grid. Electricity would thus be generated and lost. The demand for electricity would not decrease, and the reliance on less environmentally friendly sources for electricity in South Africa would be increased. The solar energy resource in Upington would not be utilised and would go to waste. The initiative of the South African Department of Energy to diversify electricity generation sources would be seriously impacted.

At a provincial and local level the reliability of electricity supplies to the Northern Cape Province would remain a significant concern unless other sources of power generation and transmission are provided. With increasing economic activity and demand for electricity in the Northern Cape Province, the regional impact of electricity failures would be significant and increasingly severe.

6.1.2 Design Alternatives

Below the ground alternative

The 400 kV line is the second largest in South Africa in terms of capacity. The servitude width is 55 m, and the height is of the order of 30 – 40 m. With 400 kV Transmission lines, there is always a visual impact, some areas being more sensitive than others. The option of taking the Transmission lines underground will address this impact, but there are other issues that need to be considered:

- The cost of underground lines is approximately 20 times more expensive than the equivalent overhead lines.

- Servitude requirements are far more onerous.
- The servitude would effectively be sterilised for many land uses, including most agricultural applications.

Once the transmission line is installed, and the area rehabilitated, surface uses are restricted. Tree growth is not permitted as any plants with a substantive rooting depth are controlled. Grasses and small shrubbery may be established over time. Any surface uses are also prohibited, and the area is sterilised to most agricultural applications.

This alternative is therefore considered economically unfeasible, and has not been considered further in this EIR.

<u>Substation Designs</u>

At present Eskom are evaluating two proposed designs for the Solar Park Substation. The two designs are very similar with the exception being a gap between the bus bars for the distribution (132 kV) lines and the transmission (400 kV) lines in the one option as opposed to no gap in the other. **As indicated, the authorisation of the CSP substation does not form part of this application for environmental authorisation, but the substation concept design indicating the layout of the proposed substation is included in Appendix K for continuity in assessment of this application**.

<u>Tower Designs</u>

There are various types of tower designs that have different implications in terms of cost for implementation. The need for selecting a tower type will be determined by the project team that will consider the tower type that is most feasible and can still be a lower risk in terms of bird collisions. The tower designs will conform to Eskom (see Appendix L) and recognized national and international best standards and specifications. The following tower design series will be considered for implementation of the transmission power lines.

These towers are generally 30 m to 40 m in height and a total footprint area of 80 m x 50 m is required for each tower. The average span between two towers is 400 m, but can be more depending on the topography and structure location within the landscape.

Self-supporting suspension tower

The self-supporting tower design (Figure 6-1) does not require a large portion of land for its footprint and is generally used where the footprint of the structure is required to be small, or where guyed suspension is not feasible or practical. In terms of the economic feasibility, it was found that self-supporting suspension towers are more costly as compared to other towers.

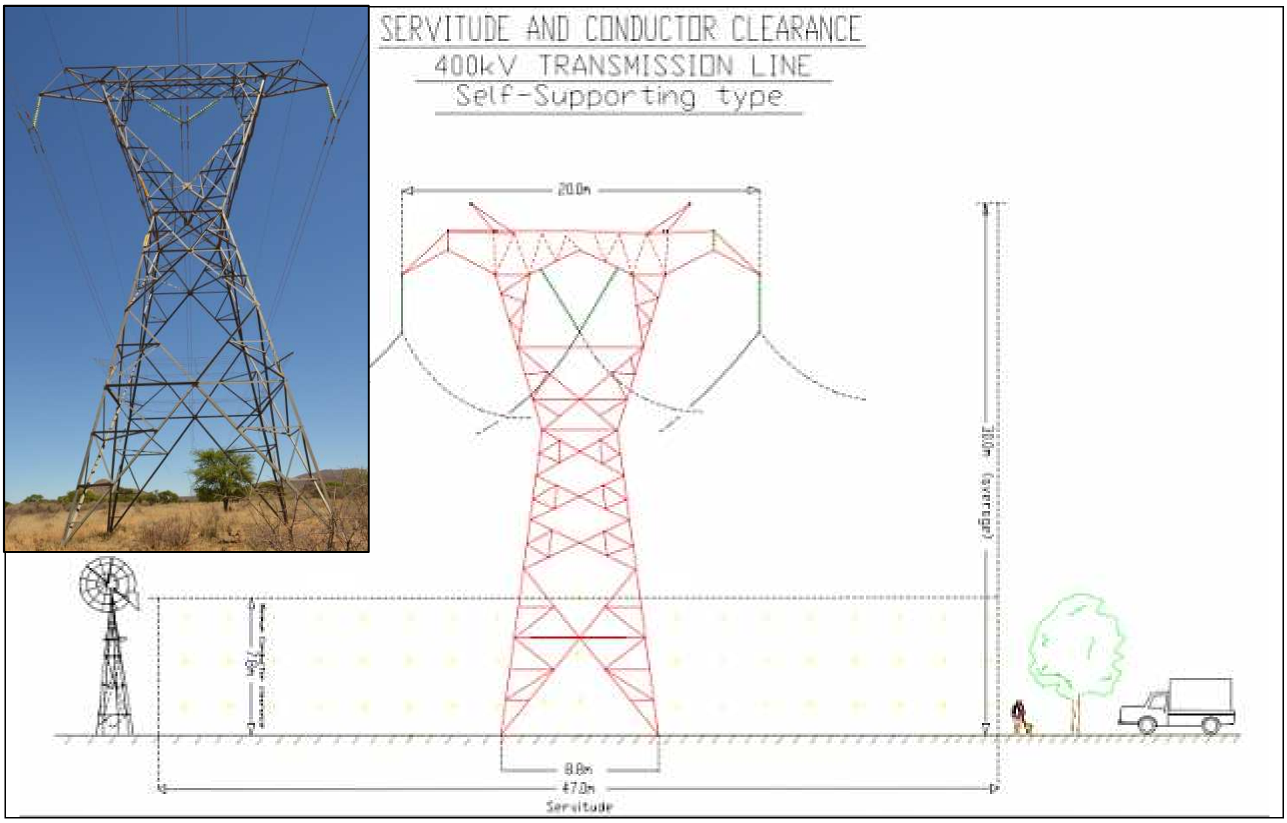

Figure 6-1: Self-supporting suspension tower.

Self-supporting strain tower

This tower is more or less the same with the self-supporting suspension tower however the foundation and structure is stronger. This tower is utilized on the bends in the line to allow for changes in direction. As with the Self-supporting suspension tower, this tower series is more expensive to construct.

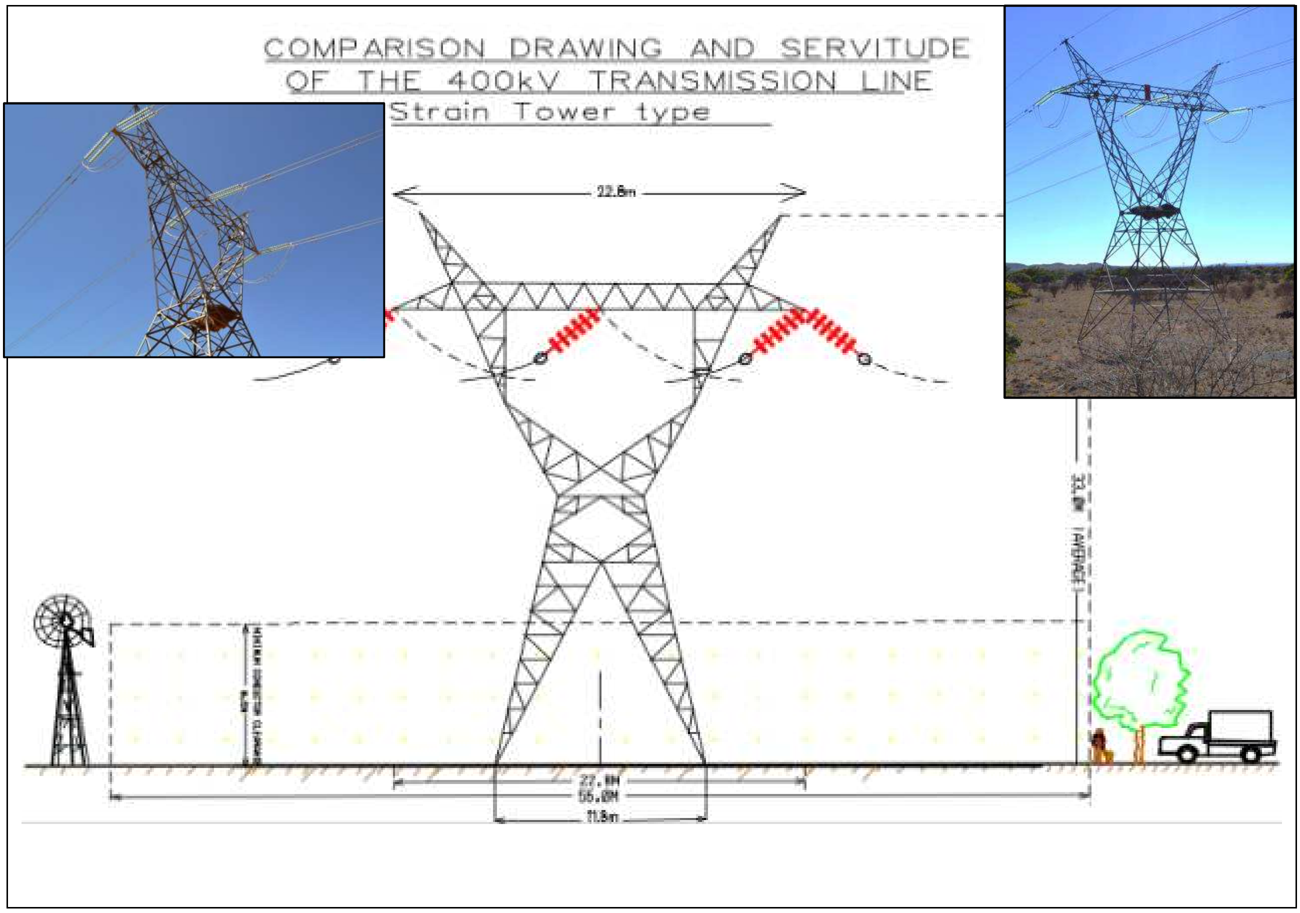

Figure 6-2: Self-supporting strain tower

Cross rope suspension tower

This tower is more suitable for long distance power lines whereby the power line is largely straight without lots of bending and turning. This is a more preferred design that is suitable for birds in terms of power line impacts on birds, but it requires more land than self-supporting tower structures.

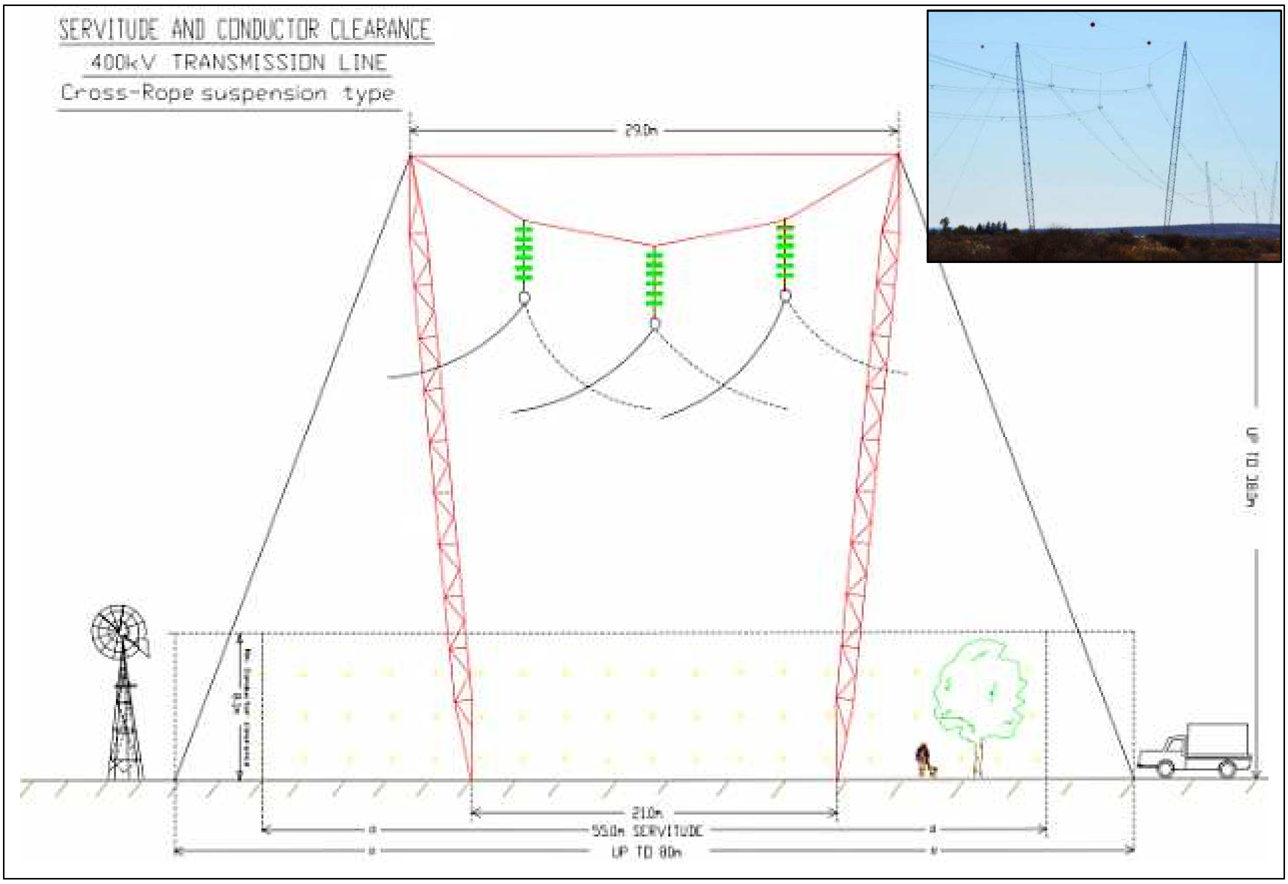

Figure 6-3: Cross rope suspension tower.

Compact cross rope suspension tower

This tower is similar to a cross rope suspension tower and is also suitable for long distances without a lot of bending and turning. The compact cross-rope suspension tower is typically used along the straight section of the power line servitude.

This configuration results in greater electrical efficiency over long distances and also reduces related substation equipment costs.

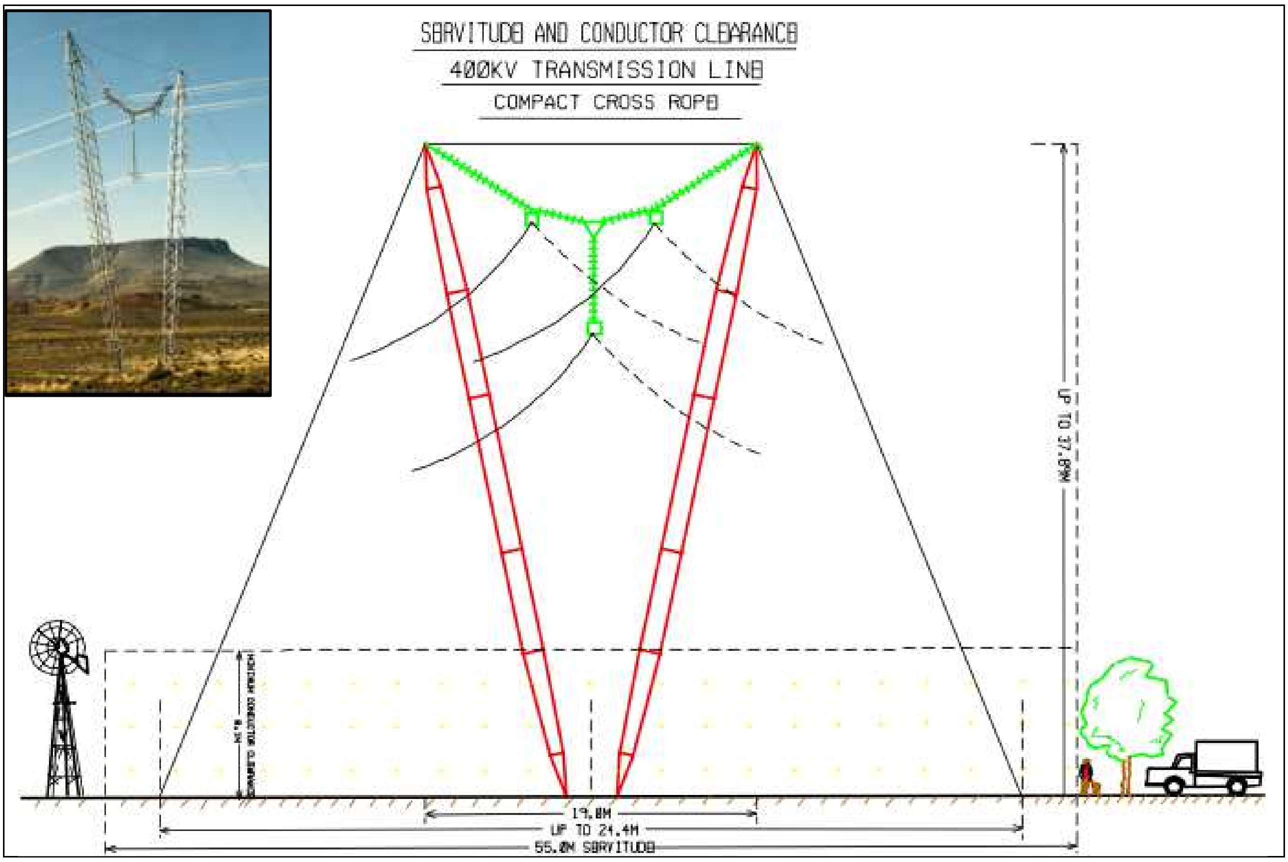

Figure 6-4: Compact cross rope suspension tower.

Guyed-V suspension tower

This tower is similar to a cross rope suspension tower and is also suitable for long distances without a lot of bending and turning. The guyed-V towers have one large foundation and four smaller foundations to anchor the guyes. This tower structure offers the best protection from lightning impulses due to the groundwire and cross arm configuration.

The guyed-V towers are limited to relatively flat terrain and maintenance is comparatively more difficult than the other tower series discussed above.

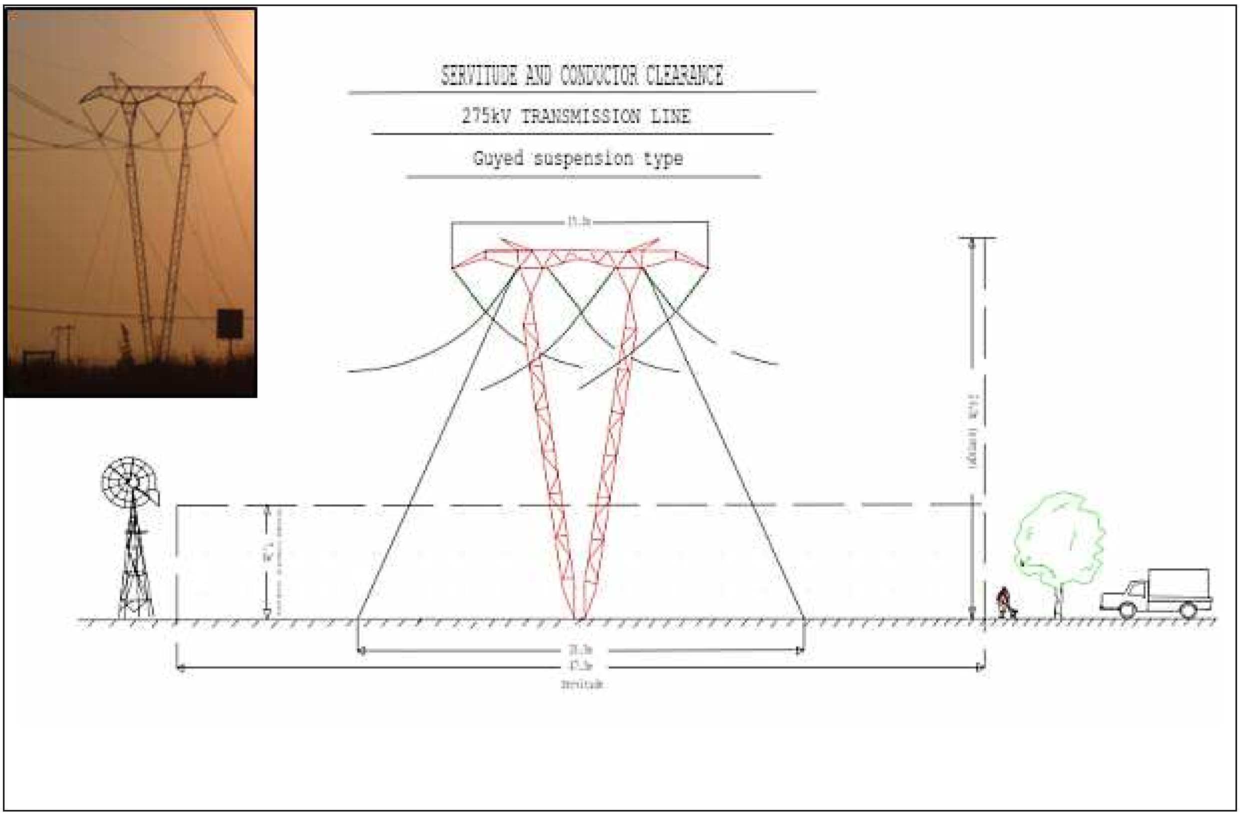

Figure 6-5: Guyed-V suspension tower.

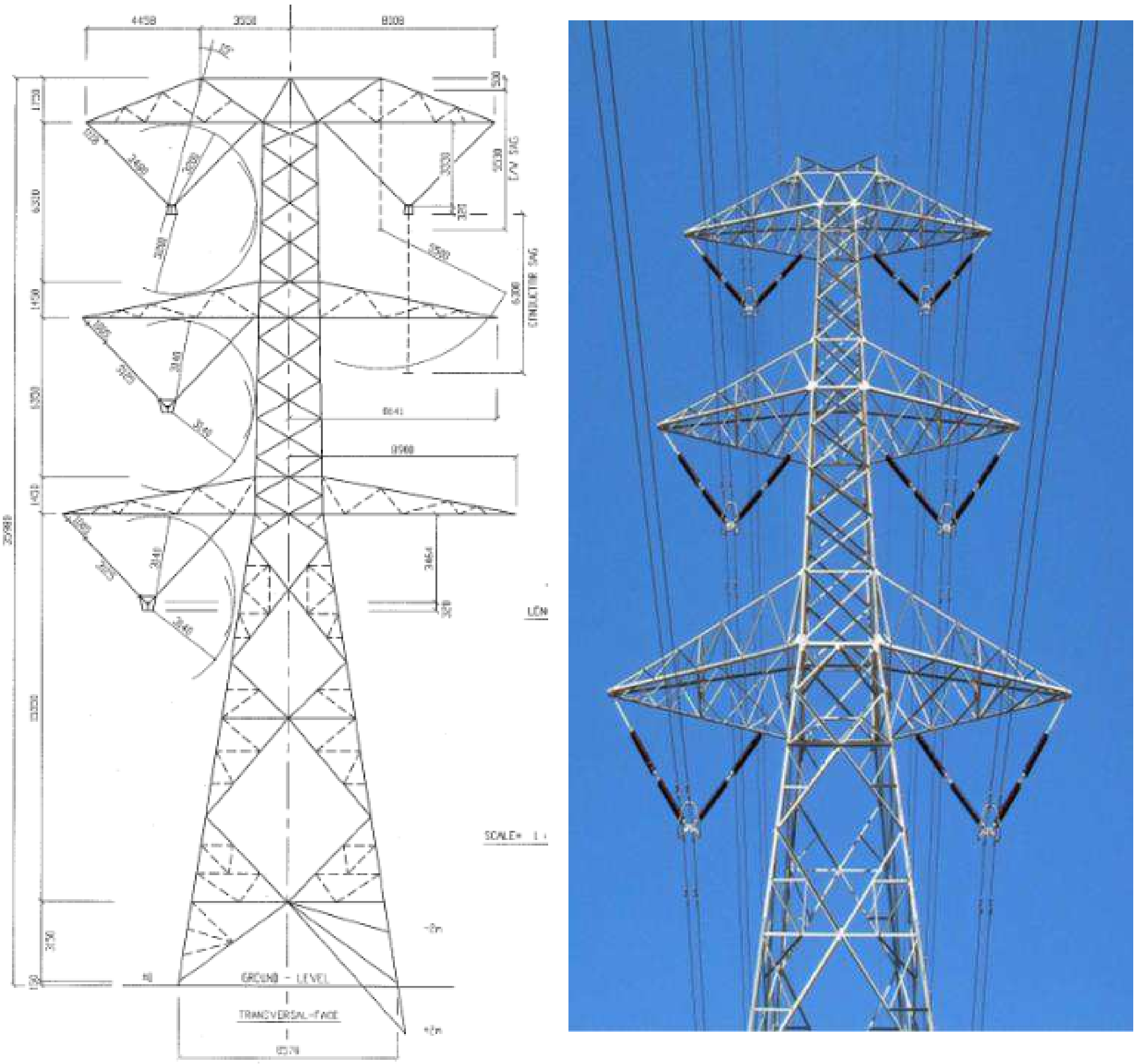

Figure 6-6: Typical self-supporting double circuit suspension tower.

Self-Supporting double circuit suspension tower

The double circuit towers were developed to reduce servitude needed by two parallel lines. The tower utilized the V assemblies with twin dinosaur conductors and silicone rubber (composite) insulators.

6.1.3 Corridor Alternatives

Pre-EIA Technical Screening

Prior to the commencement of the EIA the Eskom technical team assessed the study area between Upington and the two substations for various technically feasible alternatives for the proposed 400 kV power line. These alternatives were found to be technically sound and financially preferred based on the following criteria:

Topography:	The terrain of the study area cannot be too steep (angle must be less 20°). Additionally a 400 kV power line can span an average distance of 350 m between two pylons. Therefore large valleys and channels are considered fatally flawed areas.
Obstructions:	The power line is required to travel in a straight path as far as possible. Should the power line route be required to change direction at an angle of more than 3 degrees a self-supporting pylon is required which is more costly.
Length of route:	The shorter the route the more cost effective.

Pre EIA Environmental Screening

A pre-EIA screening assessment was undertaken on the technically feasible alternatives provided by Eskom. Mr Konrad Kruger of Zitholele Consulting accompanied the Eskom technical team on a two day fly over of the study area. Prior to the fly over a desktop screening exercise was undertaken using Arcview GIS software to identify any biophysical sensitivities. During this investigation the following aspects were utilised in visually assessing the potential environmental issues that should be avoided for each alternative:

- Water bodies / Wetlands;
- Historical building and graveyards;
- Protected areas / nature reserves;
- Build-up areas;
- Topography; and
- Sensitive fauna and flora.

After the fly over all alternatives were deemed feasible from an environmental perspective with some minor deviations and have been taken into this EIA. These newly aligned alternatives are being assessed in this EIA process.

6.1.4 Orientation of feasible corridor Alternatives

The alternatives for the proposed EIA comprise of several loop-in and loop-out corridors in an interconnected grid. The reason for these loop in and loop out alternatives is to avoid sensitivities and technical constraints that were identified in the high-level assessment mentioned above. The alternatives are discussed by means of alphabetic representation for each alternative intersection (please refer to Figure 6-16). To note is that the study area for each power line corridor was chosen as a 2 km wide corridor within which the proposed power lines could be constructed. For alternatives corridor alignments which occur next to the N14 the corridor will accommodate the N14 in the middle of the 2 km corridor area.

Consultation with the Kumba Sishen mine management highlighted the fact that the mine is in the process of commencing with the relocation of the existing 275 kV powerline crossing their property in a southwest to northeast direction (see Comments and Responses Report in Appendix E). During further consultation the mine indicated in a letter (See Appendix E) that a 1 km wide corridor have been approved along the boundary of the mine property by the competent authority and recommended that the proposed Ferrum to Solar Park line be located within this approved corridor.

Initially proposed corridor alternatives:

<u>Ferrum_Alternative 1</u>

Ferrum_Alternative 1 commences at the CSP outside of Upington traverses north-westward for approximately 18 km up to the northern boundary of the farm Olyvenhoutsdrift. From there the corridor turns north-eastward and runs along the northern boundary of Olyvenhoutsdrift for approximately 25 km, before turning eastwards for ~25 km passing the north of the Upington International Airport. The corridor maintains a distance of 5 km from the northern point of the airport runway. Once past the airport the corridor turns north-eastward for approximately 150 km to a location close to Olifantshoek where it meanders through a passage in the *Langberge* hills. When it emerges on the north-eastern side of the hill the corridor continues for approximately 22 km before it joins an existing power line servitude and runs parallel to this servitude for a short distance before it enters the property of the Sishen Iron Ore Mine. From here the proposed corridor route follows the newly relocated transmission line and railroad in a 1 km corridor that has already been approved for this purpose. The proposed corridor curls around the northern edge of the Sishen mine before it reaches the Ferrum substation, which is situated approximately 2 km south of the town of Kathu and 1.2 km west of the N14 national road (see Figure 6-7).

This proposed corridor has the shortest distance between the Solar Park substation and Ferrum substation at 212 km, however this corridor bisects numerous farm portions between Upington and Kathu. A disadvantage of this corridor is that it could potentially affect farming practices in farm portions where it bisects through the middle of farms. Landowner sentiment towards tolerating power lines across their farms also decrease drastically when farm portions are bisected in a seemingly unfeasible manner. This corridor also traverses a game farm in the between Olifantshoek and Kathu.

The hills close to Olifantshoek also has challenges that will have to be overcome in order to construct the power line. The terrain is notably more difficult to navigate when compared to the corridors that are confined to the flat areas. The construction and maintenance of access roads is expected to be challenging including the monitoring and prevention of erosion which is expected to carry a higher risk than on flat landscapes. The construction of the towers will further be more difficult, although not impossible, in the hills.

Maintenance for this corridor requires long stretches of access road to be constructed from the N14 of major roads in the area. The landscape and soil in this area north of the N14 is very sensitive with large portions of the area covered in historic vegetated dune fields. Disturbance to these could result in destabilisation of the dunes, loss of vegetation cover and erosion of the top soils.

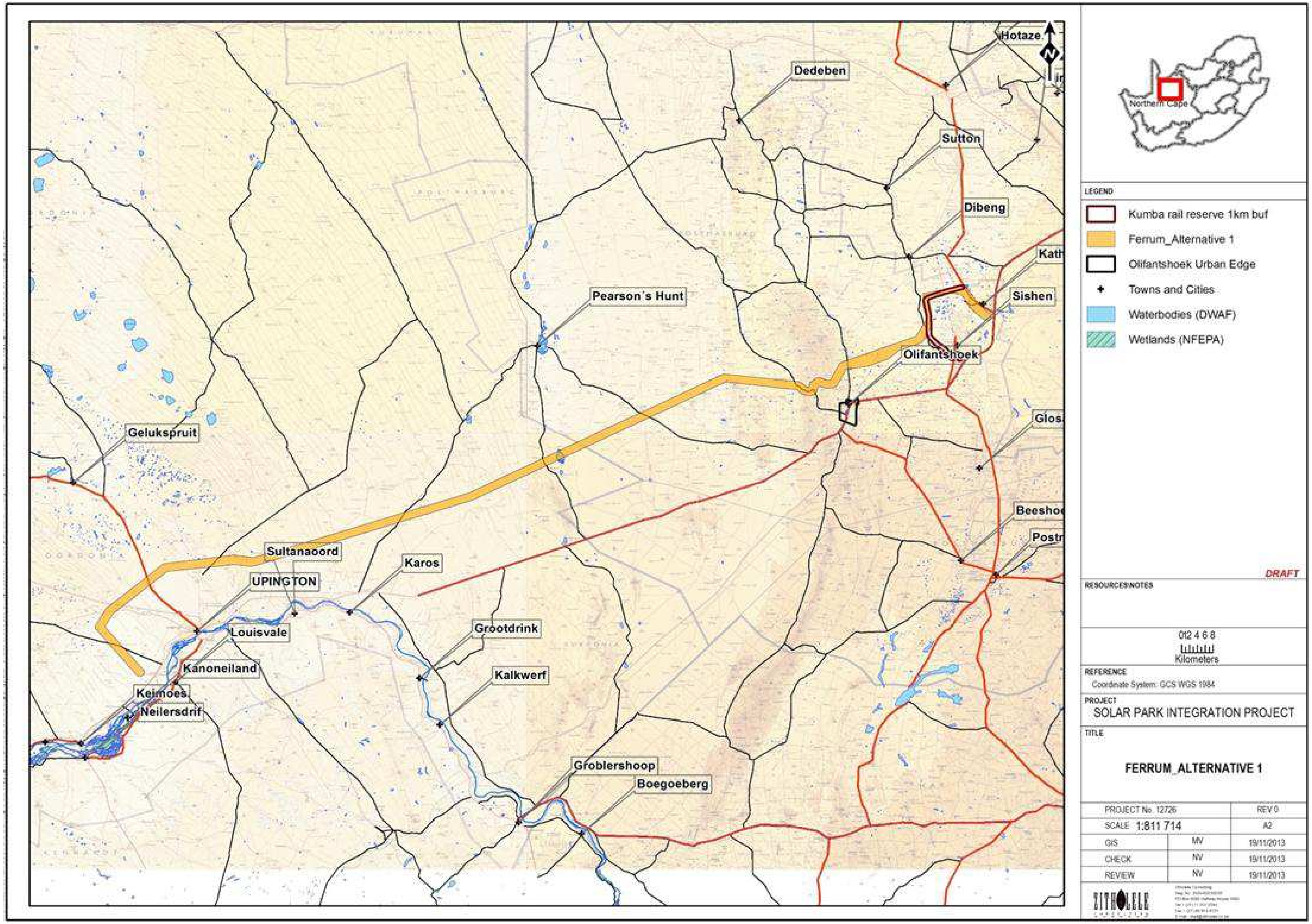

Figure 6-7: Proposed Ferrum_Alternative 1.

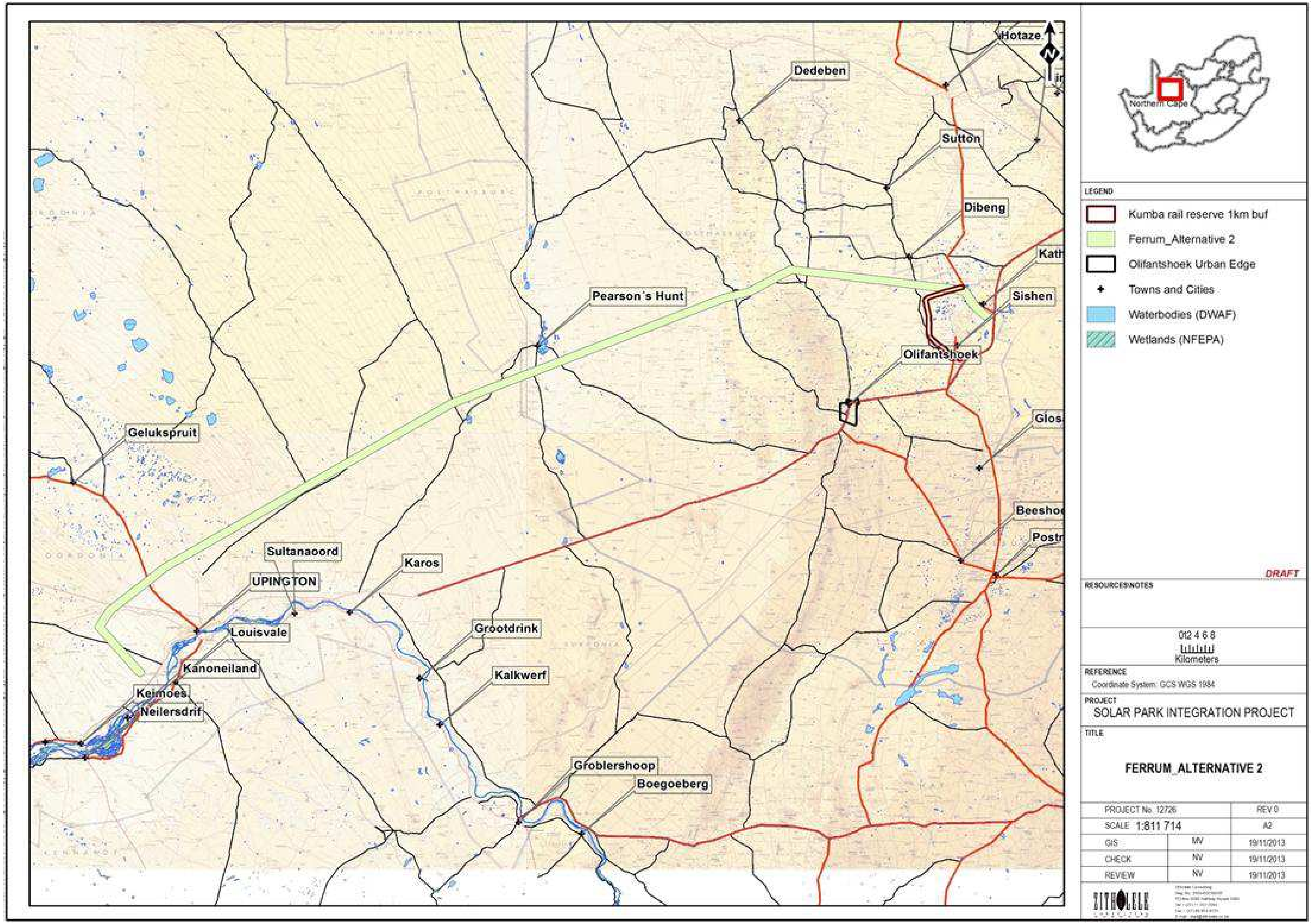

Figure 6-8: Proposed Ferrum_Alternative 2.

Ferrum_Alternative 2

Alternative 2 commences at the CSP outside of Upington traverses north-westward for approximately 18 km up to the northern boundary of the farm Olyvenhoutsdrift. From there the corridor turns north-eastward and runs along the northern boundary of Olyvenhoutsdrift passing north of the Upington International Airport and carries on largely in a north-easterly direction for approximately 184 km. The corridor maintains a distance of 5 km from the northern point of the airport runway. The corridor passes through a gorge in the Langberge hills approximately 40 km north-northwest of Olifantshoek at which point it turns east towards Kathu, passing the Sishen mine at its northern boundary to reach the Ferrum substation (see Figure 6-8).

This proposed corridor has the second shortest distance (245 km) between the Solar Park substation and Ferrum substation, however this corridor as was found with Ferrum_Alternative 1 bisects numerous farm portions between Upington and Kathu. A disadvantage of this is that it could potentially affect farming practices in farm portions where it bisects through a large portion of farm property. Landowner sentiment towards tolerating power lines across their farms also decrease drastically when farm portions are bisected in a seemingly unfeasible manner.

The construction and maintenance of access roads is will be challenging. Maintenance for this corridor requires long stretches of access road to be constructed from the N14 or major roads in the area. The landscape and soil in this area north of the N14 is very sensitive with large portions of the area covered in historic vegetated dunefields. Disturbance to these could result in destabilisation of the dunes, loss of vegetation cover and erosion of the top soils.

Stakeholder suggested corridor alternatives:

In addition to the alternatives mentioned above stakeholders at the public meeting requested that additional alternatives be investigated during the EIA phase that is aligned with the N14 highway after passing by the Upington Airport, rather than traversing through farming land. The following feasible alternatives were added after suggestions from stakeholders were considered by the EIA team.

Ferrum_Alternative 3

Ferrum_Alternative 3 (Figure 6-9) commences at the CSP outside of Upington traverses north-westward for approximately 18 km up to the northern boundary of the farm Olyvenhoutsdrift. From there the corridor turns north-eastward and runs along the northern boundary of Olyvenhoutsdrift for approximately 25 km, before turning eastwards for ~25 km passing the north of the Upington International Airport. The corridor maintains a distance of 5 km from the northern point of the airport runway. Once past the airport the corridor turns south-eastward for approximately 10 km where it joins the N14 and turns parallel to the road. The power line stretches parallel to the N14 for approximately 88 km and then turns northwards. The corridor joins the Ferrum_Alternative 2 corridor approximately 54 km north from the position where it leaves the N14. From this point Ferrum_Alternative 3 follows the Ferrum_Alternative 2 corridor for approximately 70 km to the Ferrum substation.

This proposed corridor is the longest corridor alternative at 279 kms and requires numerous changes in direction. This corridor bisects a number of farm portions when it leaves the N14 road to join the Ferrum_Alternative 2 corridor. A disadvantage of this corridor is that it could potentially affect farming practices in farm portions where it bisects through the middle of farms. The construction and maintenance of access roads through the sensitive dune fields between Upington and Kathu is a concern. Maintenance for this corridor requires the construction of access roads from the N14 or major roads in the area. Disturbance to the historic dune fields could result in destabilisation of the dunes, loss of vegetation cover and erosion of the top soils.

Ferrum_Alternative 3A

This corridor alternative follows Ferrum_Alternative 3 from its origin in Upington all the way along the N14 to its northern divergence. From here it continues to follow the N14 up to approximately 25 kms from Olifantshoek where the corridor turns south-eastwards and continues in this direction for approximately 13 km to join the existing power line servitude for the Ferrum-Garona 275kV and 2nd Ferrum-Garona 400kV power lines. Ferrum_Alternative 3A follows the existing power line servitudes for approximately 48 kms until it enters the Sishen mine property. From here the corridor turns northwards and enters an approved 1 km wide corridor for rail and power line servitudes. The corridor follows this approved corridor around the western and northern boundary of the Sishen mine property after which it turns south-east towards the Ferrum substation. See Figure 6-10 for a map indicating this proposed alternative.

The proposed Ferrum_Alternative 3A corridor is approximately 269 kms in length, which is notable more than the shortest corridor alternative – approximately 212 kms. The longer the route and the more bend points are required, the greater the capital cost is to Eskom that is required. A number of landowners have also indicated that they are opposing the proposed corridors, especially on farms where the proposed corridor will be the third corridor across the property.

The advantage of this corridor is that it is aligned along linear features (N14 road and existing power line servitudes) where an impact already exists for most of its route. Existing roads (N14 and power line access roads) will be used as far as possible, minimising the potential impact from the construction of long spans of access roads to tower locations. Where the corridor diverges from the existing linear infrastructure, its placement was further optimised by placing the corridor along a path where the presence of protected and sensitive tree species, which is abundant in the Olifantshoek area, is less abundant.

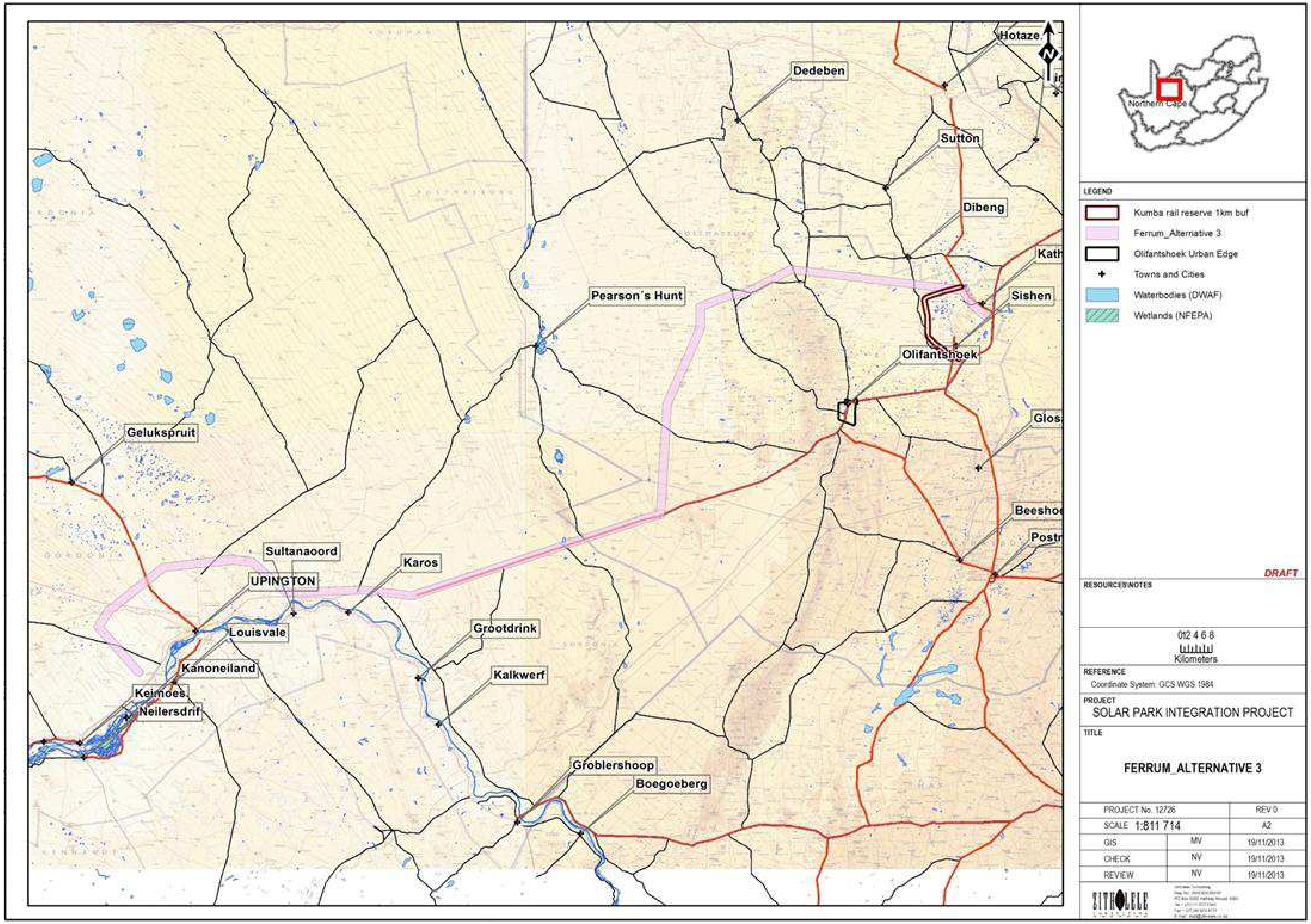

Figure 6-9: Proposed Ferrum_Alternative 3.

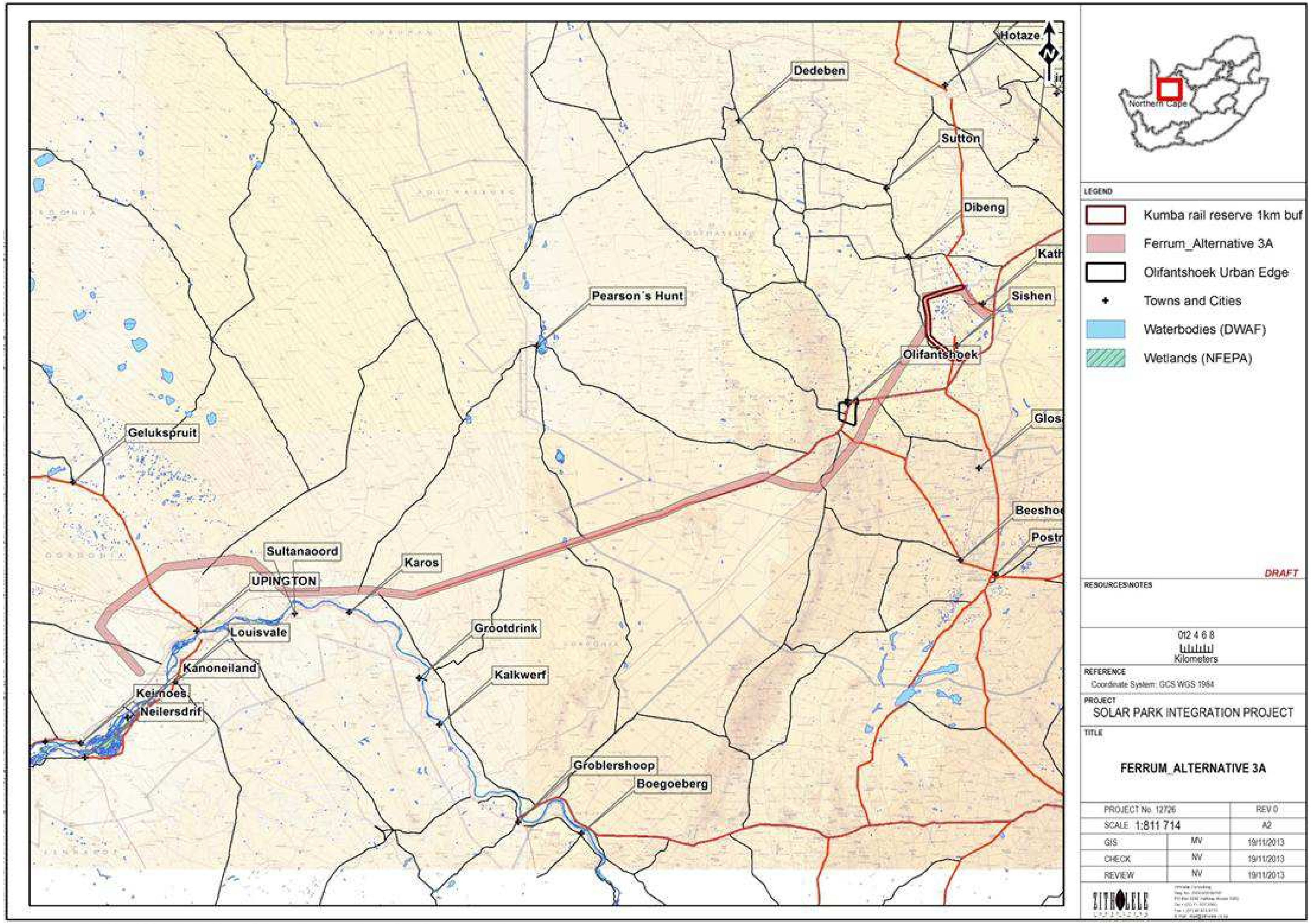

Figure 6-10: Proposed Ferrum_Alternative 3A.

Ferrum_Alternative 3B

This corridor alternative follows Ferrum_Alternative 3 from its origin in Upington all the way along the N14 to its northern divergence. From here it continues to follow the N14 up to approximately 14 kms from Olifantshoek where the corridor turns eastwards for a short distance and then kinks north-eastwards before joining the existing power line servitude for the Ferrum-Garona 275kV and 2nd Ferrum-Garona 400kV power lines (Figure 6-11). Ferrum_Alternative 3B follows the existing power line servitudes for approximately 34 kms until it enters the Sishen mine property. From here the corridor turns northwards and enters an approved 1 km wide corridor for rail and power line servitudes. The corridor follows this approved corridor around the western and northern boundary of the Sishen mine property after which it turns south-east towards the Ferrum substation.

The proposed Ferrum_Alternative 3B corridor is approximately 265 kms in length, which is notable more than the shortest corridor alternative – approximately 212 kms. A number of landowners have also indicated that they are opposing the proposed corridors, especially on farms where the proposed corridor will be the third corridor across the property. A further disadvantage of this corridor is that it crosses over a low hill located south of Olifantshoek. The area the corridor crosses here has higher abundances of protected and sensitive trees when compared to Ferrum_Alternative 3A, Ferrum_Alternative 3C or Ferrum_Alternative 3F.

The advantage of this corridor is that it is aligned along linear features (N14 road and existing power line servitudes) where an impact already exists for most of its route. Existing roads (N14 and power line access roads) will be used as far as possible, minimising the potential impact from the construction of long spans of access roads to tower locations. Where the corridor diverges from the existing linear infrastructure, its placement was further optimised by placing the corridor along a path where the presence of protected and sensitive tree species, which is abundant in the Olifantshoek area, is less abundant.

Ferrum_Alternative 3C

This corridor alternative follows Ferrum_Alternative 3 from its origin in Upington all the way along the N14 to its northern divergence. From here it continues to follow the N14 up to approximately 8 kms from Olifantshoek where the corridor turns eastwards for approximately 8 kms before joining the existing power line servitude for the Ferrum-Garona 275kV and 2nd Ferrum-Garona 400kV power lines. Ferrum_Alternative 3C follows the existing power line servitudes for approximately 34 kms until it enters the Sishen mine property (Figure 6-12). From here the corridor turns northwards and enters an approved 1 km wide corridor for rail and power line servitudes. The corridor follows this approved corridor around the western and northern boundary of the Sishen mine property after which it turns south-east towards the Ferrum substation.

The proposed Ferrum_Alternative 3C corridor is approximately 266 kms in length, which is notable more than the shortest corridor alternative – approximately 212 kms. A number of landowners have also indicated that they are opposing the proposed corridors, especially on farms where the proposed corridor will be the third corridor across the property.

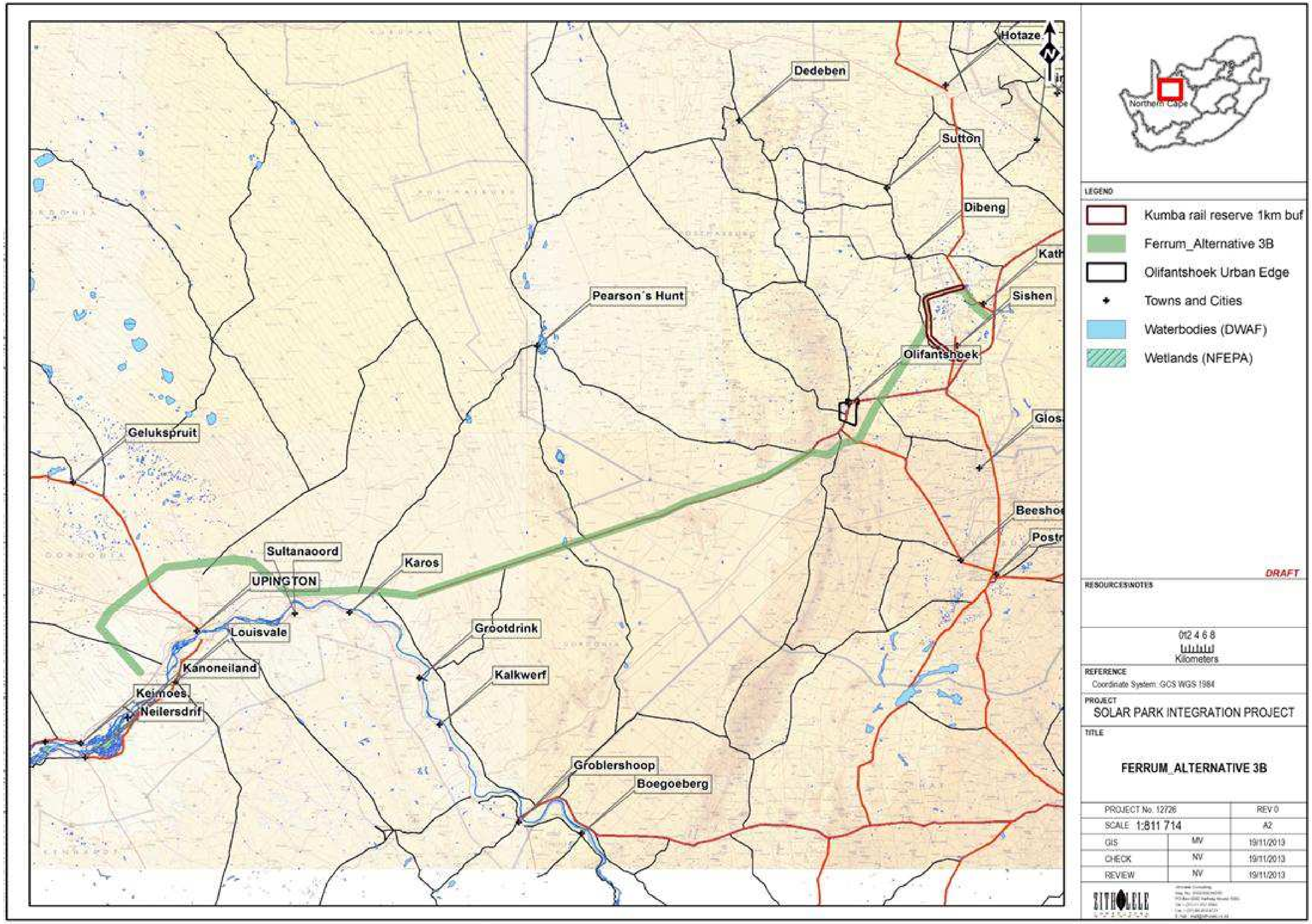

Figure 6-11: Proposed Ferrum_Alternative 3B.

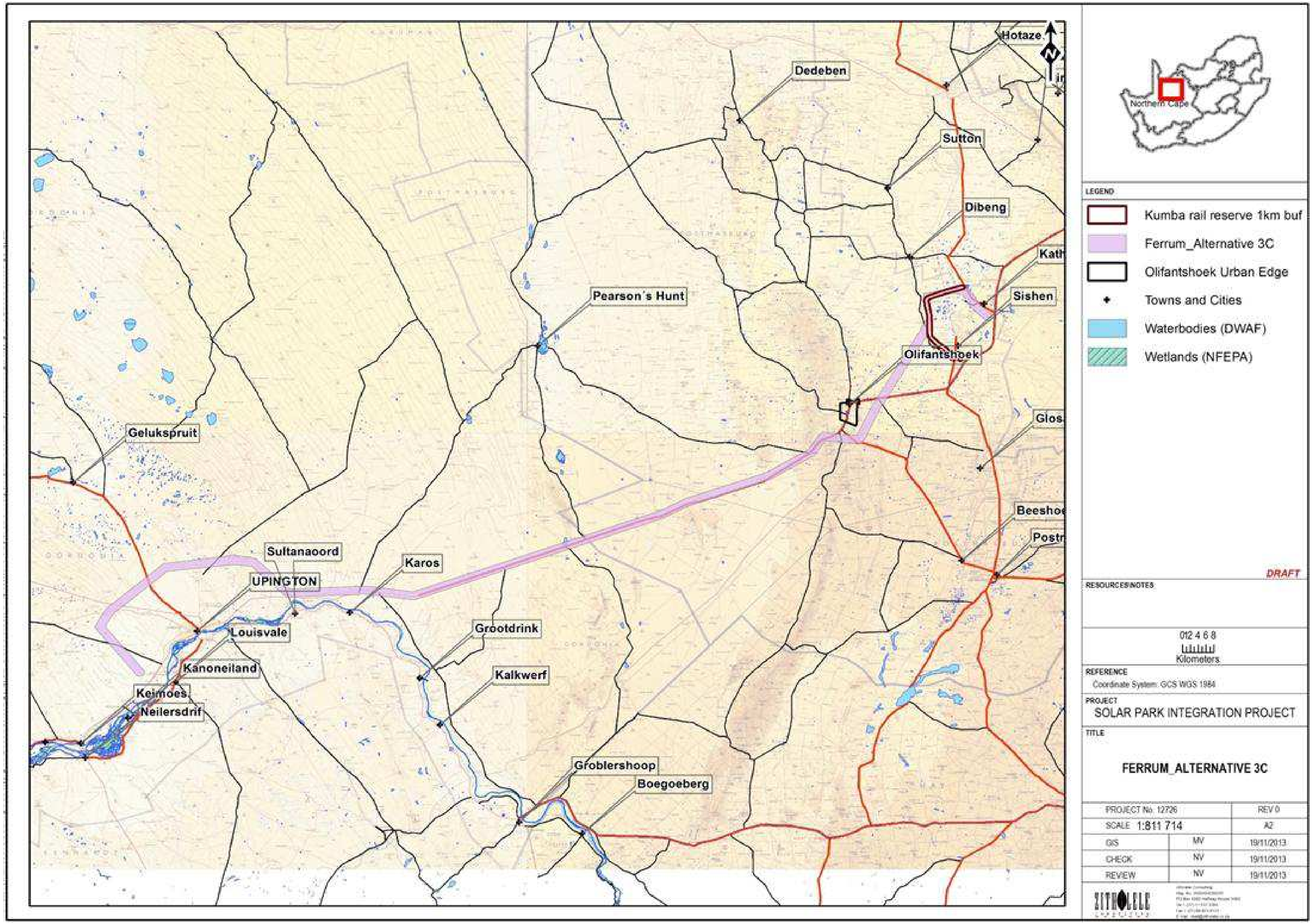

Figure 6-12: Proposed Ferrum_Alternative 3C.

When Ferrum_Alternative 3C diverges from the N14 it cuts through a flat area between the low hills to join the existing power line servitude. This area has lower abundances of protected and sensitive trees than what is generally found in the area.

The advantage of this corridor is that it is aligned along linear features (N14 road and existing power line servitudes) where an impact already exists for most of its route. Existing roads (N14 and power line access roads) will be used as far as possible, minimising the potential impact from the construction of long spans of access roads to tower locations.

Ferrum_Alternative 3D

This corridor alternative follows Ferrum_Alternative 3 from its origin in Upington all the way along the N14 to its northern divergence. From here it continues to follow the N14 up to approximately 14 kms from Olifantshoek where the corridor turns south-eastwards for approximately 7 kms before joining the existing power line servitude for the Ferrum-Garona 275kV and 2nd Ferrum-Garona 400kV power lines. Ferrum_Alternative 3D follows the existing power line servitudes for approximately 43 kms until it enters the Sishen mine property. From here the corridor turns northwards and enters an approved 1 km wide corridor for rail and power line servitudes. The corridor follows this approved corridor around the western and northern boundary of the Sishen mine property after which it turns south-east towards the Ferrum substation (Figure 6-13).

The proposed Ferrum_Alternative 3D corridor is approximately 270 kms in length, which is notable more than the shortest corridor alternative – approximately 212 kms. A number of landowners have also indicated that they are opposing the proposed corridors, especially on farms where the proposed corridor will be the third corridor across the property. The area the corridor crosses here has higher abundances of protected and sensitive trees when compared to Ferrum_Alternative 3A, Ferrum_Alternative 3C or Ferrum_Alternative 3F.

The advantage of this corridor is that it is aligned along linear features (N14 road and existing power line servitudes) where an impact already exists for most of its route. Existing roads (N14 and power line access roads) will be used as far as possible, minimising the potential impact from the construction of long spans of access roads to tower locations.

Ferrum_Alternative 3E

This corridor alternative follows Ferrum_Alternative 3 from its origin in Upington all the way along the N14 to its northern divergence. From here it continues to follow the N14 up to approximately 20 kms from Olifantshoek where the corridor turns northwards before the *Langberge* and continues in this direction for approximately 20 km to the location where Ferrum_Alternative 1 enters the gorge in the *Langberge*. When it emerges on the north-eastern side of the hill the corridor continues for approximately 22 km before it joins an existing power line servitude and runs parallel to this servitude for a short distance before it enters the property of the Sishen Iron Ore Mine. From here the proposed corridor route follows the newly relocated transmission line and railroad in a 1 km corridor that has already been approved for this purpose.

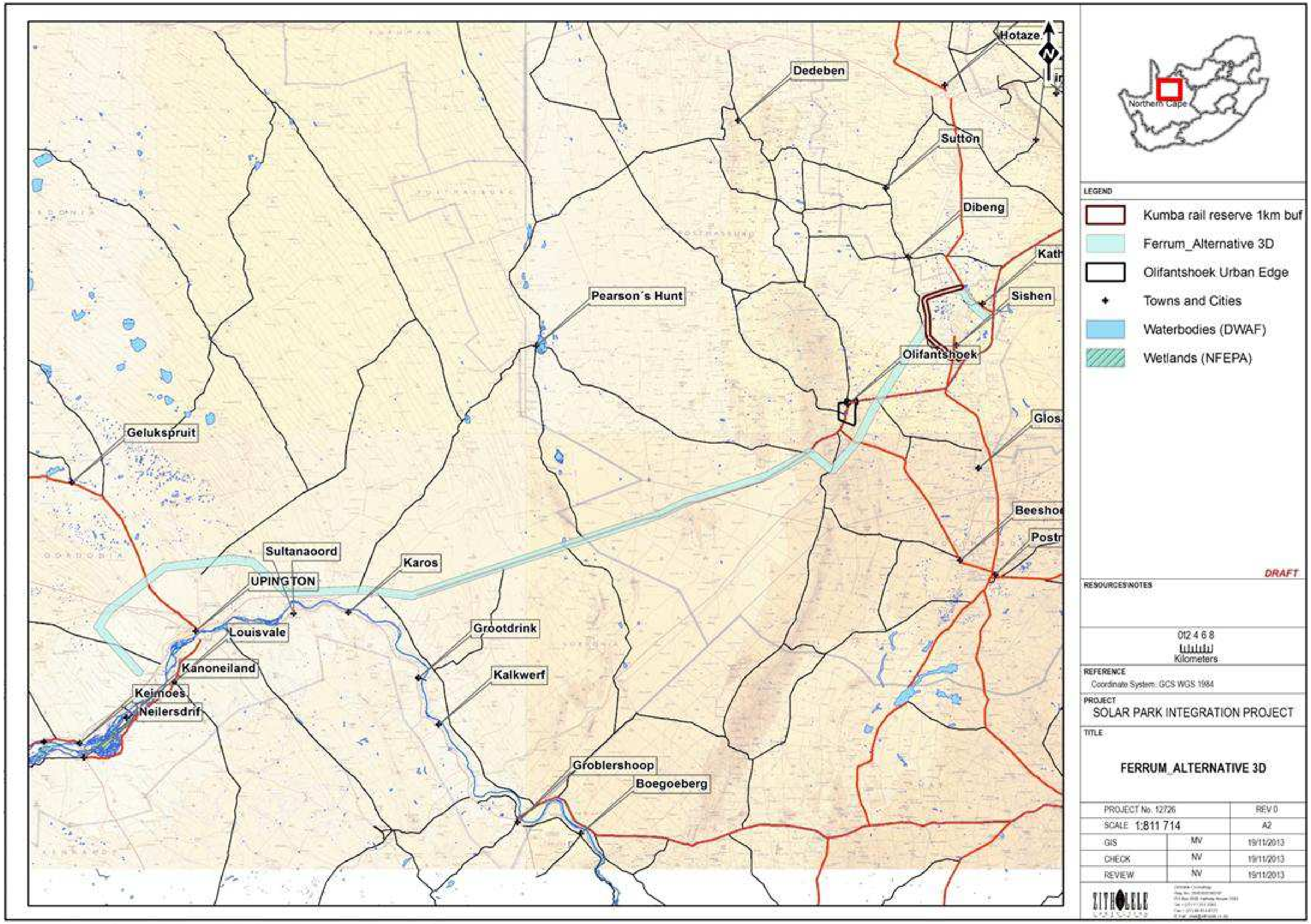

Figure 6-13: Proposed Ferrum_Alternative 3D.

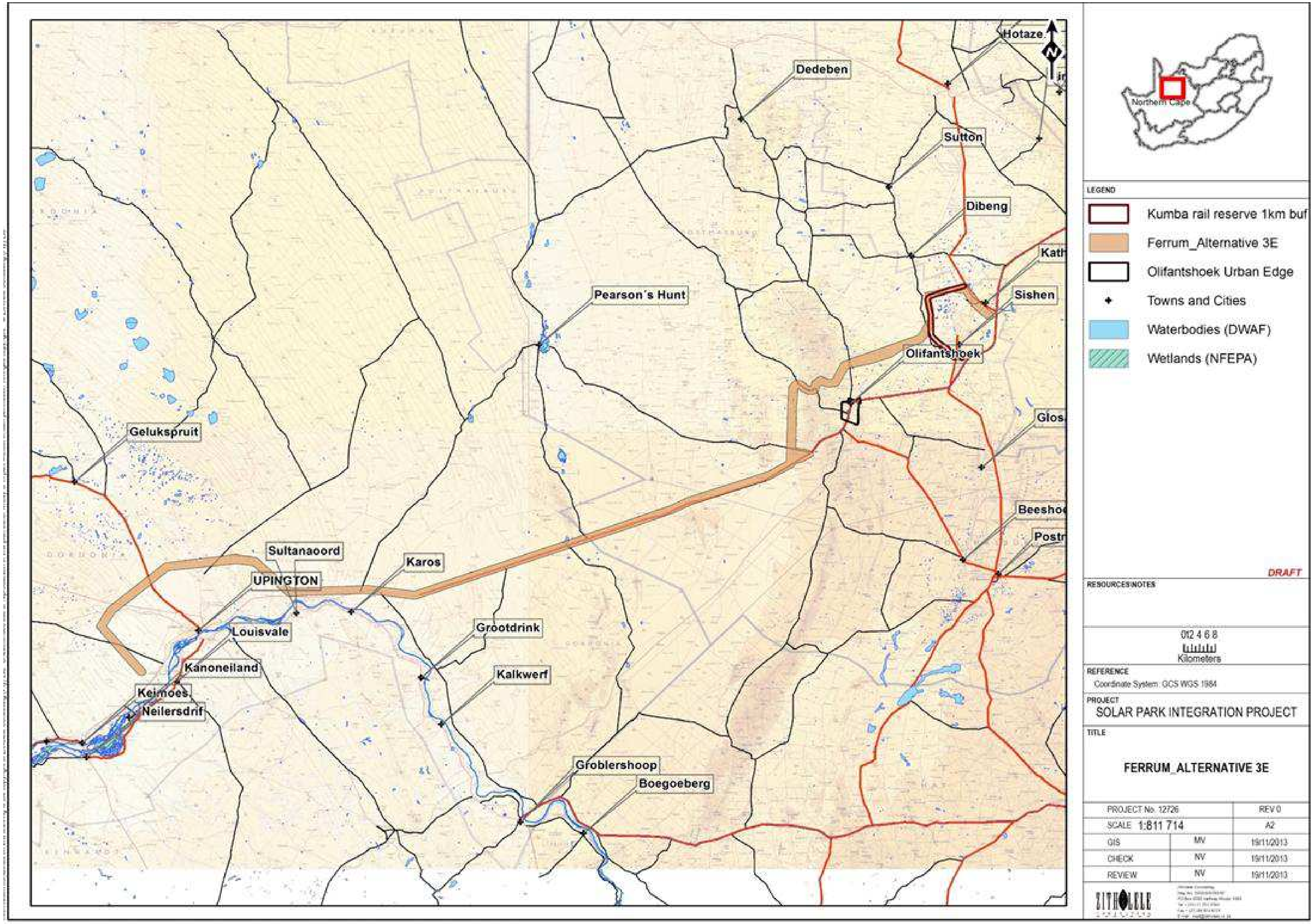

Figure 6-14: Proposed Ferrum_Alternative 3E.

The proposed corridor curls around the northern edge of the Sishen mine before it reaches the Ferrum substation, which is situated approximately 2 km south of the town of Kathu and 1.2 km west of the N14 national road. See Figure 6-14 for a map indicating this proposed alternative.

The proposed Ferrum_Alternative 3E corridor is approximately 274 kms in length, which is notable more than the shortest corridor alternative – approximately 212 kms. The longer the route and the more bend points are required, the greater the capital cost is to Eskom that is required. Landowner consultation during the Draft EIR and revised Draft EIR phases of the project highlighted the fact that landowners in general were not in favour of allowing prospecting power lines to dissect their properties by being constructed through the interior of such properties. Ferrum_Alternative 3E also cross a game farm between Olifantshoek and the Sishen mine.

The advantage of this corridor is that it is aligned along linear features (N14 road and existing power line servitudes) where an impact already exists for most of its route. Existing roads will be used as far as possible, minimising the potential impact from the construction of long spans of access roads to tower locations.

Ferrum_Alternative 3F

This corridor alternative follows Ferrum_Alternative 3 from its origin in Upington all the way along the N14 to its northern divergence. From here it continues to follow the N14 all the way to Olifantshoek where the corridor runs on the eastern side of the town's urban edge. The corridor turns eastward and joins the existing power line servitude for the Ferrum-Garona 275kV and 2nd Ferrum-Garona 400kV power lines at a location just south of the N14. Ferrum_Alternative 3F (Figure 6-15) follows the existing power line servitudes for approximately 34 kms until it enters the Sishen mine property. From here the corridor turns northwards and enters an approved 1 km wide corridor for rail and power line servitudes. The corridor follows this approved corridor around the western and northern boundary of the Sishen mine property after which it turns south-east towards the Ferrum substation.

The proposed Ferrum_Alternative 3F corridor is approximately 261 kms in length, which is notable more than the shortest corridor alternative – approximately 212 kms. This corridor alternative will require a number of additional strain towers as the corridor must change direction several times stay close to the N14 and find a feasible route past Olifantshoek. This will have a notable financial implication to construct the proposed power line, if it is authorised as the preferred alternative.

The advantage of this corridor is that it is aligned along linear features (N14 road and existing power line servitudes) for most of the route therefore confining the impact to areas of existing impact and disturbance. Existing roads (N14 and power line access roads) will be used as far as possible, minimising the potential impact from the construction of long spans of access roads to tower locations.

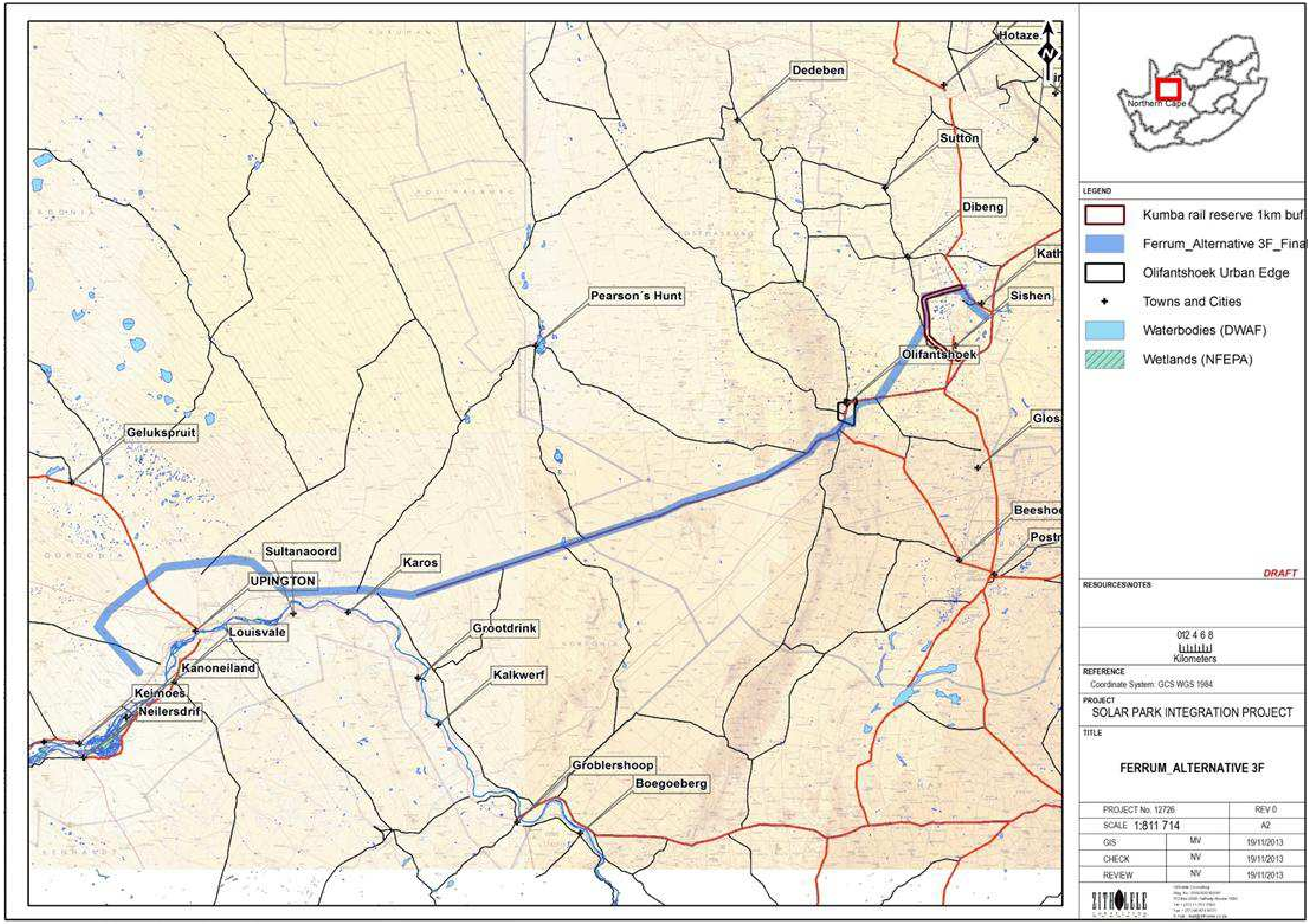

Figure 6-15: Proposed Ferrum_Alternative 3F.

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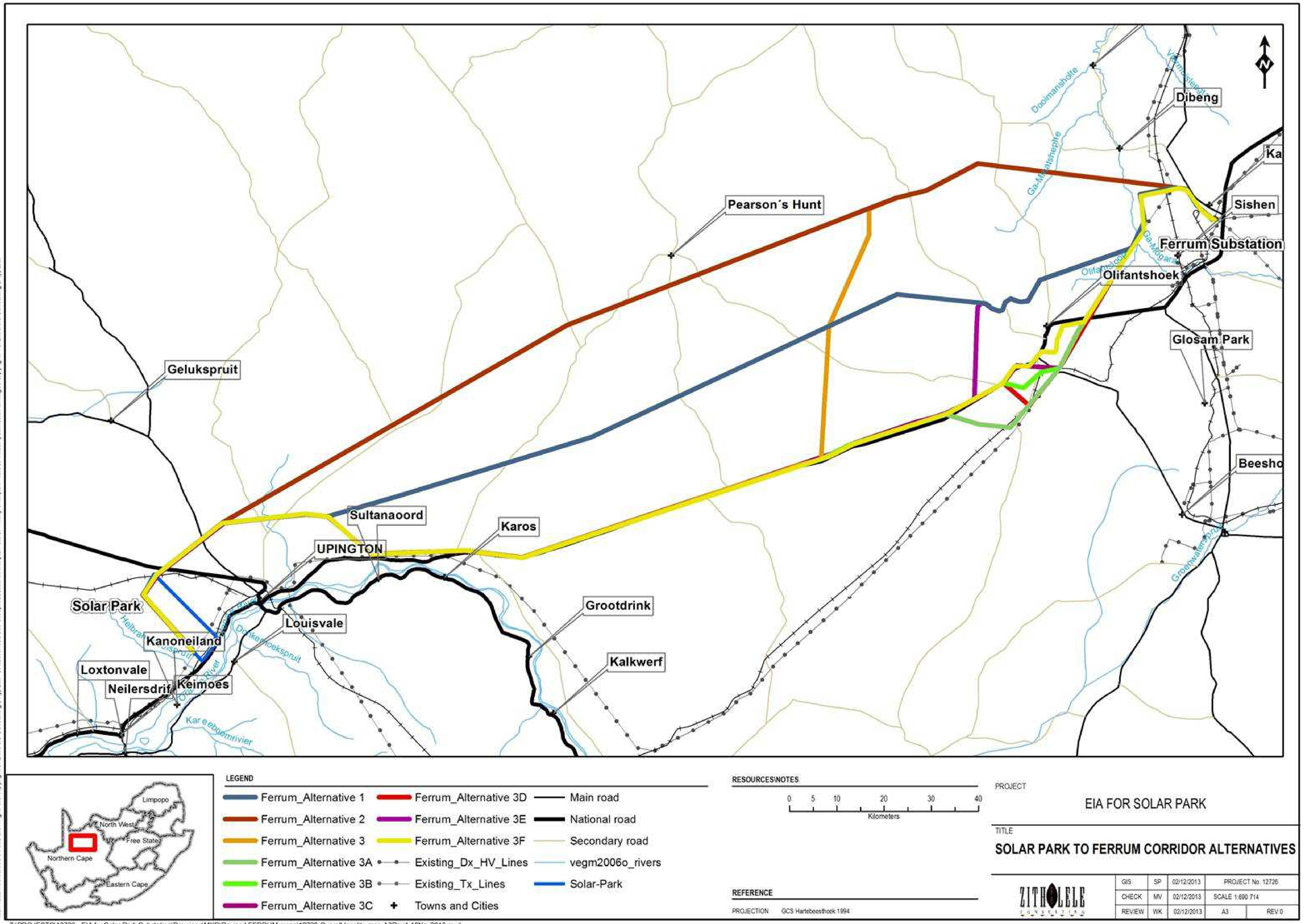

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Figure 6-16: Proposed Alternatives for the Solar-Ferrum Power Line

7 RECEIVING ENVIRONMENT

7.1 CLIMATE AND AIR QUALITY

Broad scale meteoric data was obtained from the CSIR as well as information contained in the existing Eskom CSP site EIA. It should be noted that this was not a detailed study, but merely a desktop assessment as input into the other detailed studies.

7.1.1 Rainfall

The study area is located in the north western portion of South Africa. This area receives very variable late summer rainfall between February and April. The study area receives between 70 – 200 mm of precipitation annually as shown in Figure 7-1 below.

7.1.2 Temperature

The study area is located in one of the warmer parts of the country where the mean maximum and minimum temperatures range from 40,6 ºC in summer to -3,7 ºC in winter. The mean annual temperature is 17,4 ºC as shown in Figure 7-2 below.

7.1.3 Wind

For the entire study area there is very low wind flow and no main wind direction. Whirl winds (dust devils) are common on hot summer days.

7.1.4 Lightning Strikes

The study area is located in an area with very low frequency of lightning strikes.

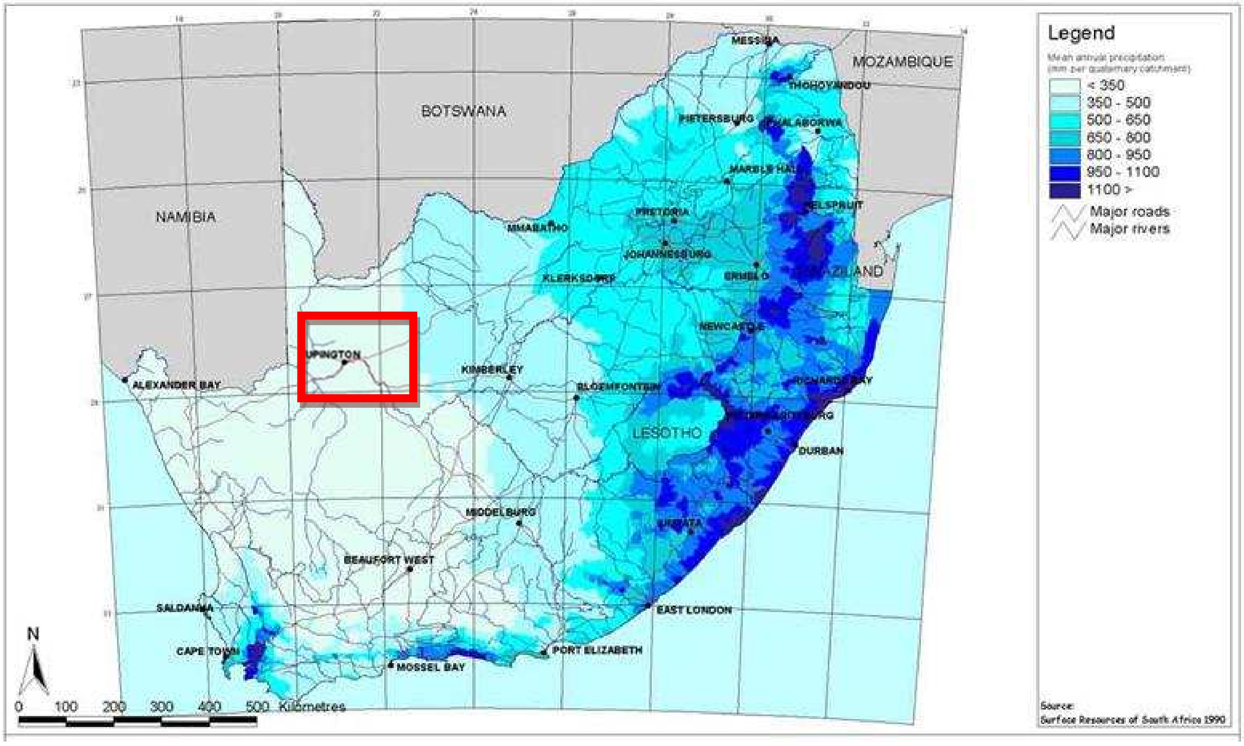

Figure 7-1: Mean Annual Rainfall.

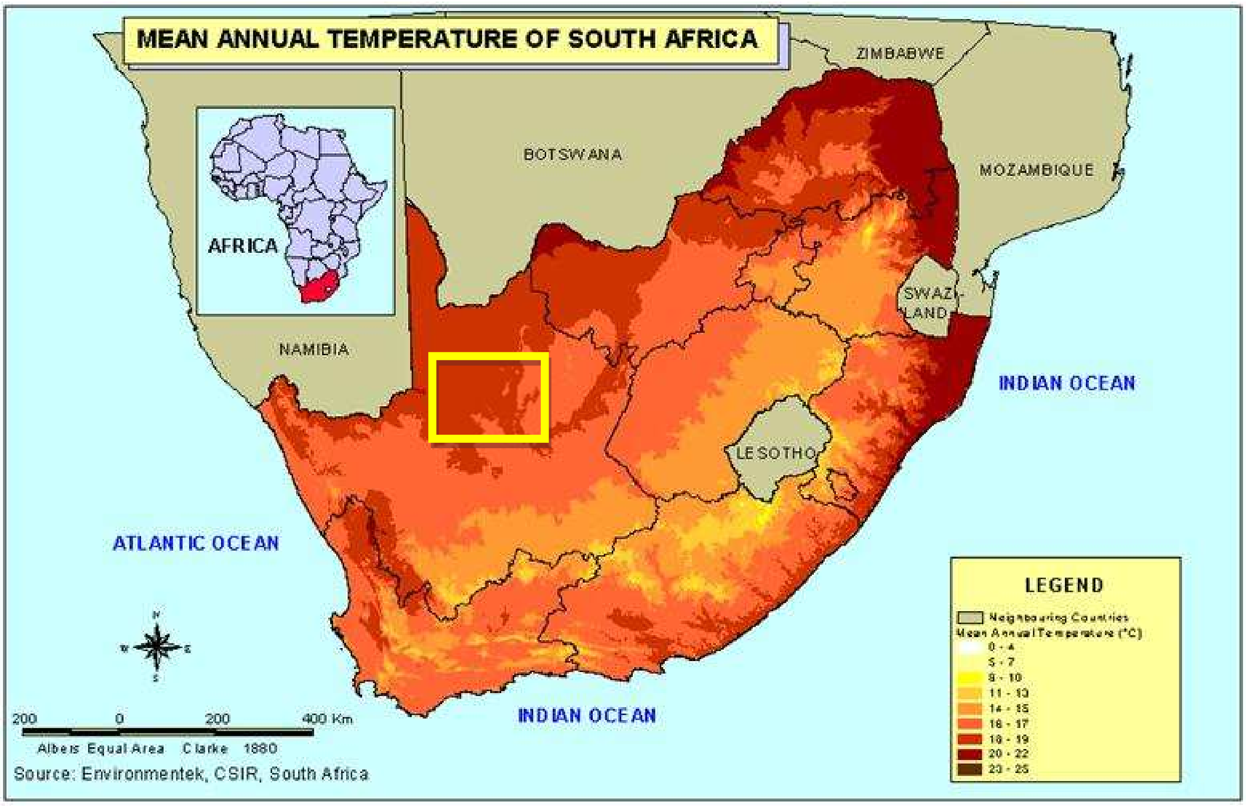

Figure 7-2: Mean annual temperatures.

7.2 GEOLOGY

7.2.1 Methodology and Data Sources

The geological analysis was undertaken through the desktop evaluation using a Geographic Information System (GIS) and relevant data sources. The geological data was taken from the Environmental Potential Atlas Data from the Department of Environmental Affairs (DEA).

7.2.2 Regional Description

The sizable portion (>30 %) of the study area is covered by recent (Quarternary) alluvium and calcrete. Superficial deposits of the Kalahari Group are also present in the east. The extensive Palaeozoic diamictites of the Dwyka Group also outcrop in the area as do gneisses and metasediments of Mokolian age (Figure 7-3).

7.2.3 Sensitivities

Due to the nature of the geology in the study area there is no potential seismic sensitivities. Additionally the proposed footings for the power line towers do not require deep excavations and consequently there are no potential impacts or sensitivities in terms of geology.

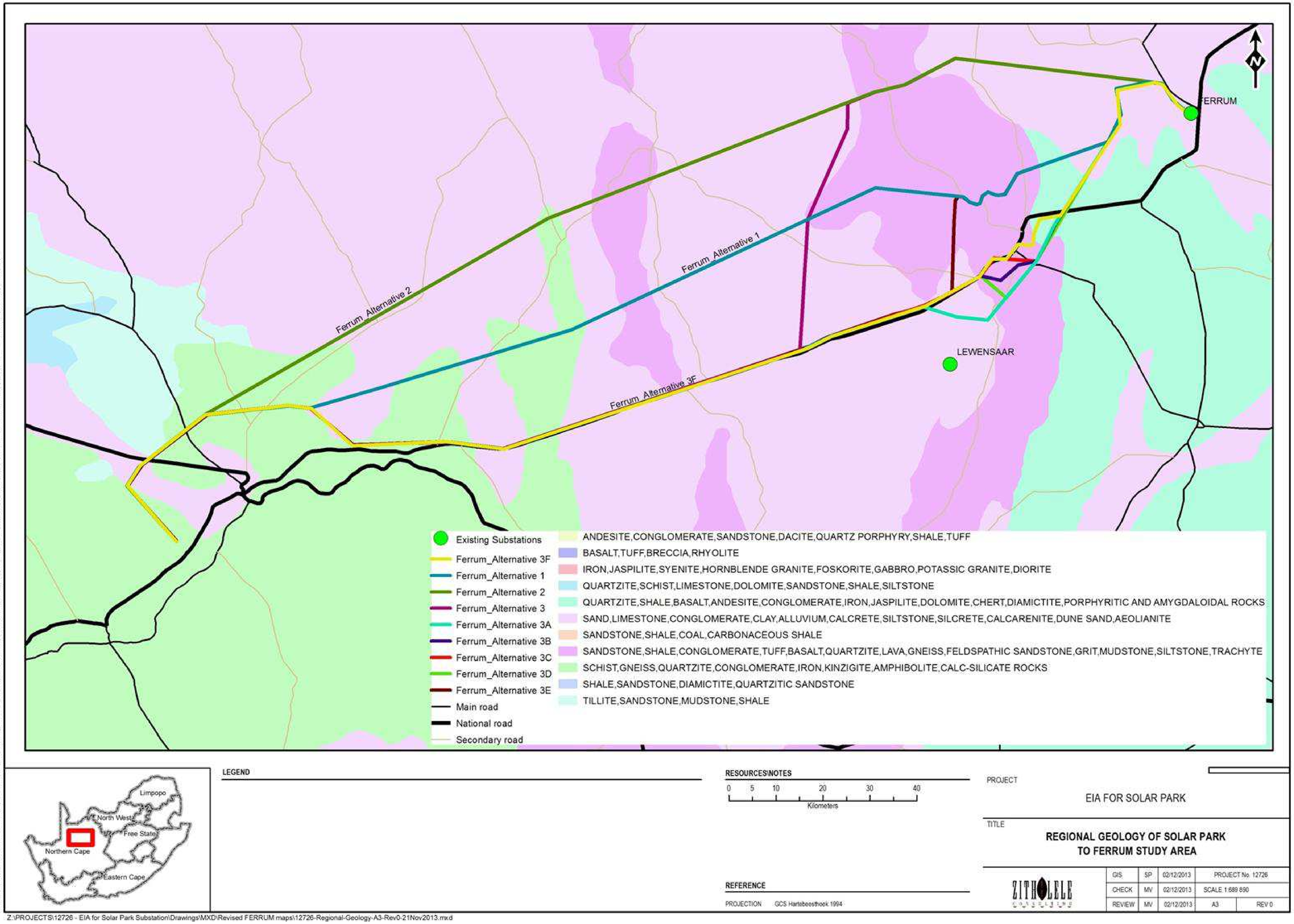

Figure 7-3: Regional geology of the study area.

7.3 TOPOGRAPHY

7.3.1 Data Collection and Methodology

The topography data was obtained from the Surveyor General's 1:50 000 toposheet data for the region. Contours were combined from the topographical mapsheets to form a combined contours layer. Using the Arcview GIS software the landforms of the region was compiled and is shown in Figure 7-5 below.

7.3.2 Regional Description

The altitude in the study area ranges from 600 mamsl (metres above mean sea level) to 1800 mamsl. The highest parts of the study area are in the eastern portions (Olifantshoek, see Figure 7-4) and in the southern portions (Kenhardt) and the lowest portions are in the southern portions of the study area (Orange River).

Figure 7-4: View in an eastward direction from the *Langberge* north of Olifantshoek.

The study area comprises of one major valley in the Orange River Basin and the Kalahari that all generally drain eastward. The area northeast of the Orange River is dominated by the Kalahari dunes and intermittent pans. On the eastern end of the study area the alternatives travel through the Langberge, a long linear mountain range that runs north-south through the study area. The area south of the Orange River is dominated by a flat plain with very few topographic features.

7.3.3 Site Description

The area between the CSP site and the substation at Ferrum near Kathu is sloping upwards in a northwesterly direction at an average slope of about 1.8 %. The lowest point is at the SCP site at about 812 mamsl with the highest point occurring close to Kathu at about 1815 mamsl.

7.3.3 Sensitivities

In terms of topographical features no sensitivities exist although the dunefields in the Kalahari do afford some unique challenges.

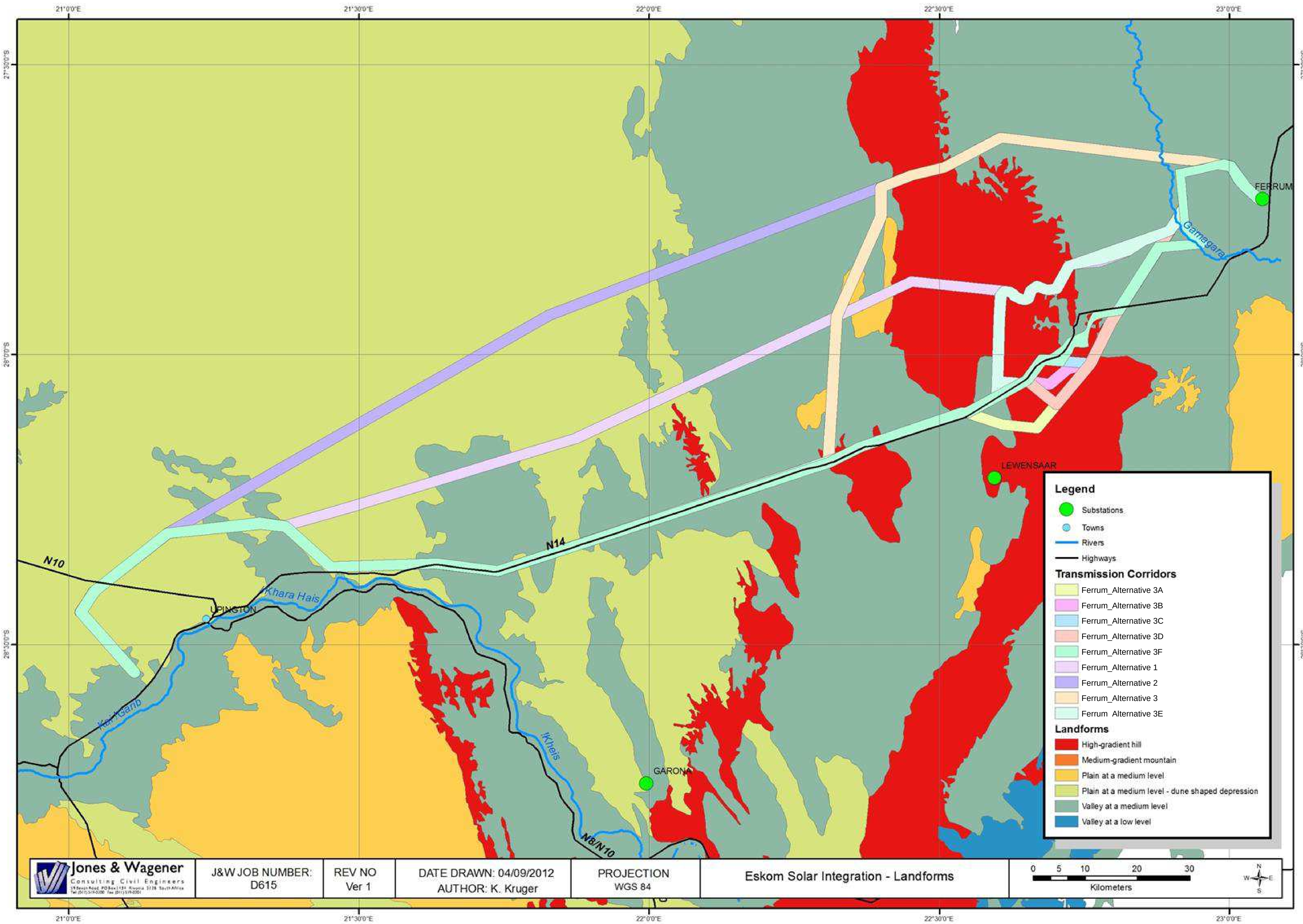

Figure 7-5: Landforms of the study area.

7.4 SOIL

7.4.1 Data Collection and Methodology

The geological analysis was undertaken through desktop evaluation using a Geographic Information System (GIS) and relevant data sources. The geological data was taken from the Environmental Potential Atlas Data generated by the DEA. Soil data was obtained from the Department of Agriculture

The on-site soils assessment was conducted from August - October 2012. Soils were augered at 500 - 1 000 m intervals along the proposed power line routes using a 150 mm bucket auger, up to refusal or 1.2 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 horizons;
- Soil colour;
- Soil depth;
- Soil texture (Field determination);
- Wetness;
- Occurrence of concretions or rocks; and
- Underlying material (if possible).

7.4.2 Regional Description

The sizable portion (>30 %) of the study area is covered by recent (Quaternary) alluvium and calcrete. Superficial deposits of the Kalahari Group are also present in the east. The extensive Palaeozoic diamictites of the Dwyka Group also outcrop in the area as do gneisses and metasediments of Mokolian age.

The soils derived from these geologies are mostly red-yellow apedal soils, freely drained with a high base status and < 300 mm deep. Along the Orange River recent alluvial deposit from the river form the main soils forms.

7.4.3 Site Description

Following the site survey a number of soil forms were identified. The soils forms were grouped into management units and are described in detail in the sections below and Figure 7-15 illustrates the location of the soil types. The land capability (agricultural potential) of the abovementioned soil form is described in more detail below.

The management units are broken up into:

- Alluvial soils (Undifferentiated deep deposits);
- Rocky Areas;
- Sandy soils:
  - Red soils; and
  - Red and Yellow soils.

Each of these management units are described in more detail below.

Alluvial soils

These soils are mainly found along the Orange River floodplains and form the basis for most of the cultivation in the Northern Cape. The main soil form is the Dundee soil form which is shown below and typified by an Orthic A-horizon over a Stratified Alluvium. The stratification (layers) in the soil horizon is created by the deposition of material during flood events. The criteria for such a soil are as follows:

- is unconsolidated and contains stratifications caused by alluvial or colluvial deposition;
- directly underlies a diagnostic orthic or melanic A horizon, or occurs at the surface;
- does not qualify as diagnostic regic sand.

Unlike soil horizons that have developed by pedogenetic processes, stratified alluvium owes its distinguishing features to a depositional process and is thus not a sequence of so-called genetic horizons. Pedogenetic changes have been minimal and it is, properly, a C horizon or parent material. The rare occurrences of stratified colluvium are also accommodated by this concept.

Given time, homogenizing processes of soil formation will destroy the evidence of deposition: stratifications will disappear and be replaced by true genetic soil horizons, their kind depending upon the character of the particular material, the particular site and the particular external environment. However, alluvium is commonly utilized very intensively for crop production. For this practical reason, it has been regarded as desirable to recognise stratified alluvium as a diagnostic subsoil material. The classification reflects this importance of young alluvium by making provision, through a diagnostic horizon, for its easy inclusion. Other diagnostic subsoil horizons cater for the pedogenetic changes which affect alluvium with time.

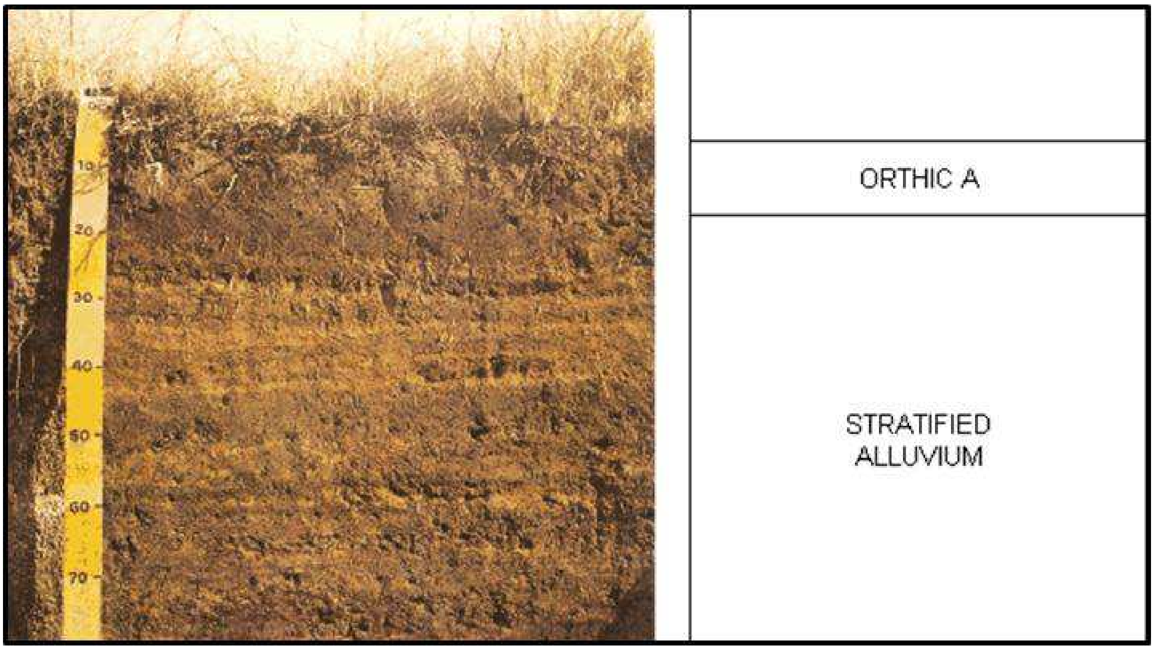

Figure 7-6: Dundee soil form.

Rocky Areas

As shown on the Soils map for the study area there are two rocky soil types. The first is rocky areas with miscellaneous soils and the second is hard rock areas. In both cases the rock originates from shallow geology found throughout the study area. In the east of the study area the hard rock areas originate from the Langbergee and some isolated outcrops en route to Upington. The first unit of miscellaneous soils with rocky areas are found closer to the Orange River and is associated with the Inselbergs that can be found throughout the area. The soil forms that are found in these areas are illustrated below. These include the Mispah and Glenrosa soil forms and both are characterised by their shallow nature overlying a hard layer.

Figure 7-7: Rocky areas on site, just south of the Orange River.

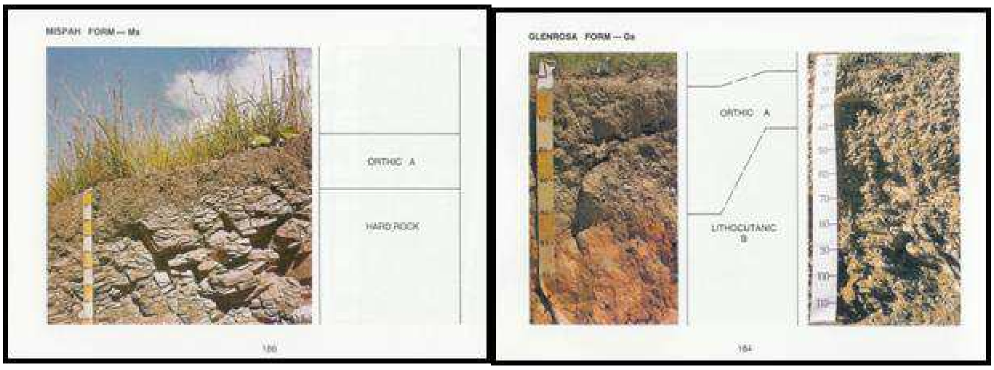

Figure 7-8: Mispah (left) and Glenrosa (right) soil forms.

The lithocutanic B horizon found in the Glenrosa soil form must comply with the following requirements:

- underlies a diagnostic topsoil horizon, either directly or via a stone-line, or an E horizon;
- merges into underlying weathering rock;
- has, at least in part, a general organization in respect of colour, structure or consistence which 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 the localization of one or more of clay, iron and manganese oxides, and organic matter in a non-homogenized matrix of geological material (saprolite) in a variable but generally youthful stage of weathering;
- lacks a laterally continuous horizon which would qualify as either a diagnostic pedocutanic 8 or prismacutanic B;
- does not qualify as a diagnostic podzol B, a neocarbonate B, a soft or hardpan carbonate horizon, or diagnostic dorbank;
- if the horizon shows signs of wetness, then more than 25% by volume has saprolite character.

The concept is one of minimal development of an illuvial B horizon in weathering rock. With the exception of its presence beneath an E horizon in Cartref form, the lithocutanic B occurs beneath a diagnostic topsoil horizon. In situ weathering of rock under a topsoil has produced a heterogeneous and, typically, highly variegated zone consisting of soil material (relatively well homogenized without traces of weathering rock) interspersed with saprolite or weathering rock in various stages of breakdown. The latter is recognised by its general organization with respect to structure, colour or consistence which still has distinct affinities with the parent rock. Furthermore, this zone grades into relatively unaffected and, eventually, fresh rock, sometimes at fairly shallow depth.

Sandy soils

This management unit described the bulk of the soils within the study area. Being an arid environment, very little pedogenesis has taken place and clay material is not common. Over the study area we have the red dunes of the Kalahari dominating the central region, and they are surrounded by deep red soil plains without dunes. To the south and far east of the study area you find shallow red soils, mostly overlying calcrete and in the extreme south and eastern region you find mixed yellow and red soils with low clay percentages. Each of the soil forms found in these areas are illustrated and described below.

Deep red soils with and without dunes

The soil that dominates in these areas is the Namib soil form. This soil form is typified by a regic sand B-horizon that in the case of the study area is very red in colour. The illustration below shows a yellow version, however the photo on the right shows the colour of the soils within the study area. A regic sand has to meet the following criteria:

- is a recent deposit, usually aeolian, which, except for a possible darkening of the topsoil by organic matter, shows little or no further evidence of pedogenesis;
- is coarse textured and has little or no macroscopically visible structure; it may be massive or single grained; aeolian stratification (cross-bedding) may be present;
- may have any colour although "grey" as defined for the E horizon is common; aeolian stratification (cross-bedding), when present, prevents a material from qualifying as a diagnostic red or yellow-brown apedal B horizon or as an E-horizon;
- has mineralogical composition little, if any different from that of the parent material;
- has consistence that is loose, friable or soft;
- directly underlies an orthic A horizon or, if this is absent, occurs at the surface; and
- does not qualify as a neocutanic B, a neocarbonate B, an E horizon or as stratified alluvium.

The term regic (Gr.rhegos = blanket) is used here to convey the idea of cover sands in which, by virtue of their youth or environment, little or no profile development has taken place. The purpose of defining this class of materials as diagnostic is to provide a place in the classification for young sands of aeolian origin (red, yellow-brown or grey). Such materials often represent an important geographic entity in desert and littoral regions. Properties reflect minimal pedogenesis; essential is the fact that the mineralogical composition of the sand (e.g. quartz, feldspars, Ferro-magnesian minerals, shell fragments) is little if any different to that of the parent deposit and that there has been little if any clay formation.

Aeolian stratification (cross-bedding), if present, is diagnostic of regic sand; these should not, however, be confused with the more or less parallel, horizontally oriented lamellae which are common in certain E horizons. Because pedogenesis has been minimal in regic sand, changes within a sand body which are attributable to pedogenesis would tend to indicate the presence in the sand body of materials which do not qualify as regic sand. Regic sands are commonly but not necessarily deep.

When there is doubt as to whether a material qualifies as regic sand on the one hand or as a red or yellow-brown apedal B horizon on the other, regic sand is preferred when the sand body takes the form of a dune and, in the virgin state, vegetation is all but absent. The texture of regic sands is usually no finer than pure sand.

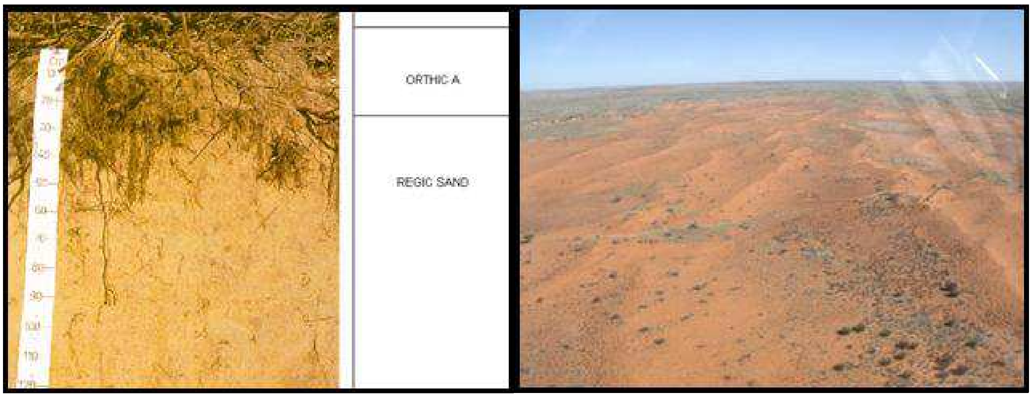

Figure 7-9: Namib soil form (left) red soils on site (right).

In cases where the regic sand horizon has undergone more pedogenesis this soil can be classified as a Hutton soil form, and in cases where the soil becomes shallow the Plooysburg soil form is found (as shown below).

<u>Shallow red soils</u>

The shallow red soils found throughout the study area most commonly overlie a calcrete layer, which in terms of the classification system is described as a soft Carbonate or a Hardpan Carbonate horizon. The dominant soils in this region are known as the Plooysburg and Kimberley soil forms as shown below. A Hardpan Carbonate layer is identified by the following criteria:

- is continuous throughout the pedon;
- is cemented by calcium and/or calcium-magnesium carbonates such as to be a barrier to roots and slowly permeable to water;
- is massive, vesicular or platy and extremely hard when dry and hard or very firm when moist;
- unless exposed by erosion, occurs beneath a melanic or orthic A, or yellow-brown apedal 8, red apedal B, neocutanic 8 or neocarbonate B horizon;
- does not qualify as diagnostic dorbank; and
- A laminar capping is common but not always present.

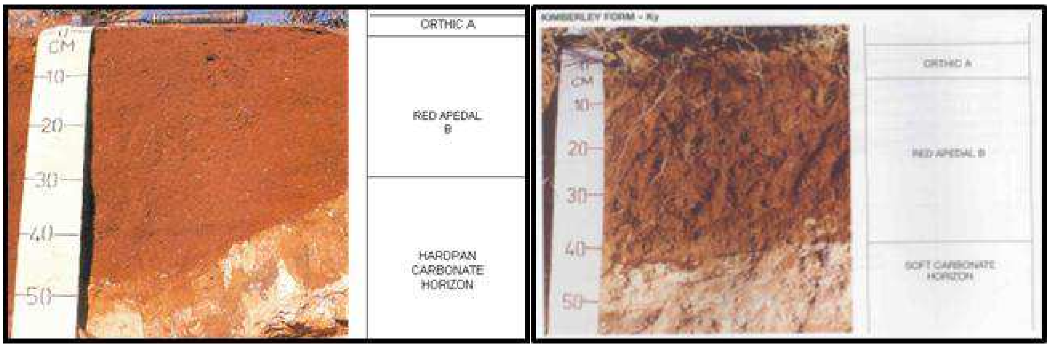

Figure 7-10: Plooysburg (top) and Kimberley (bottom) soil forms.

<u>Mixed red and yellow soils with very little clay</u>

As the red sands of the Kalahari recede the soils start to become more diverse. These areas have a variety of soils including shallow calcrete, gravel plains and red or brown soils. Below are photos of the soils found in these areas.

Figure 7-11: Mixed shallow soils on site.

The soil forms identified in this area include Coega, Brandvlei, Mispah, and Glenrosa. The latter two soils are described above, while the other two are shown below. Both the Coega and Brandvlei soils have carbonate horizons, in the Coega the concrete has hardened into an impenetrable layer.

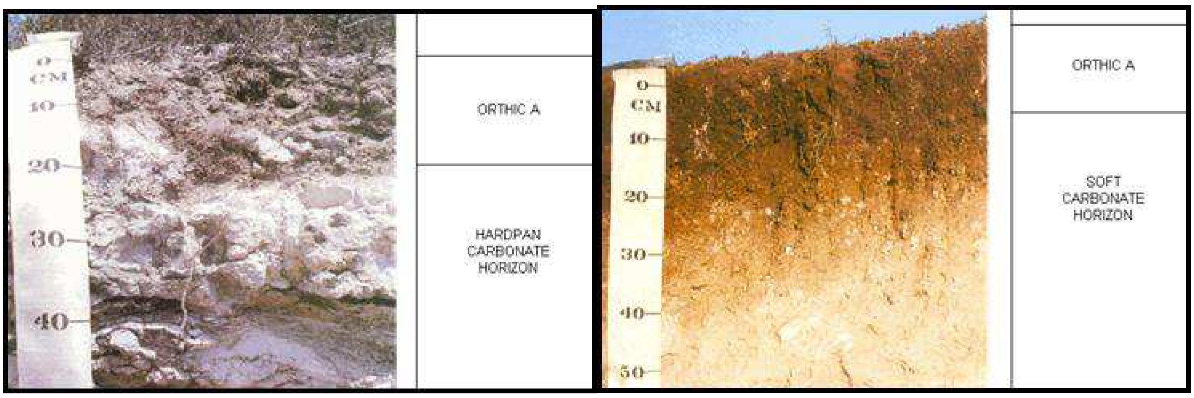

Figure 7-12: Coega soil form (left) and Brandvlei soil form (right).

Sensitivities

The potential sensitivities related to soils were screened using data from the Agricultural Research Council's (ARC) website AGIS. The data from the ARC indicates that the area is prone to two potential sensitivities relating to soil – erosion and shifting sands. Site visits undertaken by the EAP and specialist team has confirmed that erosion of the soils can become a major problem if not addressed as is seen in the Figure 7-13 and Figure 7-14 below.

Site visits to the farm Makala (646/RE) of Mr Willie Storm highlighted the impact of erosion on maintenance roads that is not properly maintained. Deep erosion gullies have formed within the servitude of an existing power line across Mr Storm's property. Complete clearance of the servitude resulted in the exposure of the topsoil which has been washed away during the rain events over time.

Figure 7-13: Erosion along the water courses on the farm Lupani where a bridge has been built (Foto courtesy of D. Ford).

Figure 7-14: Erosion occurring where concrete structures ends on farm Lupani (Foto courtesy of D. Ford).

Erosion and shifting sands are usually interrelated and in the dunefields of the Kalahari they are especially high as indicated in Figure 7-15 below. As shown in the map Ferrum_Alternatives 1 and 2 traverse large areas of potentially shifting sands.

The potential for shifting sands is caused by the high amounts of Sodium in the soil along with the sandy nature of the soil. These factors create an environment where soils easily disperse when water is introduced or erode when the vegetative cover is removed. These areas require special attention when constructing roads, erection and siting the pylon footings. These aspects are covered in the EMPr and impact assessment.

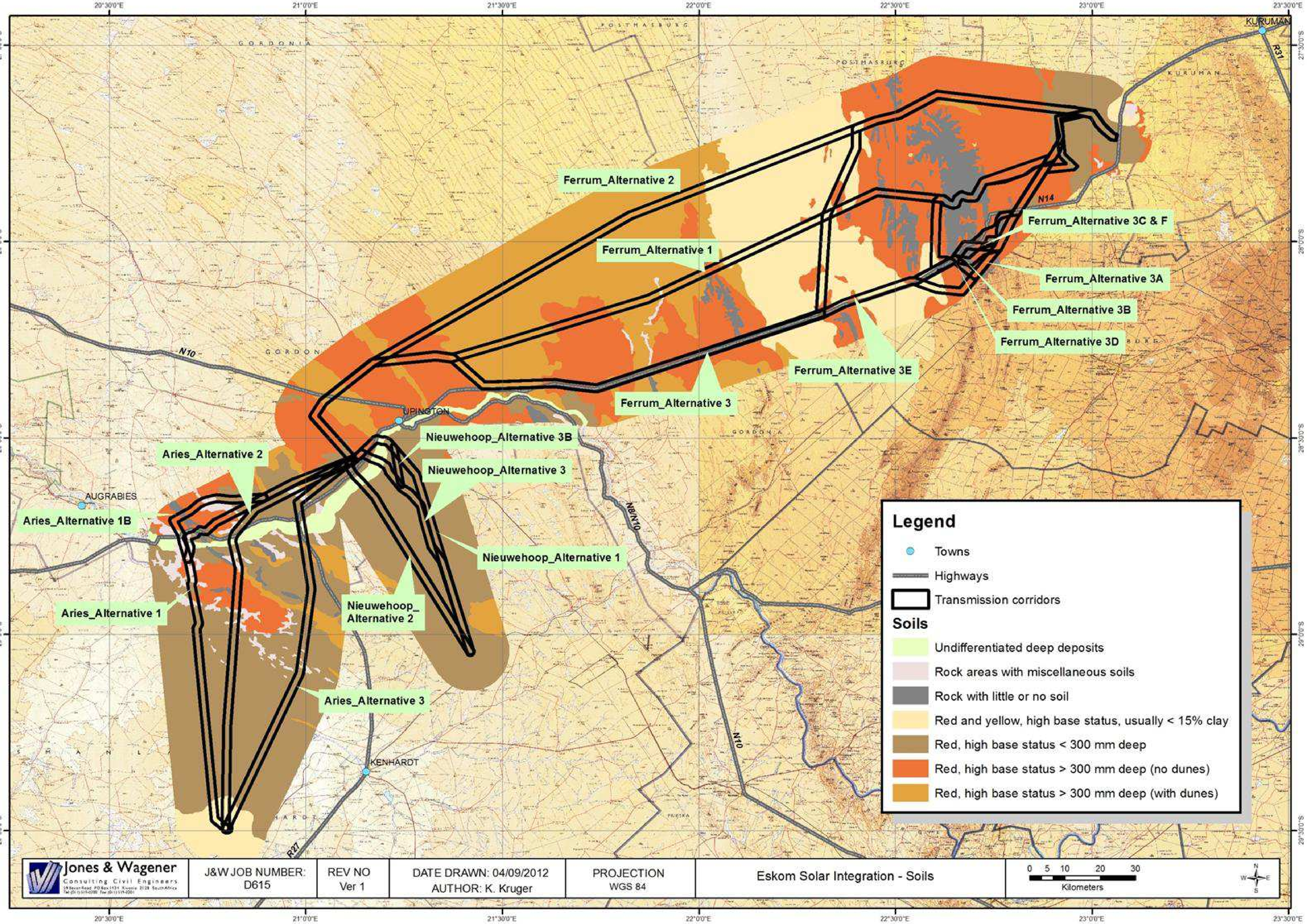

Figure 7-15: Soil map for the study area.

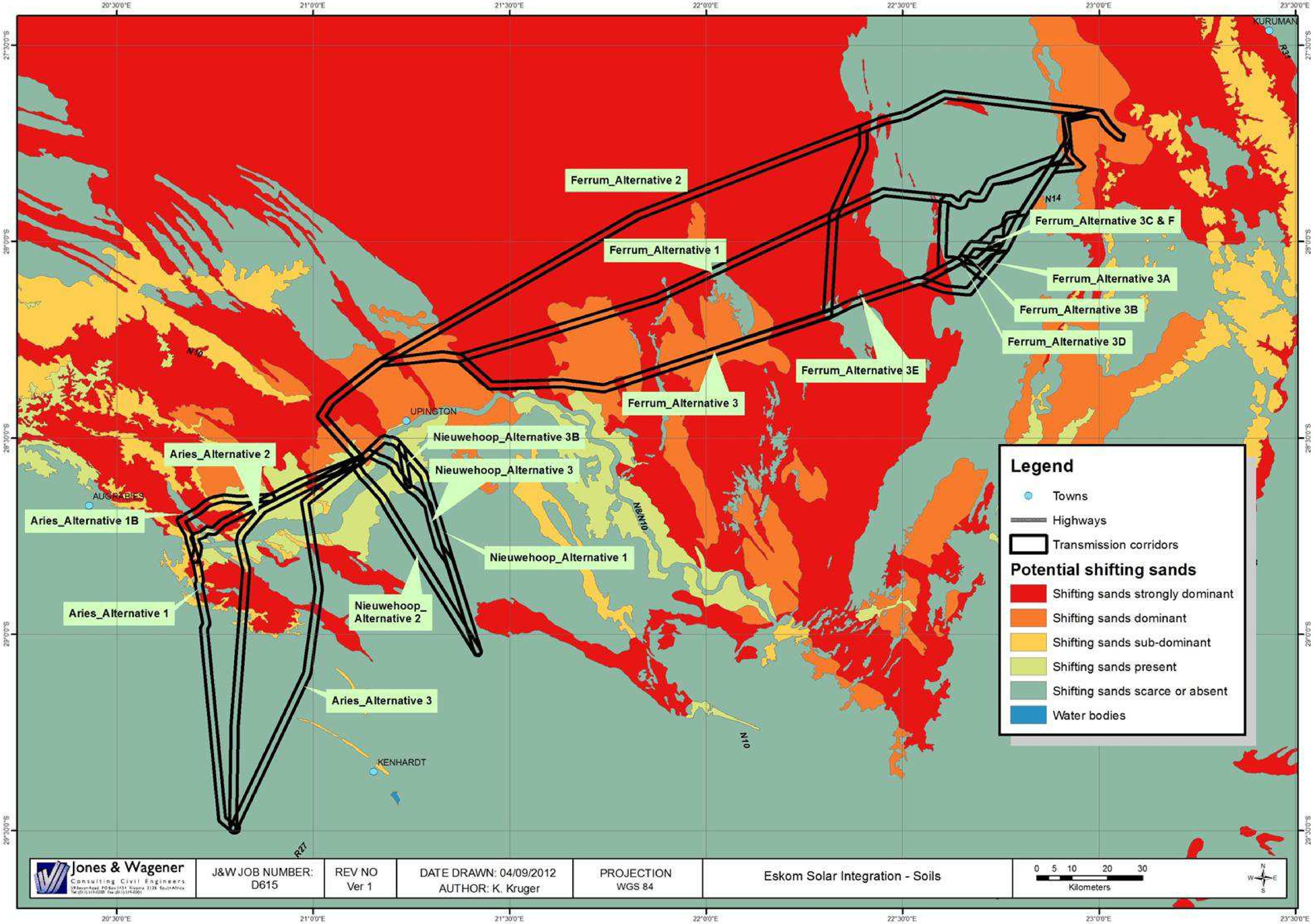

Figure 7-16: Soil sensitivity map.

7.5 LAND CAPABILITY

7.5.1 Data Collection and Methodology

Using the soil data collected during the site investigations and applying that to the land capability assessment methodology as outlined by the National Department of Agriculture[8], the agricultural potential/land capability of the site was determined. Site visits by the EAP and specialist team further substantiated the specialist's site assessment.

7.5.2 Regional Description

Regionally the Northern Cape is not known for cultivation or high agricultural potential soils. The majority of the province is utilised for grazing of livestock due to the aridity and shallow soils that occur in the area.

7.5.3 Site Description

According to the land capability methodology, the potential for a soil to be utilised for agriculture is based on a wide number of factors. These are listed in the table below along with a short description of each factor.

Table 7-1: Agricultural Potential criteria

Criteria	Description
Rock Complex	If a soil type has prevalent rocks in the upper sections of the soil it is a limiting factor to the soil's agricultural potential
Flooding Risk	The risk of flooding is determined by the closeness of the soil to water sources.
Erosion Risk	The erosion risk of a soil is determined by combining the wind and water erosion potentials.
Slope	The slope of the site could potentially limit the agricultural use thereof.
Texture	The texture of the soil can limit its use by being too sandy or too clayey.
Depth	The effective depth of a soil is critical for the rooting zone for agricultural crops.
Drainage	The capability of a soil to drain water is important as most grain crops do not tolerate submergence in water.
Mechanical Limitations	Mechanical limitations are any factors that could prevent the soil from being tilled or ploughed.
pH	The pH of the soil is important when considering soil nutrients and hence fertility.
Soil Capability	This section highlights the soil type's capability to sustain agriculture.
Climate Class	The climate class highlights the prevalent climatic conditions that could influence the agricultural use of a site.
Land Capability / Agricultural Potential	The land capability or agricultural potential rating for a site combines the soil capability and the climate class to arrive at the sites potential to support agriculture.

[8] Agricultural Research Council – Institute for Soil, Climate and Water (2002), *Development and Application of a Land Capability Classification System for South Africa*, Final Report to Directorate Agricultural Land Resource Management, National Department of Agriculture.

The soils identified above were classified according to the methodology described above. The criteria mentioned above were evaluated in the table below.

Table 7-2: Land Capability of the soils within the study site

Soil	Agricultural	Sandy soils	Shallow Soil	Hard Rock
% on Site	1.7 %	48.3%	44.3%	5.7%
Rock Complex	None	None	Yes	Yes
Flooding Risk	High	None	None	None
Erosion Risk	Moderate	High	High	Very Low
Slope %	<4	<4	<4	>4
Texture	Loam	Sand	Sand	Rock/Sandy
Effective Depth	> 90 cm	> 30 cm	< 30 cm	< 10 cm
Drainage	Imperfect	Excellent	Poorly drained	Poorly drained
Mech Limitations	None	None	Rocks	Rocks
pH	> 5.5	> 5.5	> 5.5	> 5.5
Soil Capability	Class III	Class V	Class VI	Class VIII
Climate Class	Severe	Severe	Severe	Severe
Land Capability	Class III – Moderately Arable Land	Class VII – Grazing Land	Class VII – Grazing Land	Class VIII – Wildlife

No limitation	Low	Moderate	High	Very Limiting

The site is made up of three land capability classes, namely Class III, VII and VIII as shown in Figure 7-23 below. The Class III soils are suitable for cultivation but they have some restrictions – in this case flooding and climate. The Class VII soils have continuing limitations that cannot be corrected; in this case rock complexes, climate, stoniness, and a shallow rooting zone constitute these limitations. Class VIII soils are basically hard rock and have no agricultural use.

7.5.4 Sensitivities

Of the uses above, the agricultural soils located adjacent to the Orange River supports the agricultural cultivation core for the province. Impacts to these areas should be limited as the soils as well as the water sources are very limited. As the Ferrum lines do not cross the agricultural areas there are no sensitivities in terms of agricultural potential.

As indicated in Table 7-2 the majority of the soil in the study area (92.6%) is only fit for grazing land. The study area is also impacted by grazing in varying degrees as evident from the figures below, resulting in varying degrees of vegetation cover.

Figure 7-17: Land use on a farm along Ferrum_Alternative 3E showing prevalence of Three Thorn (*Rhigozum trichotomum*). Veld in a moderate condition.

Figure 7-18: Loss of ground cover in the vicinity of outbuildings in a game farm on Ferrum_Alternative 3E.

Figure 7-19: Highly disturbed vegetation within the municipal property at Olifantshoek where Ferrum_Alternative 3F is proposed.

Figure 7-20: Moderate veld condition along Ferrum_Alternative 3A south of Olifantshoek showing linear infrastructure along which the power line infrastructure is proposed for this alternative.

Figure 7-21: Vegetation southwest of Olifantshoek showing prevalence of Three Thorn (*Rhigozum trichotomum*) and patchy loss of groundcover. Ferrum_Alternative 3C and 3F will pass through in this area.

Figure 7-22: Example of disturbance of vegetation causing loss of ground cover and ultimately exposure of dune sand near Upington. Rehabilitation of exposed sand dunes is a difficult and long process.

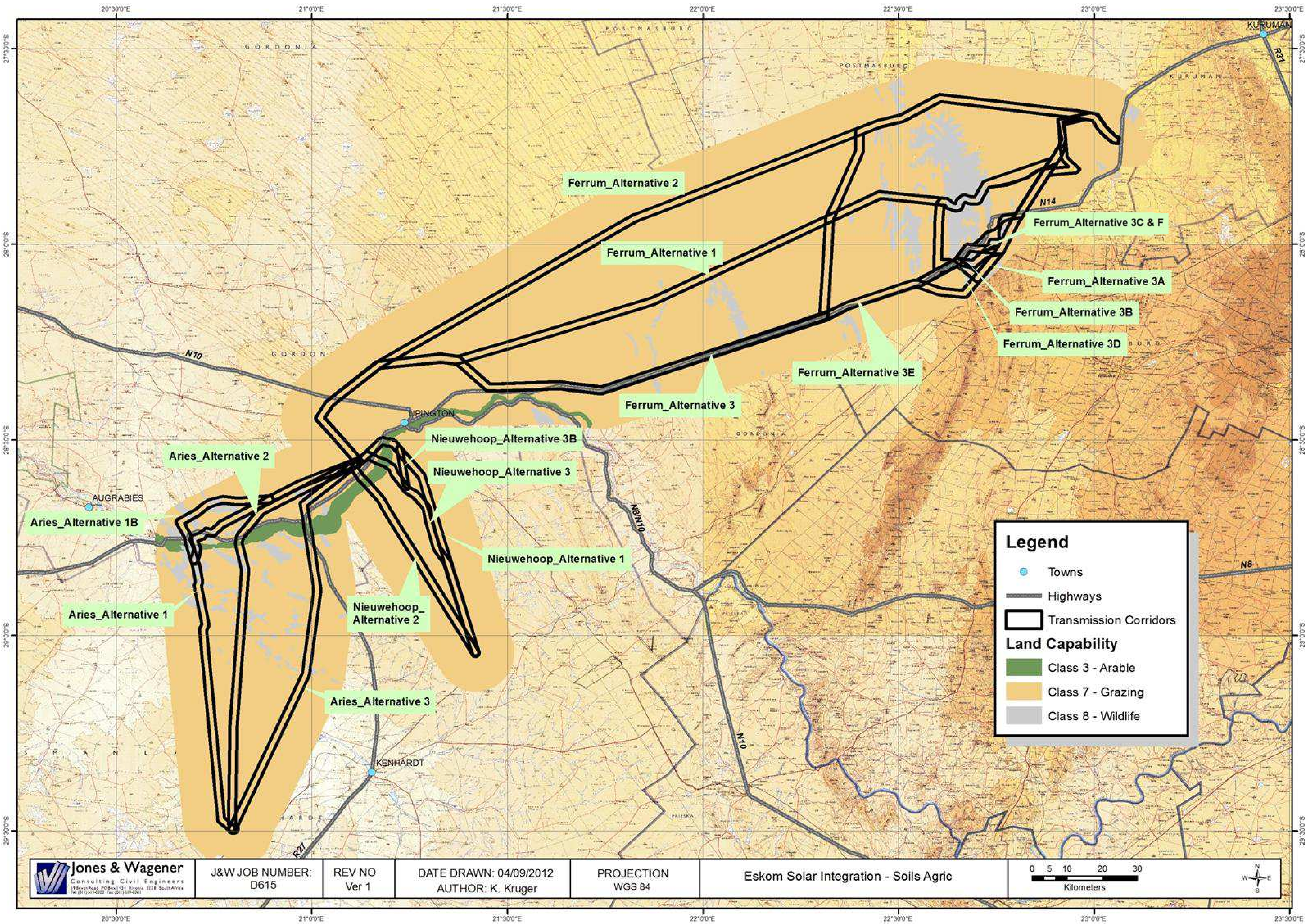

Figure 7-23: Agricultural potential for the study area.

7.6 SURFACE WATER AND WETLAND DELINEATION

7.6.1 Data Collection and Methodology

The surface water data was obtained from the National Freshwater Ecosystem Priority Area's (NFEPA) database from SANBI (2011). The data used included catchments, river alignments and river names.

Riparian Zones vs. Wetlands

Wetlands

The riparian zone and wetlands were delineated according to the Department of Water Affairs (DWA, previously known as 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 DWA 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 DWA 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 DWA 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 / presence of wetlands and riparian areas, using the methodology described above and described in more detail in the DWA guidelines.

7.6.2 Regional Description

The surface water features in the study area is dominated by the Orange River, which is the largest river in South Africa and also the only perennial river in the study area. All the alternatives have to cross the Orange River and it is anticipated that the bulk of the alignments of the alternative routes will be determined by this river crossing.

Smaller rivers that also have to be crossed include the Ga-Mogara, Hartbees and Kareeboom rivers and some of their associated tributaries depending on the alternative route selected. These rivers are all non-perennial and only flow after storm events. The surface water features in the study area is dominated by the Orange River, which is the largest river in South Africa and also the only perennial river in the study area.

7.6.3 Site description/delineation

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

Terrain Unit Indicator

The terrain on site varies from 600 metres above mean sea level (mamsl) to 1 800 mamsl. Terrain units on site include crest, slope, valley and plains. According to the DWA guidelines the valley bottom is the terrain unit where wetlands/drainage lines are most likely to occur, but the occurrence of wetlands is not excluded from any of the other terrain units.

Soil Form Indicator

Of the various soils identified in above the alluvial soils are the main soil form that can be an indicator of wetlands or drainage areas.

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 Orange River and its surrounding areas were the only water body that had wetness within the top 50 cm of the soil profile. Due to the aridity of the region, none of the other drainage lines or river beds shows signs of wetness, as they are just not saturated long enough to develop these signs.

Vegetation Indicator

From the vegetation assessment two vegetation units identified indicate the potential presence of water bodies, pans or wetlands. These include the Lower Gariep Alluvial vegetation and the Southern Kalahari Salt Pans. The Lower Gariep Alluvial vegetation is situated around the permanent water of the Orange River, while the pans are local depressions that collect water in periods of high rainfall, however these periods are very erratic and could be decades apart.

Delineated surface water features

According to the methodology that was followed for delineation of wetlands by DWA, there are three main surface water features present on site. These include:

- Rivers;
- Drainage Lines; and
- Pans.

Figure 7-24 illustrates the surface water bodies identified. It should be noted that although the area has a few rivers identified, the only perennial river is the Orange River (outside of study area). The rest of the study area is very arid, and the bulk of the drainage features are drainage lines with sandy beds that can be identified by the concentration of vegetation in these areas. These areas do however not classify as wetlands as they have no signs of wetness within the top 50 cm of the soil profile. Please refer to the photographs below for a view of the Orange River as well as the dry drainage lines found on site.

Figure 7-24: Surface Water features on site.

<u>Classification of water bodies</u>

The classification of the water bodies in the study area into different types was based on the method as defined in the National Wetland Classification System for South Africa (Figure 7-25), developed by the Freshwater Consulting Group for South African National Biodiversity Institute and the Working for Water Group.

This classification system has 6 levels of classification that in the end of level 5 described the functional wetland/water unit. This identification of the **functional unit** was the aim of this assessment. The classification of the wetlands on site proceeded as follows:

- Level 1 – System – Inland Ecosystem;
- Level 2 – Bioregion – Nama Karroo / Southern Kalahari
- Level 3 – Landscape Setting
  a) Slope;
  b) Plain; and
  c) Valley floor.
- Level 4 – Hydrogeomorphic unit
  a) Channels; and

  Channel (river, including the banks): an open conduit with clearly defined margins that (i) continuously or periodically contains flowing water, or (ii) forms a connecting link between two water bodies. Dominant water sources include concentrated surface flow from upstream channels and tributaries, diffuse surface flow or interflow, and/or groundwater flow. Water moves through the system as concentrated flow and usually exits as such but can exit as diffuse surface flow because of a sudden change in gradient. Unidirectional channel-contained horizontal flow characterises the hydrodynamic nature of these units. Note that, for purposes of the classification system, channels generally refer to rivers or streams (including those that have been canalised) that are subject to concentrated flow on a continuous basis or periodically during flooding, as opposed to being characterised by diffuse flow (see unchannelled valley-bottom wetland). As a result of the erosive forces associated with concentrated flow, channels characteristically have relatively obvious active channel banks.

  b) Depressions.

  Depression: a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. Dominant water sources are precipitation, ground water discharge, interflow and (diffuse or concentrated) overland flow. For 'depressions with channeled inflow', concentrated overland flow is typically a major source of water for the wetland, whereas this is not the case for 'depressions without channeled *inflow'. Dominant hydrodynamics are (primarily seasonal) vertical fluctuations. Depressions may be flatbottomed (in which case they are often referred to as 'pans') or round-bottomed (in which case they are often referred to as 'basins'), and may have any combination of inlets and outlets or lack them completely. For 'exorheic depressions', water exits as concentrated surface flow while, for 'endorheic depressions', water exits by means of evaporation and infiltration.*

- Level 5 – Level on inundation
  a) Drainage Lines - Non-perennial – never inundated, saturation unknown; and
  b) Pans - Non-perennial - never inundated, saturation unknown.

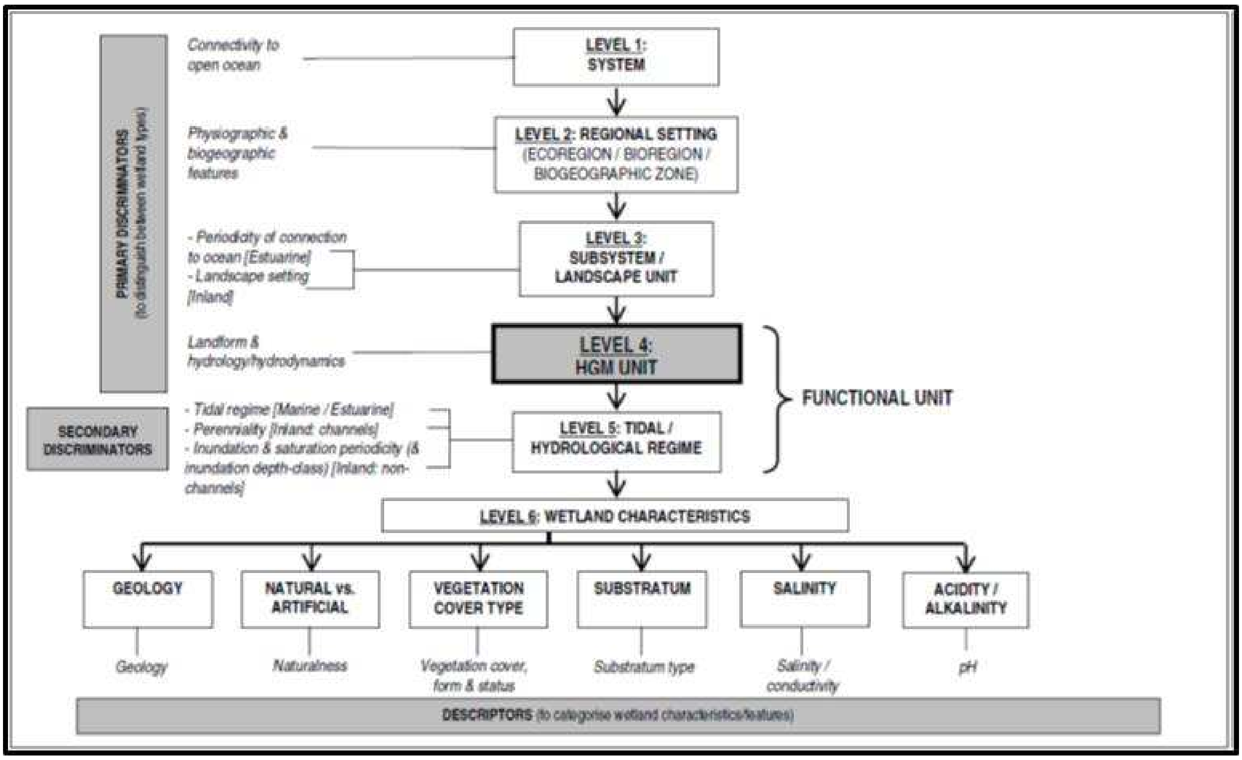

Figure 7-25: National Wetland classification system (SANBI, 2009).

Using the methodology above the following wetland types were identified on site as shown below in Figure 7-26:

- Orange River – Perennial River Channel
- Drainage Lines (channels) - Non-perennial – never inundated, saturation unknown; and
- Pans - Non-perennial - never inundated, saturation unknown.

Sensitivities

In the arid region of the Northern Cape, all water bodies are seen as highly sensitive and important features. The Orange River is the lifeline in this region and impacts to the river should be avoided as far as possible. Furthermore the drainage lines and pans are features that only hold or transport water in the unlikely event of a rainfall event. These features should also be avoided. The maps below illustrate the water features identified.

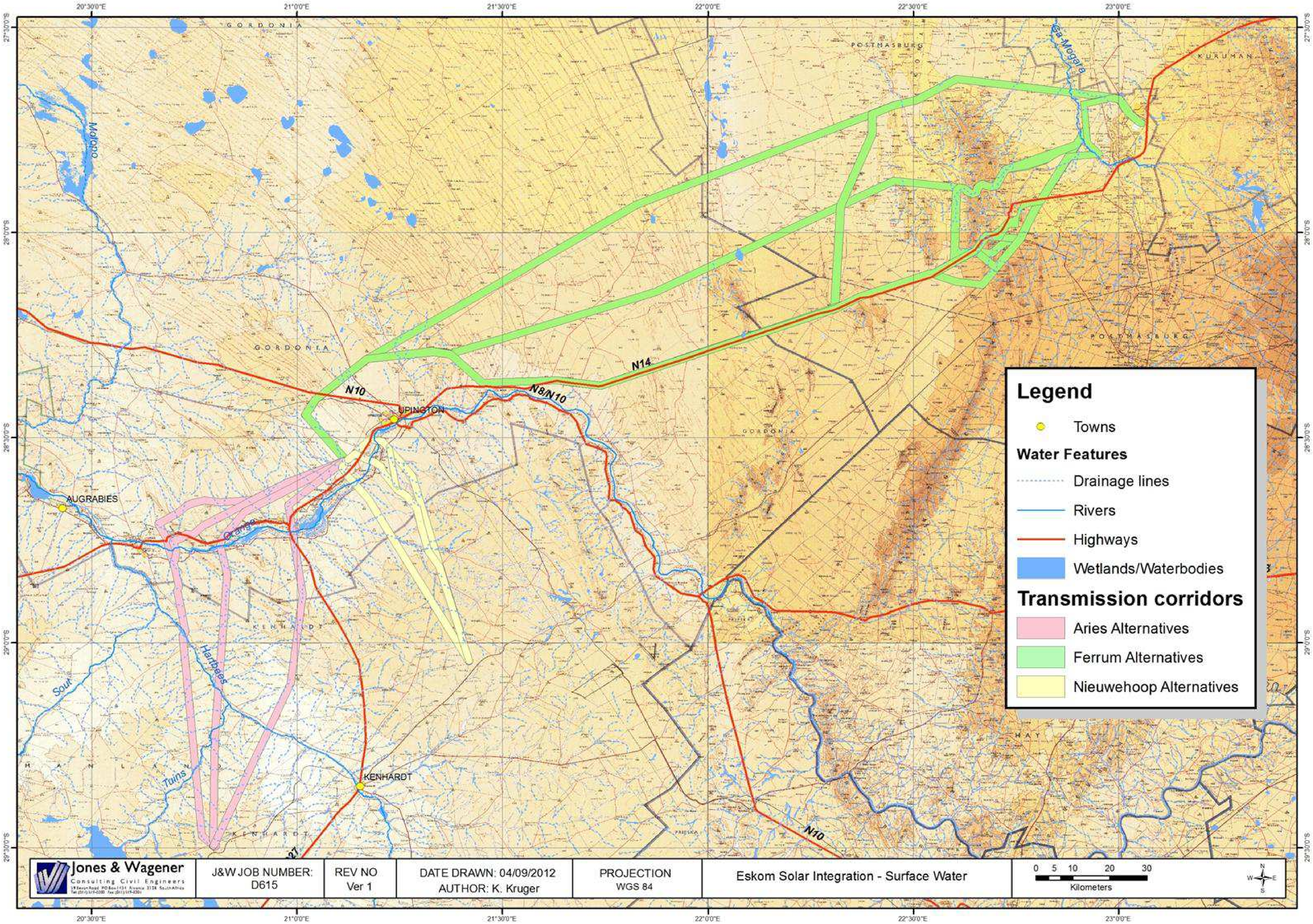

Figure 7-26: Surface Water Features.

7.7 TERRESTRIAL ECOLOGY AND BIODIVERSITY

7.7.1 Data Collection and Methodology

A literature review of the faunal and floral species that could occur in the area was conducted. The flora and fauna descriptions and data below are taken from The Vegetation of South Africa, Lesotho and Swaziland (Mucina and Rutherford 2006). Biodiversity data was obtained from the BGIS website for the Northern Cape provincial department and was used to conduct a desktop study of the area. This data consists of terrestrial components; ratings provide an indication as to the importance of the area with respect to biodiversity. Species information was obtained from SANBI's SIBIS website.

The detailed study involved extensive fieldwork, a literature review and a desktop study utilizing GIS. Site investigations were conducted from October 2011 to September 2012, from spring to summer. The area within the servitude was sampled using transects placed at 500 m intervals. At random points along these transect an area of 20 m x 20 m was 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.

In addition to the references mentioned above, 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); and
- Medicinal Plants of South Africa (Ben-Erik van Wyk, Bosch van Oudtshoorn and Nigel Gericke, 2002)

Species lists were obtained from the SIBIS *(South African National Biodiversity Institute - Accessed through the SIBIS portal, sibis.sanbi.org, 2012-08-25)*. In addition the following faunal guides were used on site and while compiling this report:

- Die Natuurlewe van Suider-Afrika, 'n veldgids tot diere en plante van die streek (Vincent Carruthers, 1997);
- Birds of Southern Africa (Ian Sinclair, 1994);
- Smithers' Mammals of Southern Africa, a field guide (Ed. Peter Apps, 2000);
- Sasol Owls and Owling in Southern Africa (Warwick Tarboton & Rudi Erasmus, 1998);
- Bats of Southern Africa (Peter John Taylor, 2000);

7.7.2 Regional Description

Nama-Karoo Biome

The Nama-Karoo Biome overlaps the main part of the study area and is a large landlocked biome in the central plateau of the western part of the country. The name is derived from the Khoi San word meaning "dry" and only the desert biome has higher variability in rainfall and the Kalahari greater extremes in temperature.

The flora in this biome is not particularly rich, and also has very low species endemism. Asteraceae (Asters), Fabaceae (Thorn Trees) and Poaceae (Grasses) are the dominant families found in the biome. The biome is a complex of extensive plains dominated by dwarf shrubs (< 1m tall) intermixed with grasses, succulents, geophytes and annual forbs. Small trees are limited to drainage lines or rocky outcrops. According to Mucina and Rutherford, the following vegetation types are found within the study area and this biome:

- Bushmanland Arid Grassland;
- Bushmanland Basin Shrubland;
- Kalahari Karroid Shrubland; and
- Lower Gariep Broken Veld.

Savanna Biome

Most Savanna has an herbaceous layer usually dominated by grass species and a discontinuous to sometimes very open tree layer. This is the most widespread biome in Africa. The savannah biome is found along the sandy dunefields to the north and east of Upington. Here the deeper soils allow for larger trees to establish themselves, especially Acacias with the intermittent shrubland in the areas between the dunes. Further to the east the topography and rainfall allows even bigger trees to establish themselves, especially around Kathu. Vegetation types found in this biome within the study area are:

- Gordonia Duneveld;
- Gordonia Plains Shrubland;
- Kathu Bushveld;
- Olifantshoek Plains Thornveld; and
- Koranna-Langbergee Mountain Bushveld.

Inland Azonal Vegetation

Also found in the study area is azonal vegetation, which is almost always associated with water bodies or wetlands. Within the study area the Orange River is the only perennial water source and the vegetation along its banks for a unique vegetation type i.e. the Lower Gariep Alluvial Vegetation.

In addition the salt pans in the area is also recognised as a separate vegetation type known as the Southern Kalahari Salt Pans. These areas are generally devoid of vegetation but some specialist plants do survive here. All the vegetation types mentioned above is illustrated in the Figure 7-27 and Figure 7-28 below.

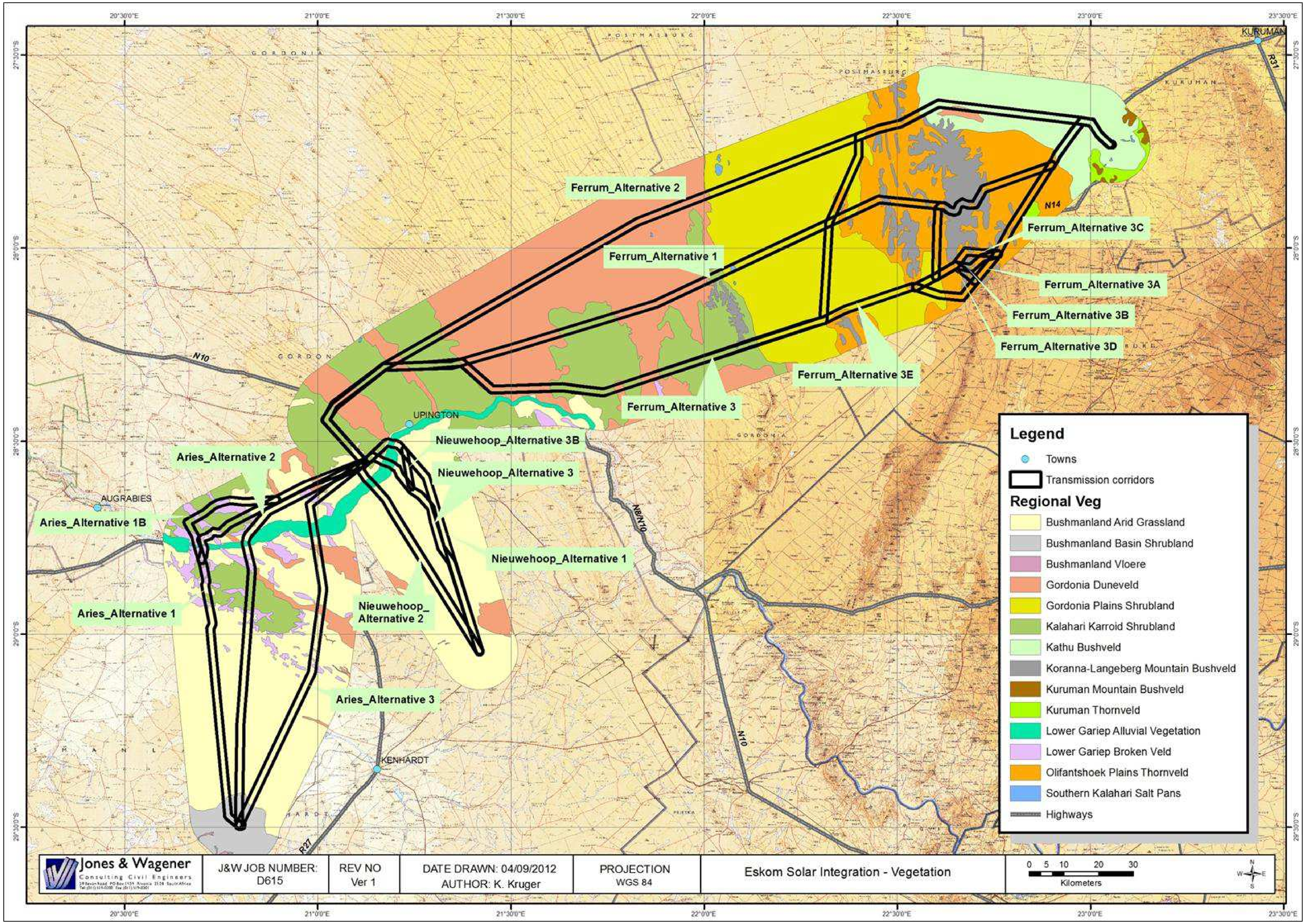

Figure 7-27: Vegetation of the study area.

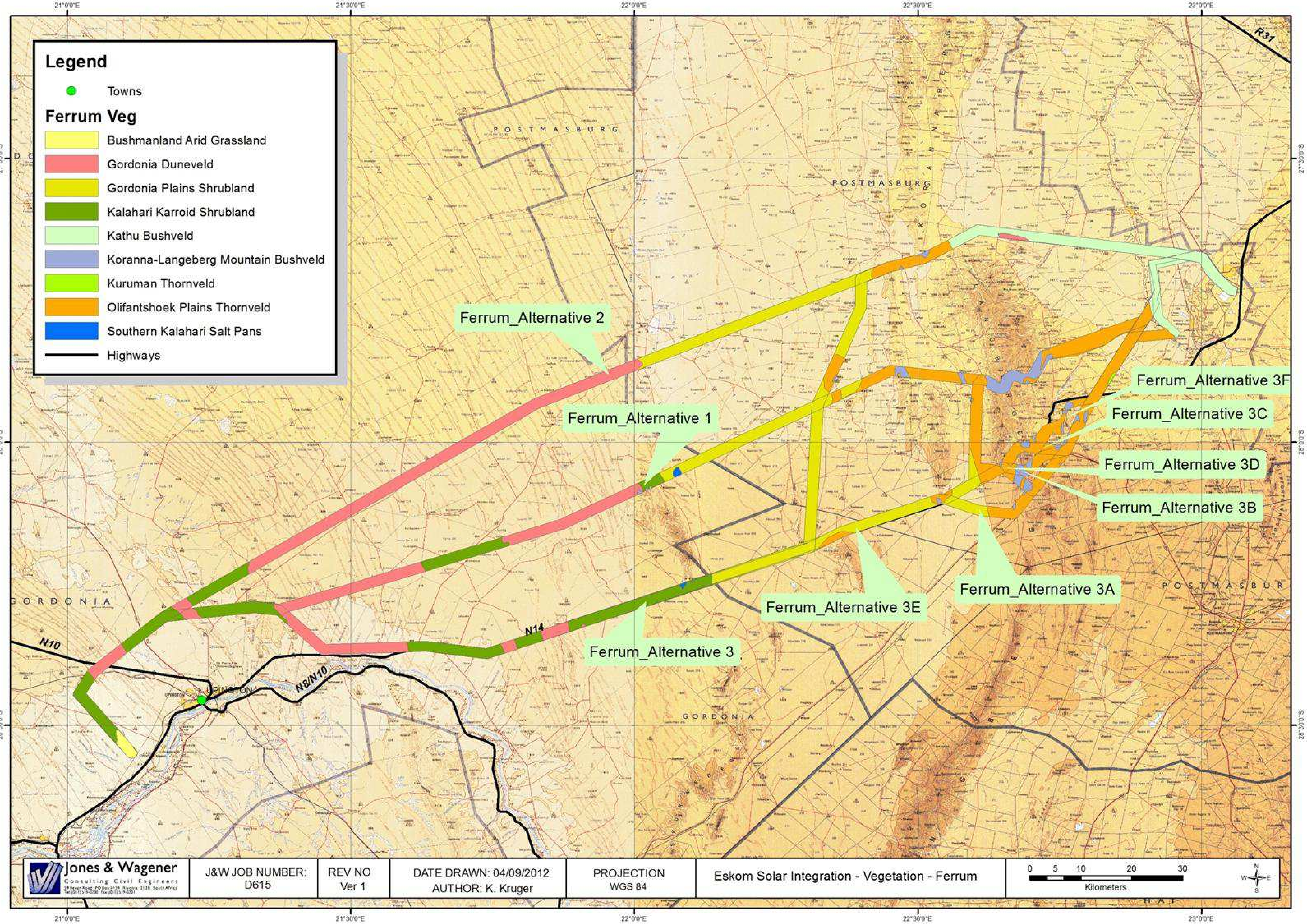

Figure 7-28: Vegetation of the Ferrum Routes.

7.7.3 Site description

In this section each of the vegetation/habitat types identified is described in more detail. This description starts at the easternmost section of the study area, at Kathu. It should be noted that as per the terms of reference for the study, this was an assessment aimed at determining the general ecological state of each of the corridors. Once a preferred corridor is identified and authorised, a detailed botanical assessment of the exact power line servitude will be undertaken. This assessment will identify all endangered, protected and specially protected species under the National Environmental Management, Biodiversity Act, the Forestry Act and the Northern Cape Nature Conservation Act.

Kathu Bushveld

This vegetation unit is found all around the Kathu area as the name suggests. The vegetation unit is typified by a medium-tall tree layer with *Acacia erioloba* in places, but the unit it mostly open with *Boscia albitrunca* as the other prominent tree. The shrub layer is the most important and dominant shrubs include *Acacia mellifera, Diospyros lycioides and Lycium hirsutum* with a variable grass layer. Dominant grasses include *Aristida meridionalis, Brachiaria nigropedata, Centropodia glauca, Eragrostis lehmanniana, Schmidtia pappophoroides and Stipagrostis ciliate*. Below are photographs taken from the helicopter flight over the study area. This unit is not threatened as only 1% of the vegetation unit has been transformed through mining in Kathu.

It should be noted that a portion of the vegetation to the north-east of the Kathu town has been declared a protected area by DAFF, the Kathu forest as per GN 727 of July 2009. This area is known for a high density of large Acacia erioloba and is shown in Figure 7-29. It should be noted that the proposed power line corridors are more than 2 km from the declared forest and its buffer zones.

Figure 7-29: Kathu Bushveld showing the vegetation as well as the impact of an existing power line.

Kathu Forest and the Ferrum Corridors

The DAFF expressed concerns regarding the location of the Kathu Forest protected area, the Griqualand West centre of endemism and the location of protected species in general. In Figure 7-30 below the proposed Ferrum-Solar Corridors are shown together with areas of high concentrations of protected species. Please note that these locations indicate general higher concentrations and do not exclude the occurrence of protected species at any other locations. Also note that the proclaimed protected area of the Kathu Forest and its buffer zones are indicated in red on the map and that none of the proposed corridors come within 2 km of the area. The bulk of the Ferrum power line corridors fall within the Griqualand West centre of endemism and succulents are of special concern here.

The additional corridors suggested by the stakeholders largely follow the Ferrum Alternative 3 alignment and then splits into a number of different corridors before linking up with the existing Ferrum-Gorona 275kV power line. The pros and cons of these corridors are:

- Using the existing N14 highway as the primary alignment and then linking with the existing Ferrum-Gorona power line alignment allows access to the bulk of the corridors and negates the requirement for extensive access road construction. This in turn reduces the impact on fauna and flora as well as the soils.
- Ferrum_Alternative 3A
    - Passes south of the *Langberge* outcrops which is technically easier and also avoids the ridges and potential succulents found in the rocky areas;
- Ferrum_Alternative 3B and 3D
    - Crosses over the ridges mentioned above which is not recommended;
- Ferrum_Alternative 3C
    - Uses the same valley as the N14 highway to traverse through the *Langberge*. This is however not recommended as there are high concentrations of *Acacia erioloba* and the valley is very narrow with limited space for additional impacts.
- Following the Ferrum-Garona 275kV alignment
    - This existing power line runs through Kathu bushveld vegetation and there is a constant presence of *Acacia erioloba* throughout the landscape although they do not dominate. This patch of bushveld extends over all three main corridors entering the Kathu region. It would be preferred to keep the impacts along existing infrastructure to prevent further fragmentation of the area and hence this section of the corridor is seen as a more preferred option for the last section of the power line.

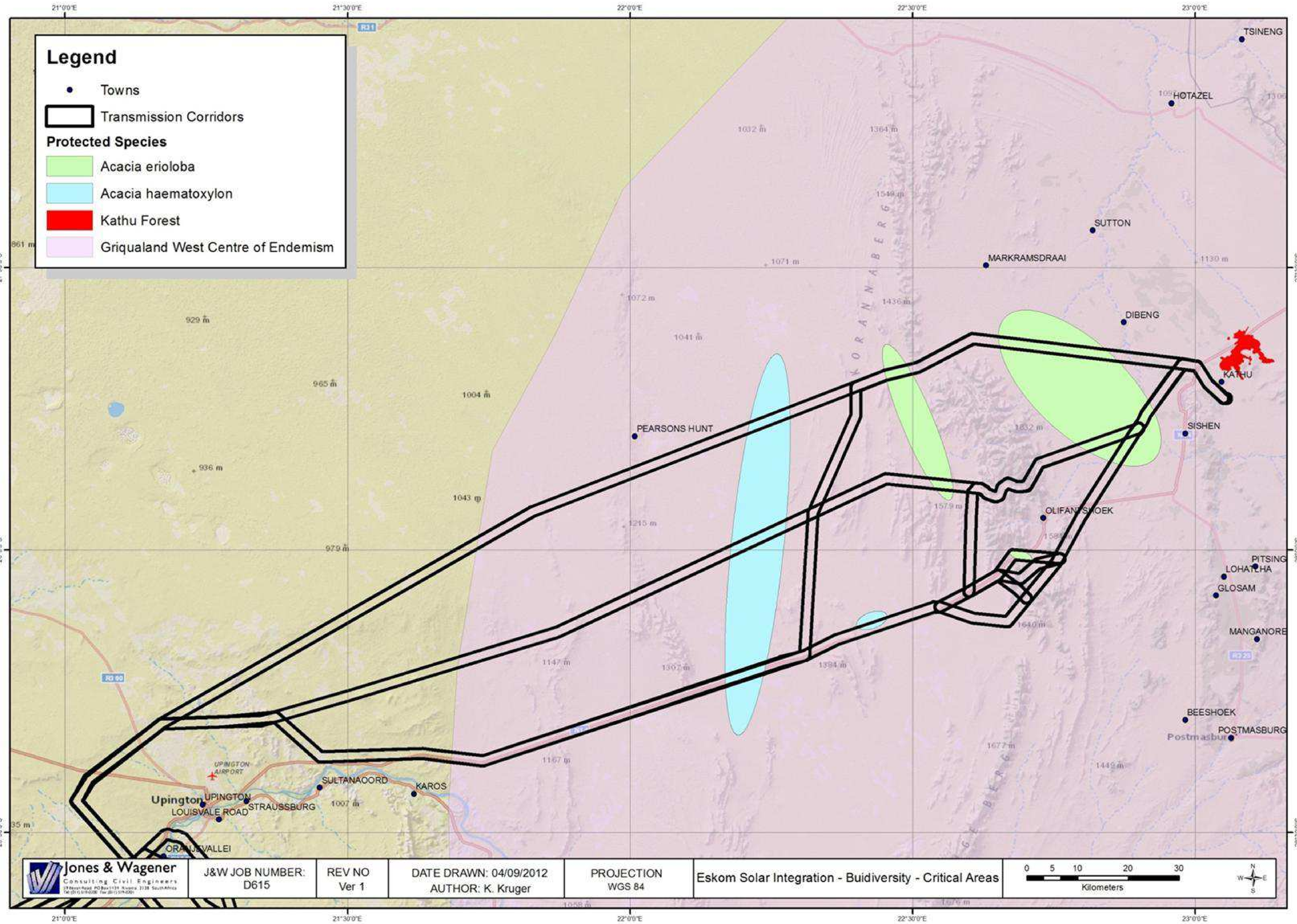

Figure 7-30: Ferrum Corridors and Protected Species.

Olifantshoek Plains Thornveld

The plains surrounding the town of Olifantshoek are dominated by thornveld and this vegetation type extends to all the plains downslope of the Korannaberg, Langberge as well as the Asbestos Mountains. Here a wide variety of thorny trees and shrubs form an open mosaic with sparse grasses. The dominant trees are *Acacia luderitzii, Boschia albitrunca* and *Rhus tenuinervis*. The odd large *Acacia erioloba* can occur and the dominant grasses are *Schmidtia pappophoroides* and *Stipagrostis uniplumis*. This vegetation unit is not threatened as only 1% has been disturbed.

Figure 7-31: Olifantshoek Plans Thornveld from the air (left) and ground level (right).

Koranna-Langberge Mountain Bushveld

This vegetation unit is found all along the Koranna and Langberge Mountains. These rugged slopes support open shrubland with moderate grass cover. Dominant shrubs and small trees include *Acacia meliffera* and *Croton gratissimus*. The grasses are dominated by *Aristida diffusa* and *Eragrostis curvula* with *Sarcostemma viminale* a common succulent climber. Virtually no transformation has taken place so this vegetation unit is not threatened. The photographs below give an illustration of the typical vegetation found in this unit.

Figure 7-32: Koranna-Langberge Mountain Bushveld.

Gordonia Plains Shrubland

The Gordonia Plains Shrubland is found in a long band between the Kalahari dunes in the west and the Koranna and Langbergee in the east on the flat plains virtually devoid of dunes in between the two landscape features. These plains comprise of mainly open grassland with occasional shrubs *Rhigozum trichotomum, Grewia flava* and some scattered *Acacia haematoxylon* and *A. erioloba*. Dominant grasses include *Aristida meridionalis, Centropodia glauca, Eragrostis lehmanniana* and *Schmidtia kalahariensis*. Very little of this area has been disturbed and the vegetation type is not threatened. Please refer to some photographs of the typical vegetation below.

Figure 7-33: Gordonia Plains Shrubland.

Southern Kalahari Salt Pans

The North West and Northern Cape Provinces house a number of intermittent endorheic, closed depressions (pans). These pans are vegetated by low grasslands although the centre of the pans is usually devoid of vegetation. The grasses are often dominated by *Sporobolus spp.* with a mixture of dwarf shrubs with an outer belt of *Lycium* and/or *Rhigozum*. Other species also include the succulent shrub *Zygophyllum tenue* and the grass *Enneapogon desvauxii*. This vegetation unit is subject to natural degradation – regeneration cycles controlled by the grazing of animals on the vegetation. In addition this vegetation unit is not threatened.

Figure 7-34: The salt pan found along the Ferrum_Alternative 1 Route.

Gordonia Duneveld

This vegetation unit covers a large expanse in the northern parts of the Northern Cape Province and is typified by the red Kalahari dunes. Several small pockets of dunes can be found scattered south of the Orange River. The dunes are parallel and about 3 – 8 m above the plains. The vegetation comprises of open shrubland with *Stipagrostis amabilis* grasses dominating the dune crests, *Acacia haematoxylon* and *Acacia mellifera* trees on the slopes and *Rhigozum trichotomum* in the interdune "streets". Other common species include *Grewia flava* shrubs, *Schmidtia kalahariensis* grasses and *Hermbstaedtia fleckii* herbs. Area sensitive to overgrazing as removal of vegetative cover can result in mobilisation of dune sands. This vegetation unit is well conserved and is not threatened.

Figure 7-35: Gordonia Duneveld showing the typical red dunes.

Kalahari Karroid Shrubland

The Kalahari Karroid Shrubland forms alternating bands with the Gordonia Duneveld and usually occurs in the areas where the dunes do not occur. This vegetation type forms the transition between the Savanna biome and the Nama-Karroo biome as the tree elements reduce and shrubs and grasses start to dominate. Small trees and shrubs include *Acacia mellifera, Parkinsonia africana*, and *Rhigozum trichotomum*. Low shrubs dominate the area and include *Hermannia spinosa, Limeum aethiopicum* and *Phaeoptilum spinosum* while the common herbs include *Dicoma capensis, Chamaesyce inaequilatera*. Common grasses are *Aristida adscensionis, Enneapogon desvauxii, E. scaber* and *Stipagrostis obtusa*. This vegetation unit is not threatened although this area was the route of choice for early roads, which lead to the introduction of alien plants. The result is that some 25 % of the unit has been colonised by scattered *Prosopis* species.

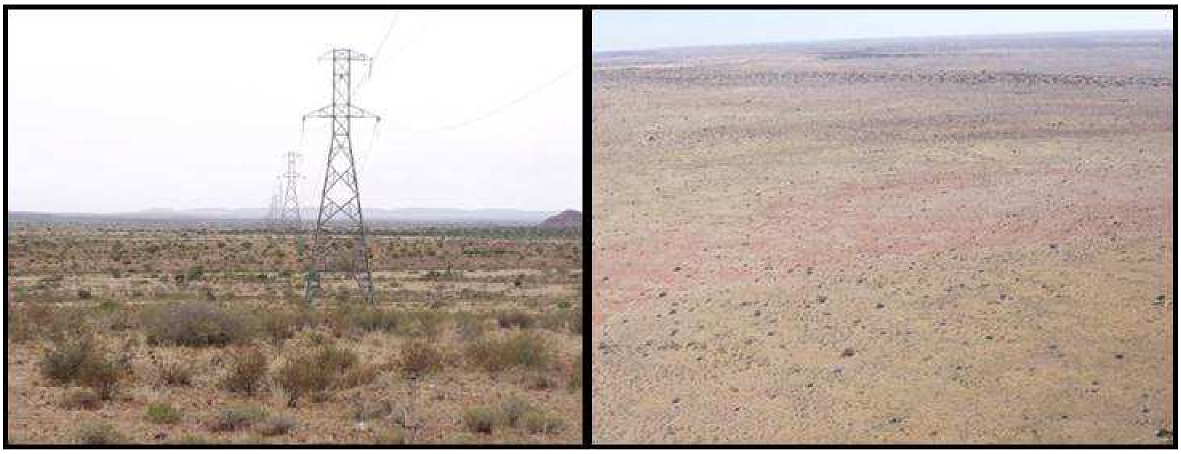

Figure 7-36: Kalahari Karroid Shrubland.

<u>Bushmanland Arid Grassland</u>

This large vegetation unit comprises the grasslands between the shrublands to the north and east, the desert landscapes to the northwest and Namaqualand hills in the west. These extensive plains are dominated by white grasses mostly of the *Stipagrostis* genus giving the vegetation a semi-desert steppe character. In some low lying places the *Sasola* shrubs change the vegetation structure and in years of high rainfall a rich display of annual herbs and their flowers can be expected. Dominant grasses include *Aristida adscensiones, A. Congesta, Enneapogon desvauxii, Eragrostis nindensis, Schmidtia kalahariensis, Stipagrostis ciliate, S. obtusa* and *Cenchrus ciliaris*. Shrubs include *Lycium cinereum, Rhigozum trichotomum, Aptosimum spinescens, Hermannia spinosa* and *Pentzia spinescens*. Very little of this vegetation unit has been disturbed and hence the unit is not threatened.

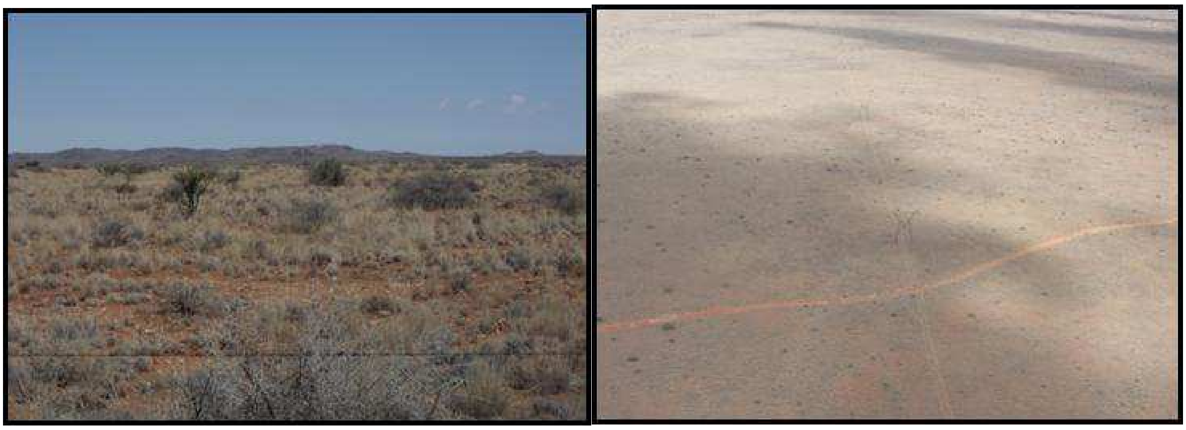

Figure 7-37: Bushmanland Arid Grassland.

Fauna

The habitats described above form the home for a variety of species and detailed lists of these are provided in Appendix H. In general the grasslands and shrub plains described above house species that can withstand the arid climate. Common species include the following:

- Mammals;
  - Bat-eared foxes;
  - Steenbok;
  - Scrub hare;
  - Springbok;
  - Aardvark;
  - Meerkat; and
  - Mongoose (variety).
- Reptiles
  - Puff adder; and
  - Leopard tortoise.

Avifauna has been specifically left out as that was a separate specialist study. In total an estimated 23 mammal, 17 reptile and 39 Arthropods are listed.

7.7.4 Sensitivities

Endangered Ecosystems

Using data from SANBI on the protected and threatened ecosystems found in the study area was generated. The provincial data highlights Critical Biodiversity Areas (CBA's) as shown in yellow on Figure 7-38. It also highlights biodiversity corridors as shown in green on the map. Lastly the remaining pockets of endangered vegetation inside the CBA are shown in red.

From the map it can be seen that the Lower Gariep Alluvial vegetation adjacent to the Orange River is classified as a threatened ecosystem. Impacting this area requires approval as per the NEMA Listing 3 Regulations and NEM:BA. However none of the proposed Ferrum alternatives enters into this area.

Endangered Species

Further to the endangered ecosystem there is the consideration of protected and endangered species. In terms of the National Environmental Management: Biodiversity Act (NEM: BA, Act 10 of 2004) and the IUCN website the study area could contain the following endangered species:

- ***Aloe pillansii*** (Bastard Quiver Tree)
  - Status: Critically Endangered
- ***Aloe ramosissima*** (Maiden's Quiver Tree)
  - Status: Vulnerable
- ***Mystromys albicaudatus*** (White-tailed Mouse)
  - Status: Endangered
- ***Pachypodium namaquanum*** (Elephant's Trunk)
  - Status: Lower Risk/near threatened
- ***Manis temminckii*** (Pangolin)
  - Status: Vulnerable
- ***Panthera pardus*** (Leopard)
  - Status: Vulnerable

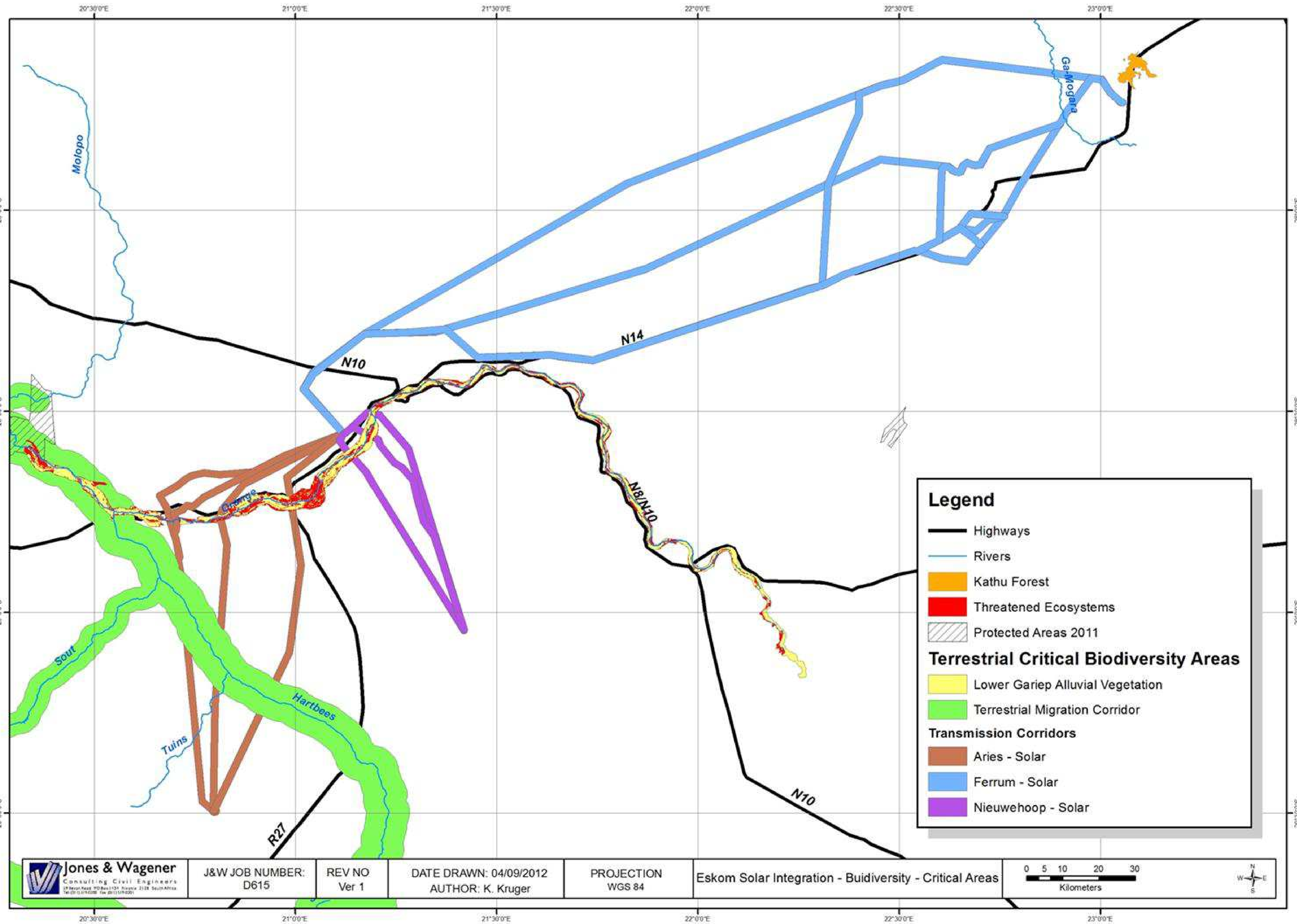

Figure 7-38: Endangered habitat as well as Critical Biodiversity Areas (CBA's).

Protected Species

In addition to the NEM: BA regulations, the Department of Agriculture, Forestry and Fisheries also have a list of protected trees that require a license to remove, crop or disturb prior to the activity. These trees are listed in terms of Section 15(1) of the National Forests Act, 1998, as amended. It should be noted that an EIA authorisation does not exempt the applicant from the NFA requirements.

The Environmental Management Plan (EMPr) has a section that details how these requirements should be met. The species that could occur in the study area include (descriptions adapted from the South African National Biodiversity Institute's plant information website www.plantzafrica.com):

***Acacia erioloba* aka Camel Thorn, Kameeldoring / Mogohlo (NS) / Mogôtlhô (T)**

This large Acacia is found throughout the drier parts of southern Africa. It frequently occurs in areas of deeper sandy soils and groundwater, often found along dry river beds. The area around Kathu is especially rich in these trees and they occur sporadically throughout the study area. These trees can become quite large and range from a 2 m spiny shrub to a 16 m robust tree as shown below. Due to the potential height of these trees it is anticipated that they might require removal or pruning prior to construction of the power lines – applicant to ensure that the license is obtained from DAFF prior to the start of construction.

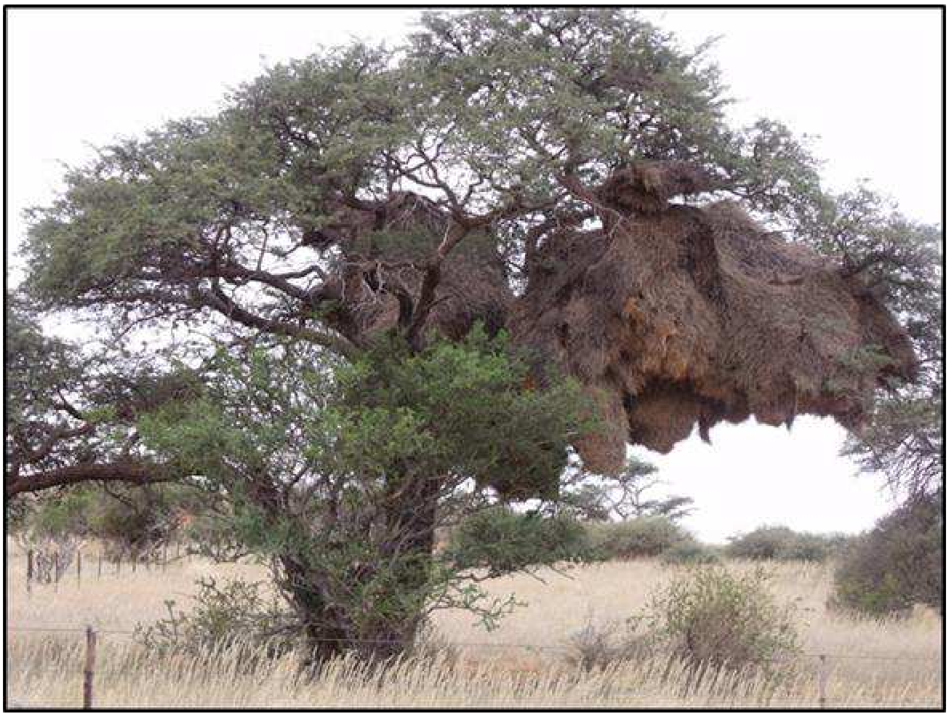

Figure 7-39: ***Acacia erioloba.***

***Acacia haematoxylon* aka Grey Camel Thorn, Vaalkameeldoring (A) / Mokholo (T)**

A shrub to medium-sized tree, 1.5 – 6 m tall with an irregular crown. These trees are characteristic of the semi-desert and desert areas in South Africa. They occur on deep sandy soils and dunes as a shrub and larger specimens are found along drainage lines. These trees although similar in name to the larger Camel Thorn, are significantly smaller, with finer leaves of grey colour. The photo below was taken on site and shown a Grey Camel Thorn in the foreground and a normal Camel Thorn in the back for comparison.

Figure 7-40: *Acacia haematoxylon* (foreground) and *A. erioloba* (background).

***Boscia albitrunca* aka Shepherd's tree, Witgat (A) / Mohlôpi (NS) / Motlhôpi (T) / Muvhombwe (V) / Umgqomogqomo (X) / Umvithi (Z)**

The Shepard's tree is the one tree in the Kalahari that does not shed its leaves, and hence provides a shady spot for animals and humans (hence the name). This small evergreen tree is characterised by an umbrella-shaped much branched crown and smooth white to grey bark. It is widespread throughout the study area covering almost all habitats. A photo of the tree is provided below.

Figure 7-41: Shepard's Tree

***Euclea pseudobenus* aka Ebony tree, Ebbeboom (A)**

The Ebony tree is a shrub to medium sized tree with slender drooping branches that is commonly found along watercourses and depressions in semi-desert and desert areas (Figure 7-42 below). The heartwood is pitch black (hence the common name) and used for construction and fuelwood. Twigs can be used for toothbrushes and the tree is browsed by livestock. This tree can be found along the watercourses within the study area, especially the Orange and Hartbees River floodplains.

Figure 7-42: Ebony Tree.

***Olea europaea subsp. africana* aka Wild Olive, Olienhout (A), Mohlware (NS, SS), umNquma (Z, X, S), Mutlhwari (V), Motlhware (T)**

The Wild olive is a small to medium-sized evergreen tree with a dense rounded crown and green foliage occurring in a wide variety of habitats as shown below. In the case of the study area a few individuals were identified in the floodplains of the Orange River.

Figure 7-43: Wild Olive.

7.8 AVIFAUNA

This section has been extracted from the specialist assessment undertaken by Chris van Rooyen for the proposed development. This report is attached in Appendix H.

7.8.1 Data Collection and Methodology

Sources of information

The study made use of the following data sources:

- Bird distribution data of the Southern African Bird Atlas Project1 (SABAP1) and 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the study area. A separate data set was obtained for each quarter degree grid cell (QDGC) which overlapped with the proposed corridors. QDGCs are grid cells that cover 15 minutes of latitude by 15 minutes of longitude (15. × 15.), which correspond to the area shown on a 1:50 000 map. SABAP1 covers the late 1980s to early 1990s.The SABAP2 data covers the period 2007 to present.
- The Important Bird Areas project data was consulted to get an overview of important bird areas and species diversity in the study area (Barnes 1998).
- The power line bird mortality incident database of the Endangered Wildlife Trust (1996 to 2007) was consulted to determine which of the species occurring in the study area are typically impacted upon by power lines (Jenkins *et al.* 2010).
- Land cover data for the study area was obtained from the National land Cover Project (NLCP) (updated version 2009), obtained from the South African National Biodiversity Institute.
- Data on biomes, bioregions, vegetation types and rivers in the study area was obtained from the Vegetation Map of South Africa (Mucina & Rutherford 2006).
- Data on the location of large raptor nests in the study area for the period 1994 – 2009 was obtained from the Kalahari Raptor Project (Maritz 2009).
- Data on the alignment of existing high voltage lines were obtained from Eskom.
- The conservation status of all species considered likely to occur in the area was determined as per the most recent iteration of the southern African Red Data list for birds (Barnes 2000), and the most recent and comprehensive summary of southern African bird biology (Hockey *et al*. 2005).
- The author has travelled and worked extensively in the Northern Cape Province since 1996. Personal observations have therefore also been used to supplement the data that is available from SABAP, and has been used extensively in forming a professional opinion of likely bird/habitat associations.
- The study area was inspected in a vehicle and on foot during a 5 day site visit in November 2012. Obviously it was not possible to travel along each alignment all the

way, therefore spot checks were made where access to the alignment was possible, and a general impression of habitat was formed.

Limitations & assumptions

This study made the assumption that the above sources of information are reliable. However, the following factors may potentially detract from the accuracy of the predicted results:

- Although the NLCP data was updated in 2009, the land cover situation on the ground may have changed in places since then.
- Different levels of survey effort for QDGCs in both the SABAP1 and SABAP2 coverage means that the reporting rates of species may not be an accurate reflection of relative densities in QDGCs that were sparsely covered to date. The reporting rates were therefore not treated as a realistic reflection of the actual densities, but merely as a guideline for the potential presence of a specific species. Strong reliance was placed on professional judgment (see 3.1 above).
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will hold true under all circumstances; therefore professional judgment played an important role in this assessment. It should also be noted that the impact of power lines on birds has been well researched with a robust body of published research stretching over thirty years.
- It is important to note that, although the predicted impacts are mostly concerned with Red Data species, the power line sensitive non-Red Data species will also benefit from the proposed mitigation measures as they share the same habitat and face the same potential impacts as the Red Data species.
- This is a desk top report. The findings of this report are preliminary and will be adapted where needed by incorporating additional data that will become available through field investigations on the ground.

7.8.2 Regional Description

The study area extends over two biomes, namely Savanna and Nama Karoo, with small sections falling within Azonal Vegetation (Mucina & Rutherford 2006), mostly along the Orange River and at salt pans. The study area further falls within three bioregions, namely Eastern Kalahari Bushveld, Kalahari Duneveld and Bushmanland.

Vegetation structure, rather than the actual plant species, is more significant for bird species distribution and abundance (in Harrison *et al.* 1997). Therefore, the vegetation description below does not focus on lists of plant species, but rather on factors which are relevant to bird distribution. The description of the vegetation types occurring in the study area largely follows the classification system presented in the Atlas of southern African birds (Harrison *et al* 1997). The criteria used to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data. The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present, and is not an exhaustive list of plant species present.

Savanna (or woodland) is defined as having a grassy under-storey and a distinct woody upper-storey of trees and tall shrubs. Soil types are varied but are generally nutrient poor. The savanna biome contains a large variety of bird species (it is the most species-rich community in southern Africa) but very few bird species are restricted to this biome. In the study area, the savanna biome contains two bioregions, namely Eastern Kalahari Bushveld and Kalahari Duneveld. **Eastern Kalahari Bushveld** (which forms part of the Central Kalahari vegetation type in Harrison et al 1997) is characterised by sparse to dense shrubland or parkland woodland dominated by semi-deciduous *Acacia, Boscia albitrunca, Terminalia sericea and Lonchocarpus nelsii* trees and *Acacia* and *Grewia* shrubs on deep Kalahari sands. Tall trees are fairly numerous, mostly *Acacia erioloba* (Camelthorn). Grass cover is variable dependent on rain, grazing and fires. There are no watercourses, but there are fossil river valleys and many pans on calcrete, which irregularly hold water. The climate is characterised by hot summer and cold winter seasons; rainfall takes place in summer (average 450 - 550 mm), but variable between years. **Kalahari Duneveld** (which forms part of the Southern Kalahari vegetation type in Harrison *et al.* 1997), is on deep Kalahari sands with rolling dunes, and consists of open shrubland with ridges of grassland and semi-deciduous *Acacia* and *Boscia albitrunca* trees along intermittent fossil watercourses and interdunal valleys. Tall trees are generally absent, except along some fossil rivers. Grass cover is very variable dependent on rain and grazing. Summers are hot, winters cold, rainfall very variable averaging <250 mm and mostly in summer.

The **Nama-Karoo** vegetation largely comprises low shrubs and grasses; peak rainfall occurs in summer – in the extremely arid region of the study area this is usually less than 130 mm per annum. Trees e.g. *Acacia karroo* and alien species such as Mesquite *Prosopis glandulosa* are mainly restricted to watercourses where fairly luxurious stands can develop, especially along the Orange River. In the study area, the Nama-Karoo contains one bioregion, namely **Bushmanland**. The vegetation structure consists mainly of extensive to irregular plains sparely vegetated by grassland dominated by white grasses (*Stipagrostis* species) giving the landscape the character of semi-desert “steppe”, with a few low shrubs in places. In some sections, mostly near the Orange River, koppies and low mountains are present with sparse vegetation dominated by shrubs and dwarf shrubs, with groups of widely scattered low trees e.g. *Aloe dichotoma* and *Acacia mellifera* (Mucina & Rutherford 2006).

7.8.3 Site Description

Whilst much of the distribution and abundance of the bird species in the study area can be explained by the description of the biomes, bioregions and vegetation types above, it is as important to examine the modifications which have changed the natural landscape, and which may have an effect on the distribution of power line sensitive species. These are sometimes evident at a much smaller spatial scale than the biome types, and are determined by a host of factors such as vegetation type, topography, land use and man-made infrastructure. For purposes of the analysis in this report, bird habitat classes were defined from an avifaunal Red Data power line sensitive perspective:

Eastern Kalahari Bushveld

This habitat class is of importance for a variety of Red Data power line sensitive species. The Eastern Kalahari Bushveld is particularly rich in large raptors, and in the study area it forms the stronghold of Red Data species such as White-backed Vulture *Gyps africanus*, Martial Eagle *Polemaetus bellicosus*, Tawny Eagle *Aquila rapax, Bateleur Terathopius ecaudatus* and Lappet-faced Vulture *Torgos tracheliotis*. All these species require large trees for breeding and roosting, and the multitude of large *Acacia erioloba* trees is ideal for that purpose. Cape Vulture *Gyps coprotheres* may also occur sparsely, although they do not breed in the area. Apart from Red Data species, it also supports several non-Red Data large raptor species, such as the Brown Snake Eagle *Circaetus cinereus*, Black-chested Snake Eagle *Circaetus pectoralis*, and in mountainous habitat (such as the Langberge near Olifantshoek), Verreaux's Eagle *Aquila verreauxii*. A multitude of smaller raptor species also occur in Eastern Kalahari Bushveld, as well as the large terrestrial Red Data Secretarybird *Sagittarius serpentarius* and Kori Bustard *Ardeotis kori*. Potential impacts that could result due to the power line in this habitat are collisions with the earthwire (Secretarybird and *Kori Bustard*) and displacement of breeding raptors and vultures due to habitat destruction.

Kalahari Duneveld

This habitat class is also of importance for the same suite of power line sensitive species described under above. However, the scarcity of large trees means that large breeding raptors and vultures are more sparsely distributed. The habitat is very suitable for Secretarybird, as the species generally breeds in small trees and forages in open duneveld. Kori Bustard is also common in this habitat, while Ludwig's Bustard *Neotis ludwigii* occurs sporadically. Black Harrier *Circus maurus* occurs sparsely as a non-breeding migrant. The major expected impact in this habitat is collisions with the earthwire (Secretarybird, Kori Bustard and Ludwig's Bustard), and to a lesser extent displacement due to disturbance and habitat destruction.

Bushmanland

The Karoo vegetation types support a particularly high diversity of bird species endemic to Southern Africa, particularly in the family *Alaudidae* (Larks) (Harrison et al 1997). Its avifauna typically comprises ground-dwelling species of open habitats. Many typical karroid species are nomads, able to use resources that are patchy in time and space, especially enhanced conditions associated with rainfall (Barnes 1998). Power line sensitive Red Data species associated with Bushmanland are mainly large terrestrial species, in particular the nomadic Ludwig's Bustard, which may occur in flocks following rainfall events, and to a lesser extent Kori Bustard. Martial Eagle and Black-chested Snake-Eagle occurs sparsely. Koppies and inselbergs provide breeding habitat for Lanner Falcon *Falco biarmicus, Peregrine Falcon Falco peregrinus, Verreauxs Eagle Aquila verrauxii* and Black Stork *Ciconia nigra*. Black Harrier Circus maurus occurs sparsely as a non-breeding migrant. The major envisaged impact is collisions with the earthwire (mainly large terrestrial species).

<u>Waterbodies and rivers</u>

Waterbodies and rivers are of specific importance to a variety of Red Data power line sensitive species in this arid study area. The perennial Orange River flows through the study area, and the river channel, pools of water and riverine islands with riparian thickets, reed beds, flooded grasslands and sandbanks provide habitat for a multitude of waterbirds, including the Red Data Black Stork *Ciconia nigra*. The non-Red Data African Fish-Eagle *Haliaeetus vocifer* occurs commonly along the river. An important feature of the arid landscape where the proposed power lines are located is the presence of pans. Pans are endorheic wetlands having closed drainage systems; water usually flows in from small catchments but with no outflow from the pan basins themselves. They are characteristic of poorly drained, relatively flat and dry regions. Water loss is mainly through evaporation, sometimes resulting in saline conditions, especially in the most arid regions. Water depth is shallow (<3 m), and flooding characteristically ephemeral (Harrison *et al.* 1997). Pans are important for a variety of non-Red Data waterbirds, and in the study area specifically for the Red Data Greater Flamingo *Phoenicopterus roseus* and Lesser Flamingo *Phoenicopterus minor*. Pans, dams and pools of water with exposed sandbanks are also used by large raptors for drinking and bathing. Ephemeral drainage lines are also corridors for woodland, which Kori Bustard often associate with, and occasionally, after good rains when pools form in the channels, it act as a draw card for waterbirds. During such times, small birds are attracted to the water, which in turn may attract Lanner Falcons and other raptors. The major envisaged impact is collisions with the earthwire (waterbirds and to a lesser extent raptors).

Boreholes are also important sources of surface water and water troughs are used extensively by various species, including large raptors and vultures, to drink and bath.

<u>Transmission lines</u>

Transmission lines are an important roosting and breeding substrate for large raptors in the study area. Existing transmission lines are used extensively by large raptors e.g. in 2005 the author did an aerial survey of the Ferrum – Garona 275 kV line together with Eskom, and found a total of 19 Martial Eagle and 7 Tawny Eagle nests on transmission line towers (Van Rooyen 2007). Transmission lines therefore hold a special importance for large raptors. Should any new lines be constructed next to existing lines, the construction activities could lead to temporary displacement of breeding eagles, resulting in breeding failure in a particular season, or even permanent abandonment of a breeding territory.

Low impact areas

The proposed corridors run through several types of habitat which would generally not attract power line sensitive Red Data species. For purposes of the analysis, these have all been grouped together under low impact areas. These are degraded areas, mines, urban/industrial areas, agricultural areas along the Orange River (mostly irrigated vineyards) and major roads. No significant impacts on power line sensitive Red Data species are expected in these areas.

7.8.4 Sensitive features

A total of 18 Red Data species have to date been recorded by SABAP1 and SABAP2 in the QDGCs that are bisected by the various alignments (see Table below). Vagrants are indicated with an asterisk. For each species, the potential for occurring in a specific habitat class was indicated, as well as the potential impact most likely associated with this specific species.

Table 7-3: Red Data species recorded by SABAP1 and SABAP2 in the study area

Name	Scientific name	Status	Eastern Kalahari Bushveld	Kalahari Duneveld	Bushman-land	Waterbodies and rivers	Transmission lines	Low impact areas	Collisions	Displacement through disturbance	Displacement through habitat destruction
Bateleur	*Terathopius ecaudatus*	V	x	x					x	x	x
Black Harrier	*Circus maurus*	V		x	x				x		
Black Stork	*Ciconia nigra*	NT				x			x		
Blue Crane*	*Anthropoides paradiseus*	V	x			x			x		
Cape Vulture	*Gyps coprotheres*	V	x				x		x	x	
Corn Crake*	*Crex crex*	V	x						x		
Greater Painted-snipe*	*Rostratula benghalensis*	NT				x			x	x	
Kori Bustard	*Ardeatis kori*	V	x	x	x				x		
Lanner Falcon	*Falco biarmicus*	NT	x	x	x		x		x	x	
Lappet-faced Vulture	*Torgos tracheliotis*	V	x	x			x		x	x	x
Lesser Kestrel	*Falco naumanni*	V	x	x	x						
Ludwig's Bustard	*Neotos ludwigii*	V		x	x				x		
Martial Eagle	*Polemaetus bellicosus*	V	x	x	x				x	x	x

Name	Scientific name	Status	Eastern Kalahari Bushveld	Kalahari Duneveld	Bushman-land	Waterbodies and rivers	Transmission lines	Low impact areas	Collisions	Displacement through disturbance	Displacement through habitat destruction
Peregrine Falcon	*Falco peregrinus*	NT			x				x	x	
Sclater's Lark	*Spizocorys sclateri*	NT			x						
Secretarybird	*Sagittarius serpentarius*	NT	x	x	x				x	x	x
Tawny Eagle	*Aquila rapax*	V	x	x					x	x	x
White-backed Vulture	*Gyps africanus*	V	x	x					x	x	x

*Vagrant

NT=Near threatened V=Vulnerable

7.9 SOCIO-ECONOMIC IMPACT ASSESSMENT

The purpose of this report is to provide baseline information regarding the social environment affected by the proposed development, to identify possible social risks/fatal flaws and social impacts that may come about as a result of the proposed development and to suggest ways in which these impacts can be mitigated. This will assist decision-makers on the project in making sound decisions by providing information on the potential or actual consequences of their actions.

7.9.1 Methodology and Data Collection

The information used in the study was based on a literature review, professional judgement based on experience gained with similar projects. Scientific social research methods were used for the assessment.

7.9.2 Regional Description

Farmers:

All the proposed routes cross farming areas. There are different commodities that are farmed. The impacts on the farming practices will depend on the commodity. A simplified distinction between different types of farmers has been made for the purpose of this report. Subsistence farmers will be discussed under the heading of vulnerable communities.

A significant part of the study area comprises livestock farmers. These farmers farm with cattle, goats or sheep that have adapted to the arid conditions. Some of the farmers breed with the stock, whilst others produce animals for the food market.

There are a few game farmers in the area. Game farms usually get their revenue from tourism, hunting or speculation with game. Game capture is often done by helicopter – the helicopters fly low and herd the game into capture areas. Sense of place, or a feeling of undisturbed nature is important for tourists visiting game farms to view game or to hunt.

There are also irrigation farmers in the area, especially around the Orange River. A number of the farmers farm with a combination of commodities. Crops include grapes (export, wine, raisins) and citrus. One of the biggest issues for this stakeholder group is access control and safety/security issues.

It must be acknowledged that some of the farmers on the route and especially near Kathu already have infrastucture such as power lines, water pipelines and railways traversing their properties. The impact on these properties will be of a cumulative nature.

Industry:

Economic activities in the study area are mainly concentrated in the mining and agricultural industry. The Sishen Mine falls in the study area for the Solar to Ferrum lines. It is one of the largest mines in South Africa, and part of the motivation for the project is that the mine want to increase its iron ore exports and therefore the existing railway line would need to be upgraded.

The core (the region with the highest concentration of receivers) of the Square Kilometre Array (SKA), the world's largest radio telescope will be constructed in the Northern Cape Province, about 80 km from the town of Carnarvon. The telescope will be very sensitive to interference, and therefore no power lines can be constructed in areas that may affect the functioning of the SKA, which is a project of international significance and as such very important to the South African scientific and economic community.

Vulnerable communities:

Although poor people are usually amongst the most vulnerable, not all vulnerable people are poor. Vulnerability means exposure and defenselessness. This concept has two sides: the external side of exposure to shocks, stress and risk; and the internal side of defenselessness, which implies a lack of means to cope without damaging loss. Moser (1998) phrase this differently and states that vulnerability has two dimensions, namely sensitivity and resilience. Sensitivity refers to the extent of a system's response to an external event, and resilience refers to the ease and speed of a system's recovery from stress. From these two definitions it can be seen that vulnerability deals with sensitive groups, which have low defenses, and are therefore susceptible to harm, and who are not able to recover from stresses easily or without external help. This definition for vulnerability was considered in the selection of vulnerable communities for the purpose of this report.

The first group of vulnerable people to consider is the **farm workers**. Due to the historical process that created the farm-worker class, farm workers have become one of the most subjugated and marginalised sectors of the South African society. In many cases, the problems have become ingrained, thereby creating a culture of poverty in farm worker households (Atkinson, 2007). Farm workers as a class are often invisible in society. They are a powerless group because the unskilled or semi-skilled nature of their jobs means that someone else can easily replace them.

Many of the proposed alternative routes also traverse **traditional areas** governed by traditional authorities. The Griqua and the San are two minority groups that reside in the area.

There are a number of **small settlements** in the study area. The people living in these settlements are poor and often "forgotten" by the government. There are no or limited activities in these settlements, and often existing social pathology like gender violence, alcoholism and drug abuse. These communities are very vulnerable to influences from outside the area and impacts traditionally associated with construction workers.

Surrounding towns:

The proposed power lines may affect a number of towns. The biggest impact on these towns will be during the construction phase and will be associated with pressure on infrastructure and deviant social behavior. There may also be positive social impacts associated with the construction phase.

Tourism:

The project area includes several scenic places that are well known for their attraction to tourists. The tourism industry in the area is developed around the sense of place, natural beauty and natural resources. One of the concerns is the visual impact of the proposed line on the livelihoods of owners of tourism establishments. There may also be a positive impact on the tourism industry in the construction phase when contractors look for temporary accommodation.

7.10 VISUAL IMPACT ASSESSMENT

7.10.1 Methodology and Data Sources

The study was undertaken visual assessment specialist using Geographic Information Systems (GIS) technology as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from 20 m interval contours supplied by the Chief Directorate National Geo-Spatial Information.

The approach utilised to identify potential issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model (DTM) of the potentially affected environment;
- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.;
- The identification of sensitive environments upon which the proposed facility could have a potential impact;
- The creation of viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures.

The specialist's visual impact assessment report sets out to identify and quantify the possible visual impacts related to the proposed facility, including related infrastructure, as well as offer potential mitigation measures, where required.

The following methodology has been followed for the assessment of visual impact:

Determine Potential visual exposure

The visibility or visual exposure of any structure or infrastructure is the point of departure for the visual impact assessment. It stands to reason that if the proposed infrastructure were not visible, no impact would occur.

Viewshed analyses of the proposed infrastructure indicate the potential visibility.

Determine Visual Distance/Observer Proximity to the facility

In order to refine the visual exposure of the infrastructure on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence.

Proximity radii for the proposed alignment corridors are created in order to indicate the scale and viewing distance of the infrastructure and to determine the prominence thereof in relation to their environment.

The visual distance theory and the observer's proximity to the infrastructure are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed infrastructure.

Determine Viewer Incidence/Viewer Perception

The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers, then there would be no visual impact. If the visual perception of a structure is favourable to all observers, then the visual impact would be positive.

It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed facility and its related infrastructure.

It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, and purpose of sighting which would create a myriad of options.

Determine the Visual Absorption Capacity of the natural vegetation

This is the capacity of the receiving environment to absorb the potential visual impact of the proposed infrastructure. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernible detail in visual characteristics of both environment and structure decreases.

The digital terrain model utilised in the calculation of the visual exposure of the facility does not incorporate the potential visual absorption capacity (VAC) of the natural vegetation of the region. It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover and other landscape characteristics.

Determine the Visual impact index

The results of the above analyses are merged in order to determine where the areas of likely visual impact would occur. These areas are further analysed in terms of the previously mentioned issues (related to the visual impact) and in order to judge the magnitude of each impact.

Determine Impact significance

The potential visual impacts identified and described are quantified in their respective geographical locations in order to determine the significance of the anticipated impact. Significance is determined as a function of extent, duration, magnitude and probability.

7.10.2 Site Description

Regionally, the study area is located in the centre of the Northern Cape Province. The elevation of the region ranges from about 65 m above sea level (a.s.l.) along the Orange River to 1200 m a.s.l. in the Koranaberg Mountains west of Kathu.

The terrain north of Upington is generally described as *Dune hills (parallel crests)* and *lowlands*. To the south are mostly *Lowlands with hills* with *Extremely irregular plans* and *Slightly irregular plains* to the south west and southeast respectively. *Hills* are to be found east of Upington and west of Kathu.

The Orange River is the most prominent hydrological feature in the area, meandering generally from the east of the study area to the west. A large number of non-perennial drainage lines are present within the study area, all of which drain towards he Orange River.

The river has, to a large degree, dictated the settlement pattern in this arid region by providing a source of perennial water for the cultivation of grapes. This and the associated production of wine is the primary agricultural activity of this district.

Cattle and game farming practises also occur, but are less intensive. Other prominent land-use activities include mining, especially in the east, beyond the Koranaberg. Conservation and nature oriented tourism is also known to occur along the Orange River and within the region.

Upington is the largest urban centre in the study area. Smaller towns include Augrabies, Marchland, Kakamas, Keimoes, Groblershoop, Hotazel, Dibeng, Kathu, Sishen, Olifantshoek, Lohatlha, Beeshoek and Posmasburg. In addition, a large number of farms and homesteads also occur within the study area, especially along the Orange River, and east of the Koranaberg.

The above-mentioned towns account for the highest population concentration within the region, which is sparsely populated (less than 10 people per km^2).

Industrial infrastructure includes existing power lines, which follow the river and main roads to some extent, as well as a number of substations. The N10, N14 and a number of regional arterial roads traverse the area, as does a railway line (mostly freight). In addition, a number of secondary roads interconnect within the region.

Land cover is mostly *Shrubland* and *Thicket* to the south of the Orange River, and *Thicket*, interspersed with *Shrubland* and *Woodland* characterises the region to the north. *Cultivated land* (irrigated agriculture) is common along the Orange River, and *Mining* and *quarries* occurs in the east, beyond the Koranaberg.

The natural vegetation of the study area is primarily *Orange river broken veld* with some *Namaqualand* broken veld occurring west of Augrabies, and Kalahari thornveld and *shrub bushveld* occurring north of Upington.

The study area includes two large formally protected conservation areas, namely Augrabies National Park which lies on the Orange River just north west of Augrabies, and the Spitskop Provincial Nature Reserve just north east of Upington. Although the Augrabies NP is a well-known and well-frequented tourist destination, the Spitskop Nature Reserve is not, and has little infrastructure at present.

The greater region is generally seen as having a high scenic value and tourism value potential. Outside of towns, and beyond the river, the landscape is characterised by wide-open spaces. Development, where this occurs at all, is domestic in scale, and sparsely spread.

The N14, N10, R27, R360 and R325 are the primary roads in the region and are the main link between Gauteng, the West Coast and Namibia. These in addition to the R359 are considered to be routes most likely to carry tourists.

In terms of tourist destinations and accommodation, the area along the Orange River is expected to host a relatively high concentration of overnight facilities. In addition, it may be expected that private nature reserves and game farms within the greater region will also cater for tourists to some extent. At this stage, however, as the locations of such tourist destinations are not known.

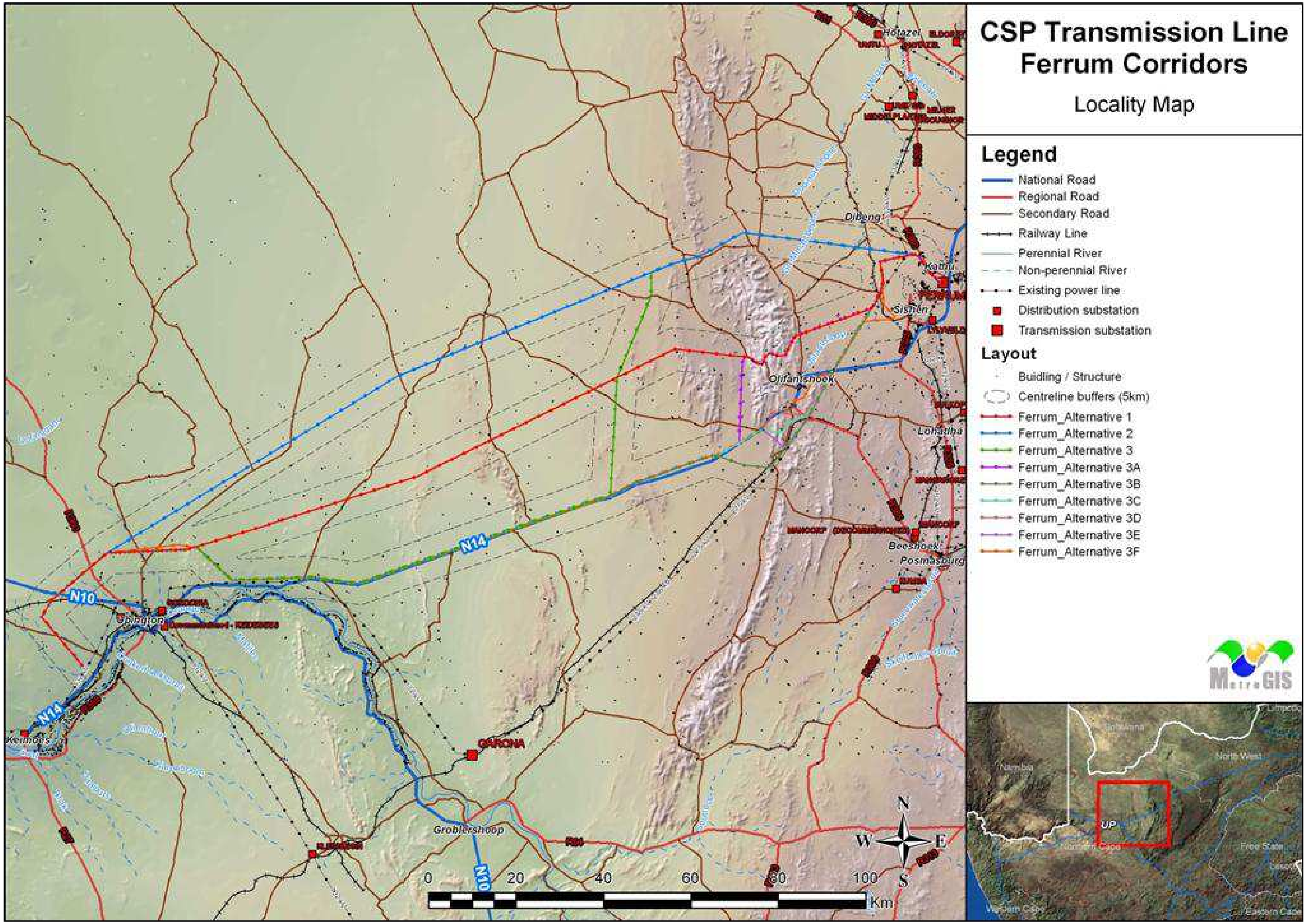

Figure 7-44: Locality and proposed alignment of the Ferrum Corridor and alternatives.

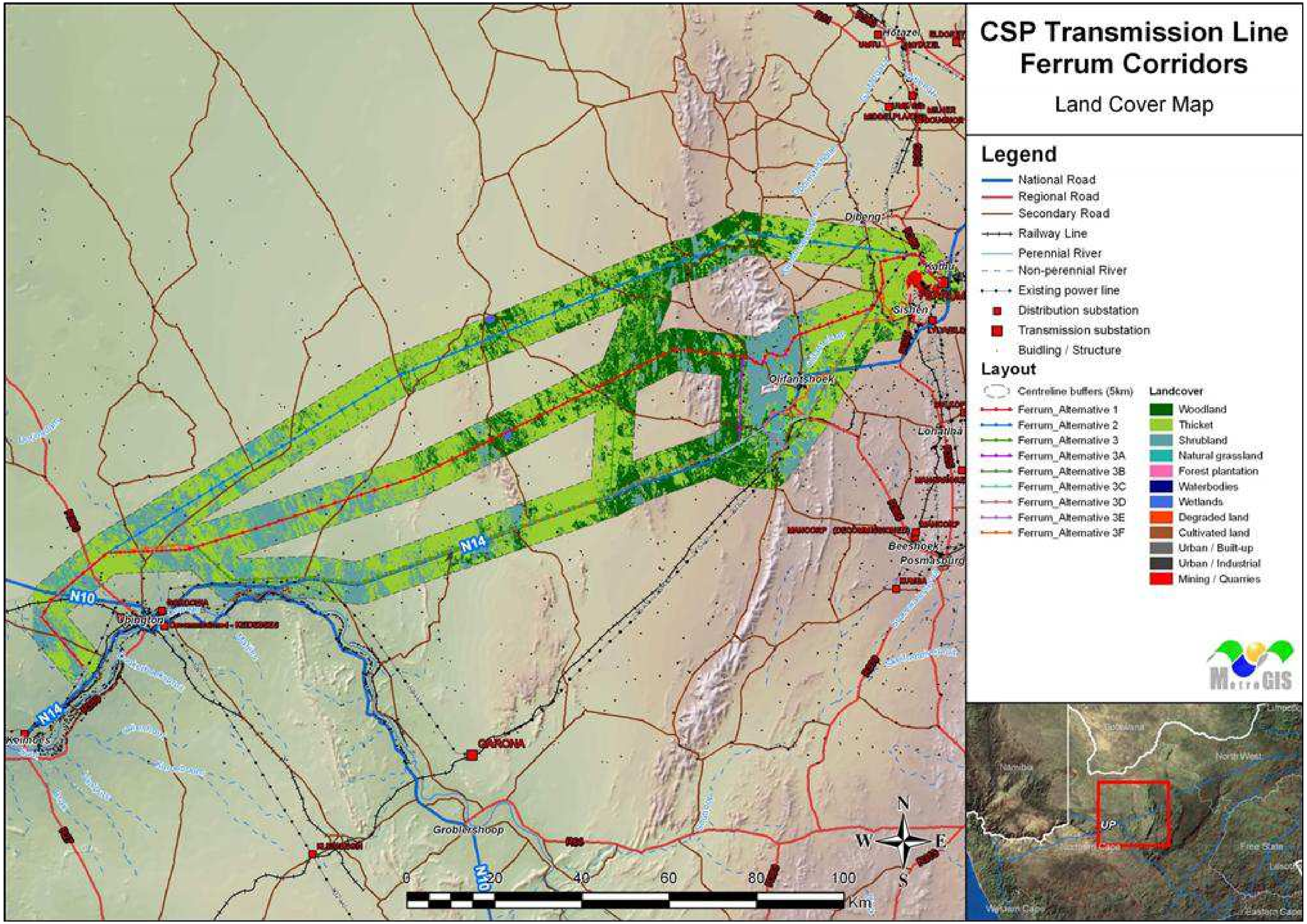

Figure 7-45: Land cover and land use along the Ferrum Corridor and alternatives.

7.11 ARCHAEOLOGICAL, CULTURAL AND HISTORICAL

7.11.1 Methodology and Data Sources

A Heritage Impact Assessment (HIA) was undertaken by a Heritage specialist for the proposed project. The Heritage Impact Assessment study defined the heritage component of the EIA process. It is described as a first phase Heritage Impact Assessment (HIA). The Heritage Report attempts to evaluate both the accumulated heritage knowledge of the area as well as information derived from direct physical observations. The alternative corridors have been evaluated to determine their cultural heritage significance.

The Heritage Impact Assessment (HIA) relies on the analysis of written documents, maps, aerial photographs and other archival sources combined with the results of site investigations and interviews with effected people. Site investigations are not exhaustive and often focus on areas such as river confluence areas, elevated sites or occupational ruins.

The following documents were consulted in this study;

- South African National Archive Documents
- SAHRA Database of Heritage Studies
- Upington Museum Information
- Internet Search
- Historic Maps
- 1936 and 1952 Surveyor General Topographic Map series
- 1952 1:10 000 aerial photo survey
- Google Earth 2011 & 2003 imagery
- Published articles and books
- JSTOR Article Archive

7.11.2 Regional Description

The Northern Cape was one of three provinces carved out of the Cape Province in 1994, the others being Western Cape to the south and Eastern Cape to the southeast. Politically, it had been dominated since 1994 by the African National Congress (ANC). Ethnic issues are important in the politics of the Northern Cape. For example, it is the site of the controversial Orania settlement, whose leaders have called for a Volkstaat for the Afrikaner people in the province.

The Northern Cape is also the home of over 1,000 San who immigrated from Namibia following the independence of the country; they had served as trackers and scouts for the South African government during the war.

The precolonial history of the Northern Cape is reflected in a rich, mainly Stone Age, archaeological heritage. Cave sites include Wonderwerk Cave near Kuruman, which has a uniquely long sequence stretching from the turn of the twentieth century at the surface to more than 1 million (and possibly nearly 2 million) years in its basal layer (where stone tools, occurring in very low density, may be Oldowan).

Many sites across the province, mostly in open air locales or in sediments alongside rivers or pans, document Earlier, Middle and Later Stone Age habitation. From Later Stone Age times, mainly, there is a wealth of rock art sites – most of which are in the form of rock engravings such as at Wildebeest Kuil and many sites in the area known as lXam -ka kau, in the Karoo. They occur on hilltops, slopes, rock outcrops and occasionally (as in the case of Driekops Eiland near Kimberley), in a river bed.

In the north eastern part of the province there are sites attributable to the Iron Age such as Dithakong. Environmental factors have meant that the spread of Iron Age farming westwards (from the 17th century – but dating from the early first millennium AD in the eastern part of South Africa) was constrained mainly to the area east of the Langberge Mountains, but with evidence of influence as far as the Upington area in the eighteenth century.

From that period the archaeological record also reflects the development of a complex colonial frontier when precolonial social formations were considerably disrupted and there is an increasing 'fabric heavy' imprint of built structures, ash-heaps, and so on. The copper mines of Namaqualand and the diamond rush to the Kimberley area resulted in industrial archaeological landscapes in those areas which herald the modern era in South African history.

All archaeological traces in the Northern Cape that are greater than 100 years old are automatically protected by the South African Heritage Resources Act, while some are formally protected by declaration as either Provincial Heritage Sites (e.g. Wildebeest Kuil and Nooitgedacht) or National Heritage Sites (e.g. Wonderwerk Cave). The archaeology of the Richtersveld is part of the universal cultural value recognised in the area’s listing as a World Heritage Site, while sites included on South Africa's Tentative List for World Heritage inscription include Wonderwerk Cave and the lXam and ǂKhomani heartland.

Due to the heritage in the area an archaeological and cultural specialist was appointed to undertake a Phase 1 Heritage Impact Assessment in the Impact Assessment Phase of this EIA.

7.11.3 Study Area

Stone Age

This area is home to all three of the known phases of the Stone Age, namely: the Early- (2.5 million – 250 000 years ago), Middle- (250 000 – 22 000 years ago) and Late Stone Age (22 000 – 200 years ago). The Late Stone Age in this area also contains sites with rock art from the San and Khoi San cultural groups. Early to Middle Stone Age sites are less common in this area, however rock-art sites and Late Stone Age sites are much better known.

During the Middle Stone Age, 200 000 years ago, modern man or *Homo sapiens* emerged, manufacturing a wider range of tools, with technologies more advanced than those from earlier periods. This enabled skilled hunter-gatherer bands to adapt to different environments. From this time onwards, rock shelters and caves were used for occupation and reoccupation over very long periods of time.

Widespread low-density stone artefacts scatter of Pleistocene age occur across areas of Bushmanland to the south where raw materials, mainly quartzite cobbles, were derived from the Dwyka till. Systematic collections of this material made at Olyvenkolk, south west of Kenhardt and MaansPannen, and east of Gamoep, could be separated out by abrasion state into a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately to heavily weathered Earlier Stone Age (ESA).

Beaumont et al. have shown that “substantial MSA sites are uncommon in “Bushmanland” (1995:241): and those that have been documented thus far have generally yielded only small samples (Morris & Beaumont 1991; Smith 1995). The ESA included Victoria West cores on dolerite, long blades, and a very low incidence of handaxes and cleavers. The Middle (and perhaps in some instances Lower) Pleistocene occupation of the region that these artefacts reflect must have occurred at times when the environment was more hospitable than today.

Any linear, primary and secondary, disturbance of surfaces in the development area could have a destructive impact on heritage resources, where present. In the event that such resources are found, they are likely to be such that potential impacts could be mitigated by documentation following approval and permitting by the South African Heritage Resources Agency and, in the case of any built environment features, by NgwaoBošwayaKapaBokone (the Northern Cape Heritage Authority).

The Late Stone Age, considered to have started some 20 000 years ago, is associated with the predecessors of the San and KhoiKhoi. Stone Age hunter-gatherers lived well into the 19th century in some places in SA. Stone Age sites may occur all over the area where an unknown number may have been obliterated by mining activities, urbanisation, industrialisation, agriculture and other development activities during the past decades especially associated with the town of Upington.

A limited number of Rock-Art sites are located in this area, mostly due to the lack of suitable shelter sites. Some of the power line alignments do however pass over undulating geographic features that could be conducive to sheltering Stone Age peoples.

The Historic Era

Although the town which today is Upington only officially came to be named in 1884, its tempestuous prior history cannot be ignored. Long before white settlers reached the area, Korana Hottentots had settled at the ford in the Great River they called Gariep, the northern border of the Cape Colony. They had been ousted from their ancestral lands in the south and found a last refuge here, on the lush banks of the river. When, inevitably, eventually the white man followed, war broke out between them and the Korana, who had nowhere else to go. They were defeated and the few remaining tribespeople dispersed.

Earlier, a Dutch Reformed Mission had been established under the guidance of the Reverend C. Schreuder at Olijvenhouts Drift, as the ford was called by hunters and traders because of the many wild olivewood trees growing there.

In 1879, after the second and last Korana War, Sir Thomas Upington, Attorney-General of the Cape Colony, sent 80 policemen to the Drift to maintain law and order along the river. Commanded by Captain Dyason they set up camp under the trees, but by 1885 already barracks had been built where later the police station was erected. Dyason’s police was very unpopular as they impounded loose animals and generally tried to keep order, while Schreuder only wanted to run a Mission. He venomously referred to the police as “"idle ne’erdowells"” and said of Dyason, “"we beseech to be delivered from such tyranny".”

Schreuder wanted the Mission to be moved elsewhere and in a letter dated the 11th of February 1884 writes, “"It is my wish that Olyvendrift or Upington not become a town but remain a Mission Station."”

This was the first time the name Upington was officially written to denote the place known as Olijvenhouts Drift and then only out of resentment against the police sent by Thomas Upington (taken from the Upington Tourism Board website).

Much of the areas between Kathu and Upington and further south have seen little development during the historic and modern era. These areas have mostly small villages or are entirely devoted to agriculture or game farming activities. The areas around the Orange River are more prominently developed and some areas are also protected, such as Kanon Eiland.

Cultural Landscape

The following landscape types could possibly be present in the study areas.

Table 7-4: Possible landscape types in the study area.

Landscape Type	Description	Occurrence still possible?	Likely occurrence?
1 Paleontological	Mostly fossil remains. Remains include microbial fossils such as found in Baberton Greenstones	Yes, sub-surface	Unlikely
2 Archaeological	Evidence of human occupation associated with the following phases – Early-, Middle-, Late Stone Age, Early-, Late Iron Age, Pre-Contact Sites, Post-Contact Sites	Yes	Unlikely

Landscape Type	Description	Occurrence still possible?	Likely occurrence?
3 Historic Built Environment	- Historical townscapes/streetscapes - Historical structures; i.e. older than 60 years - Formal public spaces - Formally declared urban conservation areas - Places associated with social identity/displacement	No	No
4 Historic Farmland	These possess distinctive patterns of settlement and historical features such as: - Historical farm yards - Historical farm workers villages/settlements - Irrigation furrows - Tree alignments and groupings - Historical routes and pathways - Distinctive types of planting - Distinctive architecture of cultivation e.g. planting blocks, trellising, terracing, ornamental planting.	Yes	Likely
5 Historic rural town	- Historic mission settlements - Historic townscapes	No	No
6 Pristine natural landscape	- Historical patterns of access to a natural amenity - Formally proclaimed nature reserves - Evidence of pre-colonial occupation - Scenic resources, e.g. view corridors, viewing sites, visual edges, visual linkages - Historical structures/settlements older than 60 years - Pre-colonial or historical burial sites - Geological sites of cultural significance.	Yes	Likely
7 Relic Landscape	- Past farming settlements - Past industrial sites - Places of isolation related to attitudes to medical treatment - Battle sites - Sites of displacement,	No	Unlikely
8 Burial grounds and grave sites	- Pre-colonial burials (marked or unmarked, known or unknown) - Historical graves (marked or unmarked, known or unknown) - Graves of victims of conflict - Human remains (older than 100 years) - Associated burial goods (older than 100 years) - Burial architecture (older than 60 years)	Yes,	Unlikely
9 Associated	- Sites associated with living heritage	No	No

Landscape Type	Description	Occurrence still possible?	Likely occurrence?
Landscapes	e.g. initiation sites, harvesting of natural resources for traditional medicinal purposes - Sites associated with displacement & contestation - Sites of political conflict/struggle - Sites associated with an historic event/person - Sites associated with public memory		
10 Historical Farmyard	- Setting of the yard and its context - Composition of structures - Historical/architectural value of individual structures - Tree alignments - Views to and from - Axial relationships - System of enclosure, e.g. defining walls - Systems of water reticulation and irrigation, e.g. furrows - Sites associated with slavery and farm labour - Colonial period archaeology	Yes	Irrigation farming within the Orange River Valley.
11 Historic institutions	- Historical prisons - Hospital sites - Historical school/reformatory sites - Military bases	No	Unlikely
12 Scenic visual	- Scenic routes	No	No
13 Amenity landscape	- View sheds - View points - Views to and from - Gateway conditions - Distinctive representative landscape conditions - Scenic corridors	No	No

7.11.4 Sensitivities

The only sign of sites of heritage potential were single Middle to Late Stone Age tools found in various areas. These finds in themselves do not constitute sites but do indicate the possible occurrence of such sites.

7.12 REGIONAL CONTEXT

The study area is located within the Northern Cape Province. A number of District Municipalities (DMs) and Local Municipalities (LMs) form part of the study area. These municipalities are as follows:

Table 7-5: Affected Municipalities

District Municipality	Local Municipality
• Siyanda District Municipality:	• // Khara Hais Local Municipality
• Kgalagadi District Municipality	• Gamagara Local Municipality

It should be noted that several areas around the study area do not fall within a local municipality and therefore are managed by the relevant District Municipality.

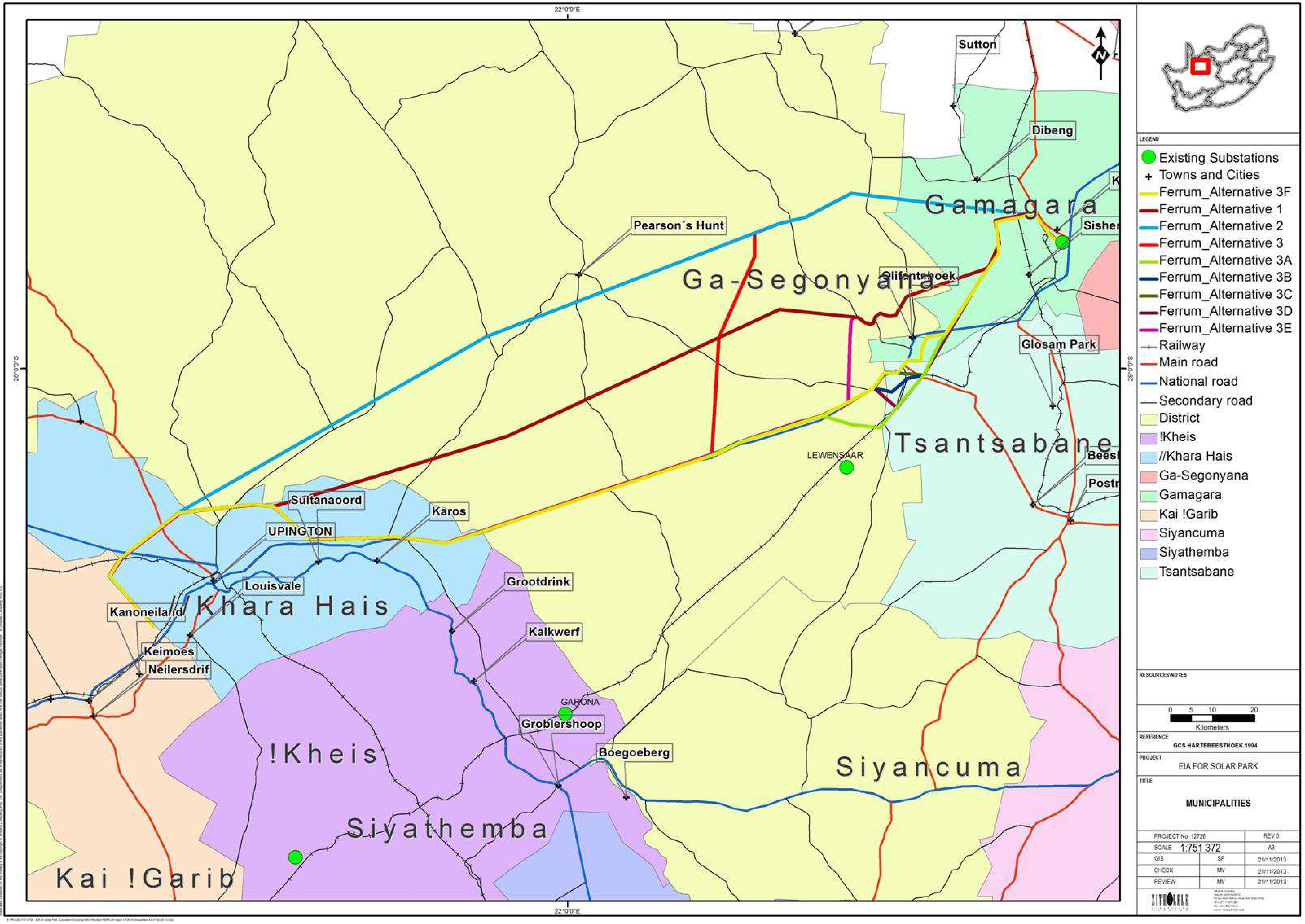

Figure 7-46: District and local municipalities in the study area.

7.13 INFRASTRUCTURE

7.13.1 Methodology and Data Sources

Infrastructure was identified using the 1:50 000 topocadastral maps of the area, and information provided by Eskom regarding existing power line services. A site fly over was undertaken to verify this information.

7.13.2 Regional Description

Roads

There is a sparse network of provincial tar roads that form the access backbone to the study area. Secondary district dirt roads provide access to all the more rural areas and farms through which the proposed lines will pass. Farms are big but access should not be a problem as there are numerous farms roads in the area.

Only two national roads are present in the direct study area, namely the N14 and N10, of which only the N10 is intersected by all the routes.

Railways

The proposed alternative routes cross over two railway lines, the first being the line from Upington to the coast and the second the freight line from Kathu northwards to Hotazel.

Power Lines

There are a few existing power lines in the study area, the majority of which are high voltage lines of between 132 kV and 400 kV. These lines are located further to the south than the proposed routes.

Airport

The only major airport that could be identified during the desktop assessment was the Upington Airport, which is within 30 km of the proposed CSP site, with both alternatives traversing close to the airport (<20 km). Furthermore there are 2 airstrips in the study area, one being *Vastrap*, a military facility and the second Kathu airstrip, managed by the Sishen Mine. The lines traverse close to the Kathu airstrip, and there are several existing powerlines in this area.

Infrastructure related for farming practices, including residences

The proposed power line corridors do in some cases cross close to existing farm infrastructure such as farm dams, windmills, fencing and structures. This infrastructure is generally avoided where possible within the approved corridor. However, in instances where no alternative exit, the infrastructure will be relocated by the proponent.

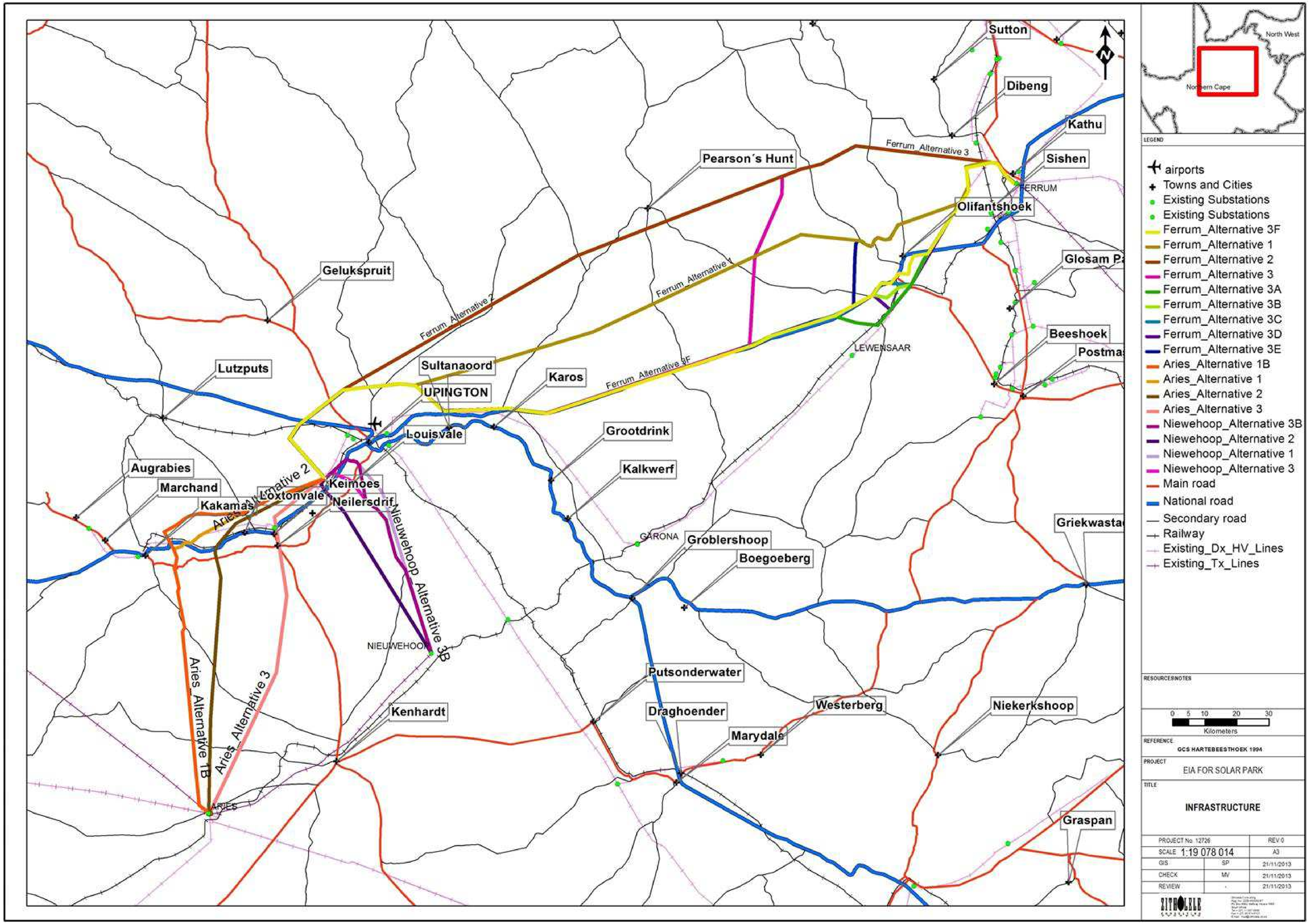

Figure 7-47: Infrastructure in the study area.

8 ENVIRONMENTAL IMPACT ASSESSMENT

The impact assessment was undertaken for the construction, operational and decommissioning phases. Impacts to each environmental element documented in the baseline are described under initial assessment, additional impact, cumulative impact, mitigation measures and residual impact. The initial assessment outlines the existing level of impact by current activities. The additional impact assesses the potential impact of the development on a criterion. Mitigation measures for the additional impact are then prescribed and a residual impact is calculated. The residual impact and initial impacts are then combined to describe the cumulative impact to the environment.

The Impact Assessment will highlight and describe the impacts to the environment following the above mentioned methodology and will assess the following components:

- Climate;
- Geology;
- Topography;
- Soils and Land Capability;
- Terrestrial Ecology;
- Avifauna;
- Surface Water and Aquatic Ecology;
- Visual;
- Archaeological, Cultural and Historical; and
- Socio-Economic.

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.

8.1 CONSTRUCTION PHASE

During construction the route will be surveyed, pegged and the soil nominations undertaken for each of the potential pylon foundations. The construction team will set up a construction camp in the study area and travel to site each day, transporting steel, workers and equipment to each of the tower sites. In some cases the power line servitude is cleared of vegetation to ease construction activities and to prevent possible electrical faults with nearby trees. The first step is the excavation of the pylon foundations, the reinforcing thereof and finally the concreting of the foundations. The equipment required to excavate the foundations can be manual labour, a TLB or in the case of hard rock – a drill rig will be required. The concrete will have to be transported via concrete trucks to the required locations.

After the foundations and footings have been installed the construction team will transport the various steel parts of the towers to the site and start erection of the pylons. This process again requires a lot of manual labour and often mobile cranes are used to assist with the erection of the towers. Once the tower are erected the stringing of the conductor cable commences, from tower to tower and the line is tensioned as per the requirements.

8.1.1 Geology

Due to the nature of the geology and soils in the study area there is no potential seismic sensitivities. Additionally the proposed footings for the power line towers do not require deep excavations and consequently there are no potential impacts or sensitivities in terms of geology.

8.1.2 Climate

Local climate conditions do not appear to be of a significant concern to the project. In addition the construction of the power lines and the substation should not have any impact on the climate of the study area.

8.1.3 Soil and Land Capability

Initial Impact

It is clear from the soils and land capability assessment as described in the baseline receiving environment that the study area consist of sandy/calcrete soil features with very little cultivation. The area is arid and all the soils have a high base status as a result. The areas affected by the Ferrum line alternatives are mainly utilised for grazing of cattle, sheep and goats with a number of game farms operating in the area as well.

Along the Ferrum routes the existing impacts are found in the form of opencast iron ore mining at the mines around Kathu, linear structures such as the N14 highway to Upington and the compulsory farm roads. With the exception of the Kathu area, the soils along this route are relatively undisturbed. There are isolated cases were farm roads cross over dunes, removing vegetation and resulting in some minor erosion on the dune crests.

Around the proposed Eskom CSP site the bulk of the area is used for grazing land. There are a few activities along the route, such as the Duineveld landfill site, the Upington Airport as well as the town itself that have impacted upon the soils in this area.

The existing impact to soils the study area are rated as a Low Impact as shown in the table below.

Table 8-1: Soil and Land Capability Initial Impact Assessment

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soils	Minor	*Site only*	Medium Term	*Definite*	Low
	2	**1**	**3**	**5**	**2**

Additional impact

The additional impact of the proposed power lines will mainly be in the form of the clearing of the vegetation for the pylon sites, excavation of the foundations for the pylons, and the construction of access roads to the pylons (if required). In terms of impact to agriculture, grazing can continue under the power lines and in the servitudes as well as the planting of low growing crops. The activities that are limited are the use of large irrigation systems such as pivots, spraying of crops by planes and the planting of high growing crops such as fruit trees, windbreaks and palms.

The average area of a typical self-supporting pylon footing is estimated at 14 m^2. There are various pylon design alternatives, but for this assessment worst case scenario is assumed which is the self-supporting pylons along the entire corridor. The potential impact to soils was estimated based on pylons being placed every 350 m. The potential impact for each corridor alternative is given below.

Table 8-2: Impacts to soils for each route alternative

Corridor Alternative	Length (km)	Foundation Impact to Soils (ha)	Agric Soils in corridor	Shifting Soils in corridor
Ferrum_Alternative 1	212 km	0.85 ha	0 ha	17 683 ha
Ferrum_Alternative 2	245 km	0.98 ha	0 ha	24 146 ha
Ferrum_Alternative 3	279 km	1.12 ha	0 ha	18 032 ha
Ferrum_Alternative 3A	261 km	1.04 ha	0 ha	15 051 ha
Ferrum_Alternative 3B	257 km	1.03 ha	0 ha	15 051 ha
Ferrum_Alternative 3C	258 km	1.03 ha	0 ha	15 051 ha
Ferrum_Alternative 3D	261 km	1.04 ha	0 ha	15 051 ha
Ferrum_Alternative 3E	271 km	1.07 ha	0 ha	15 051 ha
Ferrum_Alternative 3F	279 km	1.07 ha	0 ha	15 051 ha

As shown in the table above when considering the potential impacts to soil and agriculture, the consideration is made for the impact to agricultural soils. But in this study area the soils also pose a risk to the potential development. The prevalence of shifting sands provide a potential risk to the stability of the pylons and the power line overall.

In addition to the impact of the pylon foundations the potential impact of an access road must also be considered. It is assumed that the power lines will require an access road for the length of the corridor, hence the longer the corridor the larger the impact. However the Ferrum_Alternative 3 and Ferrum_Alternative 3 A-F corridors are aligned with a major road, the N14 and the Ferrum-Gorona power line and in this case the existing access can be used for the transport of the bulk of the materials. Access roads will still be required from the highway to the specific pylons but this is a major advantage for these corridors.

Once operational the impacts to the soil will remain, and if the construction activities have not been properly managed, wind erosion will start to occur in this phase. The utilisation and maintenance of roads will become important to limit the impacts.

Considering all the factors mentioned above, the potential impact to soils and agriculture and the potential risks for each of the alternatives are given in the table below. This table from the biophysical specialist report was adapted to reflect the impact rating methodology described above, and to make the consideration of these impacts comparable with impacts identified by other specialists.

Table 8-3: Additional impact by the proposed development to the soils and agriculture

Alternative	Significance	Spatial	Temporal	Probability	Rating
Ferrum_Alternative 1	Low	Site	Long Term	Definite	3- Moderate
Risk	Very High	Local	Long Term	High	4 - High
Ferrum_Alternative 2	Low	Site	Long Term	Definite	3 - Moderate
Risk	Very High	Local	Long Term	High	4 - High
Ferrum_Alternative 3	Minor	Site	Long Term	Definite	3 - Moderate
Risk	High	Local	Long Term	High	3 - Moderate
Ferrum_Alternative 3 A-F	Minor	Site	Long Term	Definite	3 - Moderate
Risk	High	Local	Long Term	High	3 - Moderate

From the table above it can be seen that the impacts to soils and agriculture over the length of each of the alternative routes is regarded as a Moderate impact The risk when considering the shifting sands and erosion is rated as a Moderate to High impact for the alternatives.

Mitigation/management measures

The following measures are proposed to manage and mitigate the potential impacts to soils and agricultural activities along the various routes.

- Utilise the preferred alternative suggested by the specialist;
- Avoid unnecessary removal of vegetation cover;
- Use existing access roads as far as possible;

- If a new road is constructed, ensure that the Eskom erosion prevention guideline is followed and adhere to the Eskom tower construction specification;
- Take land use into consideration when choosing pylon types, it is recommended that smaller footprint pylons be used in cultivated areas;
- Avoid placement of pylon footings in clay soils as well as on dunes, towers to be sited in between dunes in the so-called dune-streets;
- Avoid the construction of access roads through dunes;
- Spread absorbent sand on areas where oil spills are likely to occur, such as the refuelling area in the hard park;
- It is recommended that any potential hard park areas be located within areas of existing disturbance, preferably within one of the towns of the study area, and also no hard parks allowed in the dune/riparian areas;
- Oil-contaminated soils are to be removed to a contained storage area and bio-remediated or disposed of at a licensed facility;
- Use berms to minimise erosion where vegetation is disturbed, including hard parks, plant sites, borrow pit and office areas;
- If soils are excavated for the footing placement, ensure that the soil is utilised elsewhere for rehabilitation/road building purposes; and
- Ensure that soil is stockpiled in such a way as to prevent erosion from wind/storm water.

Cumulative impact

The cumulative impact of the power line construction and operations along with the impacts discussed above remains a Moderate impact as shown below.

Table 8-4: Soil and Land Capability Cumulative Impact Assessment

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soils	Minor	*Site only*	Long Term	*Definite*	Moderate
	2	**1**	**4**	**5**	**3**

Residual impact

The residual impact of the power line construction and operations along with the impacts discussed above remains a Moderate impact as shown below.

Table 8-5: Soil and Land Capability Cumulative Impact Assessment

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soils	Minor	*Site only*	Long Term	*Definite*	Moderate
	2	**1**	**4**	**5**	**3**

Preferred alternatives

It should be noted that the overall scale of the assessment makes it difficult to discern which of the routes are preferred, as the site conditions over the vast distances covered by these lines are very similar. Here we attempt to discuss the minor differences between the routes that the impact assessment table did not show.

The routes to the Ferrum Substation in the east of the study area have all been rated as Moderate Impacts to soils, however upon closer inspection it can be seen that Ferrum_Alternative 1 and Ferrum_Alternative 2 rated as 4, while the remaining alternative corridors to the route rated as a 3. This is due to the fact that the latter routes have main access roads in place that can be utilised without the need for major access road construction. In addition these two routes are also in an area with a slightly lower risk of shifting sands. Based on these criteria it is recommended that either Ferrum_Alternative 3, 3A or E/F be utilised.

8.1.4 Surface water and wetlands

Initial Impact

The surface water features in the study area is dominated by the Orange River, which is the largest river in South Africa and also the only perennial river in the study area. However none of the Ferrum alternatives have to cross the Orange River.

Smaller rivers that also have to be crossed include the Ga-Mogara, Hartbees and Kareeboom rivers and some of their associated tributaries depending on the alternative route selected. The initial impact for surface water will be the same for all the alternatives considering that the crossing of a major river as well as some smaller rivers will occur during the implementation of any one of these alternatives.

The presence of agriculture and urban areas will have had an effect on surface water flow. The construction of the existing power lines will have a negligible effect on surface water flow, as they span most of these features.

Table 8-6: Initial impact by the proposed development to surface water and wetlands

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**

Additional Impact

The construction of the proposed power lines should have no effect on drainage lines because of the distance between pylons, but it should be noted that many drainage, streams, rivers and wetlands cross over the proposed and existing lines. It is recommended 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 8-7: Additional impact by the proposed development to surface water and wetlands

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**

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

Mitigation/management measures

- No construction camps or pylons should be placed within 50 m from the edge of a surface water body.
- It should be noted that any activity that has the potential to trigger a Section 21 (c) or (i) water use as stipulated in the National Water Act, requires a Water Use License Application;
- 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;
- All areas affected by construction should be rehabilitated upon completion of the construction phase of the power line crossing. Areas should be reseeded with indigenous grasses as required;
- No fires should be permitted near the construction area;
- A storm-water management programme, 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.

Cumulative Impact

The cumulative impact of the current activities and the future activities will not increase the impact rating from a Low Impact as rated in the initial impact assessment.

Residual Impact

The residual impact of the current activities and the future activities will not increase the impact rating from a Low Impact as rated in the initial impact assessment.

Preferred alternative

As part of the impact assessment undertaken in this report, the most suitable alternative for each of the potential corridors was identified. Using the detailed assessments in the Biophysical specialist report it was determined that the following are the most preferred corridor for the Ferrum line:

- Ferrum to Solar Park – Ferrum Option 3 or its variation A or E;

8.1.5 Ground water

Due to the fact that no deep excavations are anticipated as part of the construction process and the current mining and agricultural practices in the study area, as well as the depth of the ground water, no impacts are anticipated for groundwater.

8.1.6 Terrestrial Ecology and Biodiversity

Initial Impact

In terms of the existing impact to the ecology of the study area, the vegetation has hardly been disturbed in most cases and the area is almost natural in appearance. All the vegetation units with the exception of the Lower Gariep Alluvial Vegetation show less than 5% transformation. Hence the impact on these areas is rated as a Moderate impact as shown below.

Table 8-8: Fauna and flora Initial Impact Assessment

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to fauna and flora	Minor	*Regional*	Short term	*Definite*	Moderate
	2	**3**	**2**	**5**	**2.3**

Additional Impact

The additional impact of the proposed power lines to the ecology will be the removal of vegetation within the servitude for the construction of the new power lines and the associated servitude roads. This is standard operating procedure for the construction of power lines. In addition to the impact to the vegetation, the noise and activity might scare local fauna away from the study area. The overall impact of each of the power line route alternatives on each vegetation unit is shown in the Table below. Please note that the areas indicated are for the entire corridor, not only the line.

If the standard operating procedure to clear the vegetation in the servitude is followed then the impact would be rated as a Moderate impact as shown below. Due to the bulk of the vegetation unit all being rated as not threatened, this rating applies to all the route alternatives.

Table 8-9: Fauna and flora Additional Impact Assessment.

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to fauna and flora	Low	*Site only*	Long-Term	*High*	Moderate
	4	**1**	**4**	**4**	**2.4**

Mitigation/management measures

The following measures are proposed to manage and mitigate the potential impacts to terrestrial ecology along the various routes:

- General:
  - No hunting or cooking to be permitted on site;
  - 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);
  - All alien invasive species on site should be removed and follow up monitoring and removal programmes should be initiated once construction is completed;
  - Adhere to the ESKOM vegetation management guideline;
  - The Environmental Control Officer should identify any sensitive along the servitude, particularly large terrestrial species and notify the fauna specialist of these so that advice can be given on how to best deal with the situation;
  - The construction of new access roads in particular should be limited to a minimum; and
  - All vehicle and pedestrian movement should be restricted to the actual construction site and, in the case of maintenance patrols, to the actual servitude.
- Sensitive habitat/species:
  - Removal trimming of plants should be restricted to only trees that pose a risk to the power line. All other vegetation should not be cleared with the exception of the footprint excavations;
  - Once the route is pegged, identify all trees that require removal and identify if they require a permit from DAFF or NEM:BA;
  - The sensitive alluvial vegetation unit should be avoided and construction limited to 50m from the edge of the endangered habitat if possible;
  - If construction has to take place inside the CBA, ensure that it takes place in areas that have already been disturbed;

Cumulative impact

If the abovementioned mitigation measures are implemented successfully, the cumulative impact of the power lines and the existing impacts should not result in an impact larger than was assessed for the initial impacts.

Residual impact

The residual impact of the power lines and the existing impacts should not result in an impact larger than was assessed for the initial impacts.

Preferred alternatives

From a terrestrial ecology perspective the alternatives for the proposed Ferrum corridor are very similar in nature. The area is largely natural with little impact to the environment. In terms of the potential impacts it is recommended that either Ferrum Alternative 3 or the Ferrum Alternative 3A or 3E/F be utilised as the use of existing access roads will significantly reduce the potential impact.

8.1.7 Avifauna

Initial Impact

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds and birds colliding with power lines. The initial impact on avifauna in the area is mainly due to the presence of existing power lines. The study area extends over two biomes, namely the Savanna and Nama Karoo, with small sections falling within the Azonal vegetation, mostly along the Orange River and salt pans.

Table 8-10: Initial Impact on Avifauna.

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on avifauna	HIGH	*Local Area*	Medium Term	*Has Occurred*	**High**
	4	3	3	5	**3.3**

Additional impact

The additional impact of the construction of the power lines will cause further disturbance. Some habitat will be lost, especially considering the servitude that will be used for the powerlines. The largest impact will result from the overhead traction equipment and the power lines. The alternatives all cross over streams and sensitive biomes. The following potential impacts on birds were identified:

- Collisions with the transmission line;
- Displacement due to habitat destruction; and
- Displacement due to disturbance.

Table 8-11: Additional Impact on Avifauna.

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Collisions with powerlines	HIGH	*Regional*	Medium Term	*Has Occurred*	**High**
	4	4	3	5	**3.7**
Displacement due to habitat destruction	HIGH	*Local Area*	Medium Term	*Could Happen*	**Low**
	4	3	3	3	**2.0**
Displacement due to disturbance	HIGH	*Local Area*	Short Term	*Could Happen*	**Low**
	4	3	2	3	**1.8**

Mitigation/management measures

- There are many methods that can be used to mitigate avian power line interactions (for example, APLIC 1994) and several investigations dealing with the collision problem have focused on finding suitable mitigation measures.
- The most proactive measures are power line route planning (and the subsequent avoidance of areas with a high potential for bird strikes) and the modification of power line designs (this option includes line relocations, underground burial of lines, removal of over-head ground wires, and the marking of ground wires to make them more visible to birds in flight).
- The phase conductor should be insulated for a distance of one metre on either side of the insulator for all three phases to prevent any risk of phase-earth electrocution.
- Install power lines according to the Eskom bird collision prevention guideline.

The mitigation of bird impacts caused by power lines is to a large extent determined by the microhabitat within a zone of a hundred metres to about 1 km on both sides of the line. This is particularly relevant as far as mitigation for bird collisions are concerned.

With the successful implementation of the above mitigation measures the impacts to avifauna can be mitigated to a moderate.

Cumulative impact

If the abovementioned mitigation measures are implemented successfully, the cumulative impact of the power lines and the existing impacts should not result in an impact larger than was assessed for the initial impacts.

Residual impact

The residual impact of the power lines and the existing impacts should not result in an impact larger than was assessed for the initial impacts.

Preferred alternatives

The potential for interaction with the proposed power line was assessed for each of the Red Data species. This was done by assessing the probability of each potential impact (collisions, displacement through disturbance and displacement through habitat destruction) occurring, for each species, within each of the described habitat classes. The following probability scale was used: 1 = low, 2 = medium, 3 = high. Each habitat class therefore received a risk score for each species. The total risk score for a habitat class was calculated as the sum of the various individual species scores for that habitat class. The Table below gives the risk scores for each of the habitat classes:

Table 8-12: Risk scores for each habitat class.

Habitat class	Risk score
Eastern Kalahari Bushveld	62
Kalahari Duneveld	51
Bushmanland	25
Waterbodies & rivers	5
Transmission lines	30
Low impact	0

The risk scores in the table were incorporated into a formula to arrive at a risk rating for each 1 km wide corridor alternative. The surface area of a corridor that intersected with a habitat class was calculated. Buffers were designed as follows for the following habitat classes:

- Waterbodies and rivers: A buffer of 250 m was drawn around water bodies, which were identified from the National Land Cover Project (2009). Rivers (including alluvial vegetation) were identified from the Vegetation Map of South Africa (Mucina & Rutherford 2006), and also buffered by 250 m. The perennial Orange River was buffered, as well as two large ephemeral rivers, namely the Ga-Mogara River near Kathu and the Hartbees River in the extreme south-west of the study area, on the assumption that the latter two rivers may at times hold water after rains.
- Existing transmission lines: A buffer of 200 m was drawn around existing transmission lines.
- Low impact areas: Degraded areas, mines, urban/industrial areas, agricultural areas along the Orange River (mostly irrigated vineyards) and major roads were identified from the National Land Cover Project (2009). A buffer of 100 m was drawn around major roads.

The **risk rating** for a power line **corridor alternative** was calculated by multiplying the surface area of each habitat class that overlaps with the 1 km wide corridor with the risk score for that habitat class. The risk ratings of the respective corridors are listed in the Table below. The corridors that have emerged with the lowest risk scores are highlighted in green.

Table 8-13: Risk ratings of the alternative corridors

Corridor	Risk Rating
Ferrum_Alternative 1	242
Ferrum_Alternative 2	247
Ferrum_Alternative 3	256
Ferrum_Alternative 3A	223
Ferrum_Alternative 3B	219
Ferrum_Alternative 3C	218
Ferrum_Alternative 3D	223
Ferrum_Alternative 3E	243
Ferrum_Alternative 3F	227

After each of the transmission line alternatives were assessed for potential bird impacts, Ferrum Alternative 3C emerged as the preferred alternatives as highlighted above.

8.1.8 Socio-Economic Impact Assessment

The impacts to the socio-economic environment were assessed by a specialist consultant. The Social Impact Assessment (SIA) is attached in Appendix H. The social impacts are summarised in the section below, but more detail can be obtained by reading the full report in the attached report.

Initial Impact

The initial impacts of existing activities on the existing social fabric were not assessed.

Additional Impact

Table 8-14 represents the social change processes that have been identified and the possible social impacts that may result because of these processes. It also identifies the stakeholder group that is most likely to be affected by the process.

Table 8-14: Social Changes processes

Social Change Process	Possible Social Impact	Affected stakeholder group
In-migration	Increased pressure on local services & infrastructure Increased incidence of STD's, HIV & AIDS Disruption to existing power relationships and decision-making structures Social nuisance e.g. prostitution, damage to property, discrepancy in income of workers	Vulnerable communities Surrounding towns Tourism Farmers
Resettlement	Range of social impacts – specific procedures to be followed, best to be avoided Uncertainty about future	Vulnerable communities
Change in land use	Decreased access to sources of livelihood resulting in poverty and/or drop in standard of living Loss of productive land leading to loss of profit leading to job losses Long term conflict about management of servitudes Environmental nuisance e.g. noise, dust Safety hazards Communication and arrangements surrounding access to properties & management of servitude – can be positive or negative Loss of sense of place	Farmers Vulnerable communities Tourism
Deviant social behaviour	Increase in crime and disorder Breakdown of traditional values	Vulnerable communities Farmers Industry

Social Change Process	Possible Social Impact	Affected stakeholder group
		Tourism Surrounding towns
Employment opportunities	Loss of workers to construction process because of higher pay Opportunity for local low skill employment Indirect employment opportunities	Vulnerable communities Farmers Industry Tourism Surrounding towns
Legal processes	Uncertainty resulting from EIA process (selection of route) Fear and anxiety related to the land acquisition process Feelings related to management of servitude – Eskom's social license to operate.	Industries Farmers Vulnerable communities Tourism Surrounding towns

Potential impacts:

- Will be felt by landowners with more than one servitude on their farm i.e. additional people wanting to access the servitude; additional fire risk; and more opportunity for invader species to take over.
- In areas where people have had negative experiences with the management of servitudes their expectation will be to have similar experiences, should Eskom not improve their service the impact will be felt much more intensely.
- Heavy vehicular traffic in rural areas where there are already heavy vehicles travelling on a daily basis;
- In some places in the project area, where other construction activities are underway, the influx of people has already resulted in increased crime levels. Acts of sabotage is already used by some of the local residents as a form of retribution. There is a risk that this may become the accepted way of dealing with grievances in the eyes of the affected communities.
- Cumulative impacts on local entrepreneurs will be positive and assist in developing their businesses further.
- Local businesses in some parts of the project area have already lost labour to other construction processes and this process may escalate that impact.
- People lose faith in the EIA process if they experience a number of these processes in a negative light. The less faith they have in the process the higher the levels of stress and anxiety will be. If Eskom reportedly continues to conduct themselves the way they are currently doing, their public image will suffer irreparable damaged and this will filter through in acts of sabotage or denial of access. It can also result in extended legal battles.

The assessment for each of the aforementioned impacts is summarised in Table 8-15.

Table 8-15: Additional impact rating for socio-economic features

Finding	Magnitude	Duration	Scale	Probability	Significance
Pressure on infrastructure	HIGH	Short term	*Local*	*Has occurred*	**Moderate**
	4	2	3	5	**3.0**
Leave behind infrastructure for community	VERY HIGH	Permanent	*Local*	*Could Happen*	**Moderate**
	5	5	3	3	**2.6**
Increase in STDs	HIGH	Medium-term	*Local*	*Very likely*	**Moderate**
	4	3	3	4	**2.6**
Social nuisance	HIGH	Medium-term	*Local*	*Has occurred*	**High**
	4	3	3	5	**3.3**
Resettlement	VERY HIGH	Permanent	*Study Area*	*It's going to happen*	**High**
	5	5	2	5	**4**
Sense of place	HIGH	Permanent	*Local*	*It's going to happen*	**Very High**
	4	5	3	5	**4**
Management of servitude	HIGH	Long term	*Regional*	*Very Likely*	**High**
	4	4	4	4	**3.2**
Safety hazards	MODERATE	Long term	*Local*	*Could Happen*	**Low**
	3	4	3	3	**2.0**
Environmental nuisance	MODERATE	Medium term	*Local*	*It's going to happen*	**Moderate**
	3	3	3	5	**3.0**
Increase in crime & disorder	HIGH	Short term	*Regional*	*Very Likely*	**Moderate**
	4	2	4	4	**2.7**
Breakdown of traditional value systems	VERY HIGH	Short term	*Local*	*Very Likely*	**Moderate**
	5	2	3	4	**2.7**
Loss of workers to construction team	HIGH	Short term	*Regional*	*It's going to happen*	**High**
	4	2	4	5	**3.3**
Local job opportunities	HIGH	Short term	*Regional*	*Very Likely*	**Moderate**
	4	2	4	4	**2.7**
Indirect employment opportunities	HIGH	Short term	*Local*	*Very Likely*	**Moderate**
	4	2	3	4	**2.4**
Uncertainty caused by EIA process	HIGH	Short-term	*Regional*	*It's going to happen*	**High**
	4	2	4	5	**3.3**
Fear & anxiety caused by land acquisition process	HIGH	Short-term	*Local*	*Very likely*	**Moderate**
	4	2	3	4	**2.4**

Mitigation/management measures

- Infrastructure such as roads should be maintained in the present condition or improved on. The contractor should be responsible for managing this impact on private property.
- Contractors must adhere to the rules as set down by the property owner. This aspect should be included in their scope of work to ensure that they provide the financial means to execute the necessary maintenance and repair work required. Should they disobey the local rules regarding speeding a fine system must be implemented.

- Eskom must appoint an environmental and social monitor (or farm liaison officer) for the project. These people must be independent from the contractor. The social monitor can also act as the community liaison officer.
- Any incidences must be reported in a complaints register that should be inspected by the social and environmental monitor on a weekly basis. Eskom must audit this document on a monthly basis.
- When provincial and national roads are involved, the expectation is not that the contractors are responsible, but that the responsibility lies with Eskom, and they should consult with the relevant roads agency to ensure that they do not contribute to the deterioration of roads without taking some responsibility for the impact that their vehicles have on the road during construction.
- The site of construction camps must be discussed with local government structures (or traditional structures in tribal areas) and opportunities for co-operative development should be investigated.
- The contractor should have a person trained in first aid on site to deal with smaller incidents that require medical input.
- If construction camps with local barracks are used these should adhere to strict environmental requirements.
- Services should be negotiated with landowners and local municipalities and Eskom should audit the agreements that must be put in place to ensure that essential services are not taken away from communities.
- Local landowners should be allowed to produce a set of rules to which contractors must adhere if they are on private property. The environmental and social monitor should inspect this.
- The landowner must sign a release form when the construction team leave his property to ensure that there is no unfinished business on his property. The social monitor must check in with the affected landowners on a weekly basis whilst there are construction activities on the property.
- There must be a well-published, culturally appropriate grievance mechanism. This must be agreed with local communities at the start of the construction period in the area. The communities must give input in the process to ensure ownership.
- Grievances must be dealt with within a certain period.
- All grievances must be recorded in a register stating the grievance, date that it occurred and action taken.
- The aggrieved person should sign a form that explain the grievance, the process followed and what the outcomes were.
- Communication and grievance channels must be explained in writing. The landowners must not be sent on a wild goose chase between Eskom and the contractors if they have grievances or complaints.

- Should the provision of bulk-services to contractors be to the detriment of the affected communities, these services should be brought in from outside the affected area.
- When investigating existing accommodation the contractor should ensure that the necessary sanitation services are available and have the capacity to meet the additional needs. This assurance should be given to the contractor in writing.
- Eskom cannot control squatter settlements surrounding towns. The contractor must ensure that no squatter settlements are erected near or adjacent to construction camps. People should be asked to leave before they have the opportunity to settle. The assistance of the local police in this matter will be crucial.
- The contractor must put up signs that no recruitment will take place on site, and all jobseekers must be shown away from site.
- The contractor should not allow his staff to utilise services from squatters. There must be a formal trading area for informal traders, but they must not be allowed to sleep where they trade or set up camps in close proximity to the construction camp.
- HIV/AIDS and Sexually Transmitted Disease (STD) awareness training must form part of the induction of staff.
- Condoms must be freely available on site. Condoms should also be distributed in local places such as schools, clinics, shebeens and other recreational facilities.
- STD and HIV / AIDS awareness training should be provided in conjunction with local NGOs or the Department of Health, these awareness training programmes must also be given at local schools and clinics.
- STD and HIV / AIDS awareness training should include discussions about birth control and the potential long-term risks associated with casual sex.
- The workforce must be discouraged from engaging in casual sexual relationships with local people and informed of the consequences.
- Local people must be discouraged from entering the construction camp.
- Access to the construction camp should be controlled. Visitors should be signed in and out and no overnight visitors should be allowed.
- The code of conduct as agreed with the affected communities and landowners should be adhered to.
- No alcohol should be sold in the camps, and the amount of alcohol allowed in the camp should be limited.
- Prostitutes should not be allowed to enter the camp.
- There should be fines for breaking the rules.
- Frequent inspections of the camps should take place, and if non-conformances are found payment to the contractor must be withheld until it is corrected.

- Become member of community organisations such as community police forums, fire management areas etc.
- Develop and implement community relations programme.
- Involve the community in the process as far as possible – encourage co-operative decision-making and management and partnerships with local entrepreneurs;
- Be accessible and sensitive to community needs.
- Should resettlement be required a detailed resettlement action plan should be compiled specifically for the community that will be affected by such a process.
- There are international best practice guidelines compiled by the IFC that should be adhered to in the event that resettlement is required.
- A specialist in the field of relocation should conduct the process of resettlement, and the community must be actively involved in the process to ensure participatory decision-making and that cultural significance is taken into consideration.
- Unspoilt natural areas should be avoided as far as possible and infrastructure should rather be erected in areas where similar infrastructure already occur, whilst considering cumulative impacts.
- To ensure local service providers benefit as much as possible from the proposed project, the use of these establishments by Eskom and its contractors is recommended. This should be on a rotation basis to ensure that the benefits are distributed across the service providers.
- In some areas people already have infrastructure such as railways, roads and power lines on their properties. Putting another line over such a property may make it no longer economically viable. In such instances the entire property should be purchased. The landowner should be compensated in such a way that they can replace their property with something similar.
- Given the potential economic impact on the timber farmers, and the secondary impacts that this will have on vulnerable communities it is recommended that timber areas should be avoided.
- Eskom must work in conjunction with the farmer’s associations and any security systems that they have.
- Farmers should be informed the day before there is any activity on the servitude. If there is an emergency and this cannot happen, the farmer must be informed at least before his property is entered.
- Eskom staff must wear identification cards and farmers should have access to a phone number that they can call to confirm that the person on the card is authorised to be in the servitude.
- A multi-lock and chain system should be used to ensure that gates remain locked but that all the relevant people always have access to the servitude.

- There must be a designated person at Eskom that deal with the community affected by the servitude. All affected landowners must have direct access to this person.
- Landowners should only have to deal with one person and be allowed to establish a relationship of trust with this person.
- Eskom must contribute to fire-fighting equipment and adhere to the protocols of different fire protection areas. They must utilise the local knowledge available in the project area to assist them with all fire-related matters.
- A more flexible approach to switching off lines for burning purposes should be followed.
- Where possible dust suppression must be used.
- No construction work should take place on Sundays, public holidays and during the night.
- Eskom must approach local schools and community organisations in the project area to present information sessions about the safety risks associated with power lines. The responsibility of contacting these organisations is on Eskom, and not on the organisations.
- Access to the site and the servitude should be controlled as far as possible.
- Construction camps must be fenced and local security companies must be employed to patrol the areas where there are active construction activities.
- Local unemployed people must be given preference in the recruitment process.
- Contractor must refrain from employing people who are currently employed in permanent positions.
- There must be employment desks in the towns or settlement areas.
- No recruitment may take place in the construction camps.
- A standard recruitment policy must be implemented across the project area, especially if more than one contracting firm is used.
- The local recruitment process must be agreed with local leadership. This process must then be advertised in an accessible way – radio advertisements, community meetings and press releases in local languages.
- No false expectations must be created and it must be underlined that the employment opportunities are specifically for the unemployed.
- Women must make up a percentage of the workforce.
- Eskom and the contractor must support local entrepreneurs as far as possible.
- Eskom should consider a local economic development programme that can stretch across all its operations. An example would be to buy a mobile kitchen, and train women along the construction route to cater for the construction forces. This kitchen can move

with the labour force and women in different areas will be given the opportunity to get trained and earn an income.

- It must be acknowledged that there will be local entrepreneurs trying to sell their goods to the construction force. Unless managed carefully this may lead to squatter camps near the construction camps. The contractor should provide a designated area where such services can be provided – the area should ideally form part of the construction camp and be cleared and fenced.
- No open fires must be allowed. Food should rather be prepared off-site and transported in. Vendors must travel in and out of the area and should not be allowed in the construction area. The social monitor must assist in managing this process.
- In the ground-truthing phase of the project when a physical route will be determined by in-depth investigations, the affected landowners must be consulted and kept informed about the future actions. The social monitor should be appointed in this phase to start building relationships with affected communities and looking for opportunities to link with local entrepreneurs.
- An effort should be made to engage with affected parties in a culturally sensitive manner in the next phase of the project, especially since all routes potentially affect vulnerable communities.
- The land acquisition process must be explained to affected parties in a language of their choice. They must also be supplied with a written document spelling out the process. It must be considered that this process would need to be explained repeatedly to affected parties to allow them to digest it. Two land valuators that work independent of each other should be appointed. One of them should have local knowledge and knowledge of the affected industry, if relevant. The other should have experience in similar projects across the country.
- A community relations programme should be implemented (take note that this is different from a public relations programme). Eskom must insure that personnel with appropriate qualifications are appointed and that communication channels with communities are established and maintained.

Residual Impact

Many of the impacts cannot be mitigated to such an extent that they are no longer significant. Many of the impacts will be short term, and disappear after the construction phase. Residual impacts that are mentioned are those impacts that will be long term or permanent. Many of these impacts cannot be managed or controlled by Eskom, as some occur on an individual level.

Damage to roads may not be repaired for a long period, and as a result local communities and travellers will be exposed to safety risks. The mitigation of this impact lies outside the scope of Eskom. Although they can enter into negotiations with the relevant parties, the influence that they have to prioritise repairs may be limited.

Another residual impact is STDs and HIV/AIDS. For all practical purposes this is a permanent impact that will be felt on an individual level.

Unplanned pregnancies resulting in female-headed households are also a long-term residual impact that Eskom can do little about.

Changes in power relationships in power relationships and community cohesion may have long-term implications resulting in permanent changes in the community. It must be acknowledged that social change occurs in any event, and that communities can adapt to this change.

It takes years for a community to stabilise after resettlement. It will have a permanent impact on the affected communities. Whilst physical things can be mitigated quite easily with financial aid, psychological and social impacts will take time to recover. It must be considered that when dealing with social change and social impacts that second or higher order change/impacts often cause more harm than first order change/impacts[9].

There may be a breakdown of traditional values as a result of crime and external influences.

Residual impacts will be a positive impact on skills development and economic growth for small-scale entrepreneurs. There may be a negative impact on workers who were temporarily employed and lost their jobs, in that they might struggle to find new employment opportunities. Should Eskom implement the mitigation, especially related to a community relations programme the results will be a long term and positive in terms of neighbourly relationships.

The residual impact after mitigation has been assessed and is reflected in Table 8-16.

Table 8-16: Residual social impact (All Alternatives)

Finding	Magnitude	Duration	Scale	Probability	Significance
Pressure on infrastructure	MODERATE	Short term	*Local*	*It's going to happen*	**Moderate**
	3	2	3	5	**2.7**
Leave behind infrastructure for community	VERY HIGH	Permanent	*Regional*	*Could Happen*	**Moderate**
	5	5	4	3	**2.8**
Increase in STDs	MODERATE	Long term	*Regional*	*Could Happen*	**Moderate**
	3	4	4	3	**2.2**
Social nuisance	MODERATE	Short-term	*Local*	*Could Happen*	**Low**
	3	2	3	3	**1.6**
Resettlement	HIGH	Permanent	*Local*	*It's going to happen*	**Very High**
	4	5	3	5	**4**

[9] Social change processes/impacts that result directly from the intervention, the so-called "first order changes/impacts" can lead to several other social changes/impacts - the second and higher order change processes/impacts.

Fear and anxiety caused by land aquisition	MODERATE	Short term	*Study Area*	*Very likely*	**Low**
	3	2	*2*	4	**1.9**
Management of servitude	MODERATE	Long term	*Regional*	*Could Happen*	**Moderate**
	3	4	*4*	3	**2.2**
Safety hazards	HIGH	Long term	*Study Area*	*Unlikely*	**Low**
	4	4	2	2	**1.3**
Environmental nuisance	LOW	Medium term	*Study Area*	*It's going to happen*	**Moderate**
	2	3	2	5	**2.3**
Increase in crime & disorder	MODERATE	Short-term	*Local*	*Very Likely*	**Moderate**
	3	2	*3*	4	**2.1**
Breakdown in traditional value systems	HIGH	Short-term	*Study Area*	*Could Happen*	**Low**
	4	2	2	3	**1.6**
Loss of workers to construction team	MODERATE	Short-term	*Regional*	*Could Happen*	**Low**
	3	2	*4*	3	**1.8**
Local job opportunities	VERY HIGH	Long term	*Regional*	*Very likely*	**High**
	5	4	*4*	4	**3.5**
Indirect employment opportunities	VERY HIGH	Short-term	*Regional*	*It's going to happen*	**High**
	5	2	*4*	5	**3.7**
Uncertainty caused by EIA process	MODERATE	Short-term	*Regional*	*Could Happen*	**Low**
	3	2	*4*	3	**1.8**

Preferred Alternatives

Ferrum_Alternative 3 or the stakeholder suggested alternative is the preferred alternative from a social perspective. Ferrum Alternative 3F is the preferred alignment, but Ferrum Alternative 3B will also be acceptable. Although this route will impact on some small-scale farmers, the impact can be mitigated. It must be acknowledged that all of the routes will have an impact.

The need for the proposed project is undeniable in the current economic conditions. It is therefore recommended that the project proceed. The mitigation measures should be adhered to.

8.1.9 Traffic Assessment

The majority of traffic within the study area is generated by the mining activities in the area that generates traffic in terms of machinery and trucks. Agricultural activities are another source of traffic which emanates from the N14 highway as well as provincial and secondary roads in the area. Traffic is not anticipated to be impacted on significantly and the construction of access roads associated with the project will reduce the ambient traffic to the secondary road network significantly.

8.1.10 Noise Assessment

The character of the noise environment has not been affected only by external factors such as small scale industrial and mining activities. The character is also affected and the background ambient level elevated by noises produced by farming activities, which is the principle land-use activity affecting noise-sensitive recipients in the area. It would therefore be improper to consider the baseline reference of the environment and the proposed development target for new development as Rural in terms of SANS 10103 guidelines. The proposed activity also will in itself not contribute significantly to the noise impact in the area.

8.1.11 Visual Impact Assessment

<u>Initial Impact</u>

The present visual landscape is one dominated by agriculture with intermittent rural residences, urban areas and industrial or mining activities. The initial impact to the visual environment is LOW negative acting in the long term, and has already occurred.

<u>Additional Impact</u>

The Ferrum Corridor Alternatives links the Solar Park to the 400 kV Ferrum Substation located approximately 210 km to the north east of Upington, near Kathu. Three alternative corridors have been considered.

Ferrum_Alternative 1:

This Alternative runs alongside an existing power line for a short stretch in the west outside Kathu. The alignment does not follow a road alignment, but short stretches of the N14, N10, R360 and R380 will be visually affected as the line crosses over. Of note is that the N14, N10 and R360 are considered to be tourist access routes. Thirteen secondary roads also lie within the zone of potential visual exposure. The alignment does not cross or visually affect the Orange River, but four non-perennial streams fall within the viewshed. In addition, the alignment traverses a high section of the Koranaberg south west of Kathu, as well as some hills located a further 80 km to the west. It is likely that the Spitskop Nature reserve north of Upington lies within the zone of potential visual exposure. The town of Kathu will be visually exposed, as will a moderately high number of settlements and homesteads, especially in the vicinity of Kathu.

Table 8-17: Visual Additional Impact Assessment – Ferrum_Alternative 1.

Finding	Magnitude	Duration	Scale	Probability	Significance
Visual impact on road users	VERY HIGH	Long term	*Local*	*Could Happen*	**Moderate**
	5	4	4	3	**2.6**
Visual impact on residence in built up areas	VERY HIGH	Long term	*Local*	*Could Happen*	**Moderate**
	5	4	4	3	**2.6**
Visual impact on residents of farmsteads	VERY HIGH	Long term	*Local*	*Very likely*	**High**
	5	4	4	4	**3.5**
Visual impact on sensitive receptors	HIGH	Long term	*Regional*	*Very likely*	**Moderate**
	4	4	3	4	**2.9**
Visual impact on conservation areas	LOW	Long term	*Regional*	*Could Happen*	**Low**
	2	4	3	3	**1.8**
Visual impact of associated infrastructure	MODERATE	Long Term	*Local*	*Could Happen*	**Moderate**
	3	4	4	3	**2.2**
Visual impact of construction	MODERATE	Short Term	*Local*	*Very Likely*	**Moderate**
	3	1	4	4	**2.1**
Visual impact on scenic and sensitive topographic features	HIGH	Long term	*Regional*	*Very Likely*	**Moderate**
	4	4	3	4	**2.9**
Visual impact on tourism	VERY HIGH	Long term	*Regional*	*Could Happen*	**Moderate**
	5	4	3	3	**2.4**

Ferrum_Alternative 2:

Ferrum_Alternative 2 does not follow an existing power line or a road alignment, but short stretches of the N14, N10, R360 and R380 will be visually affected. Of note is that the N14, N10 and R360 are considered to be tourist access routes. Seventeen secondary roads also lie within the zone of potential visual exposure. The alignment does not cross or visually affect the Orange River, but six non-perennial streams fall within the viewshed. The alignment also passes through the Koranaberg, but does not traverse any mountains. Adjacent slopes are visually affected, however. It is likely that the Spitskop Nature reserve north of Upington lies within the zone of potential visual exposure. The town of Kathu will be visually exposed, as will a moderately high number of settlements and homesteads, especially in the vicinity of Kathu.

Table 8-18: Visual Additional Impact Assessment – Ferrum_Alternative 2

Finding	Magnitude	Duration	Scale	Probability	Significance
Visual impact on road users	VERY HIGH	Long term	*Local*	*Could Happen*	**Moderate**
	5	4	4	3	**2.6**
Visual impact on residence in built up areas	VERY HIGH	Long term	*Local*	*Could Happen*	**Moderate**
	5	4	4	3	**2.6**
Visual impact on residents of farmsteads	VERY HIGH	Long term	*Local*	*Very likely*	**High**
	5	4	4	4	**3.5**
Visual impact on sensitive receptors	HIGH	Long term	*Regional*	*Very likely*	**Moderate**
	4	4	3	4	**2.9**
Visual impact on	LOW	Long term	*Regional*	*Could Happen*	**Low**

Finding	Magnitude	Duration	Scale	Probability	Significance
conservation areas	2	4	3	3	**1.8**
Visual impact of associated infrastructure	MODERATE	Long Term	*Local*	*Could Happen*	**Moderate**
	3	4	4	3	**2.2**
Visual impact of construction	MODERATE	Short Term	*Local*	*Very Likely*	**Moderate**
	3	1	4	4	**2.1**
Visual impact on scenic and sensitive topographic features	HIGH	Long term	*Regional*	*Impossible*	**Low**
	4	4	3	2	**1.5**
Visual impact on tourism	VERY HIGH	Long term	*Regional*	*Could Happen*	**Moderate**
	5	4	3	3	**2.4**

Ferrum_Alternative 3:

This Alternative runs alongside an existing power line for a short stretch in the east of Upington, and follows the N14 for a stretch of about 100 km. In addition to the visual exposure along this route, short stretches of the N10, R360 and R380 will be visually affected. Of note is that the N14, N10 and R360 are considered to be tourist access routes. Nineteen secondary roads also lie within the zone of potential visual exposure. The alignment does not cross over the Orange River, but a short stretch is visually impacted upon to the east of Upington. In addition, six non-perennial streams fall within the viewshed. The alignment also passes through the Koranaberg, but does not traverse any mountains. Adjacent slopes are visually affected, however. It is likely that the Spitskop Nature reserve north of Upington lies within the zone of potential visual exposure. The town of Kathu will be visually exposed, as will a moderately high number of settlements and homesteads, especially in the vicinity of Kathu.

Table 8-19: Visual Additional Impact Assessment – Ferrum_Alternative 3

Finding	Magnitude	Duration	Scale	Probability	Significance
Visual impact on road users	VERY HIGH	Long term	*Local*	*It's going to happen*	**High**
	5	4	4	5	**4.3**
Visual impact on residence in built up areas	VERY HIGH	Long term	*Local*	*Could Happen*	**Moderate**
	5	4	4	3	**2.6**
Visual impact on residents of farmsteads	VERY HIGH	Long term	*Local*	*Very likely*	**High**
	5	4	4	4	**3.5**
Visual impact on sensitive receptors	HIGH	Long term	*Regional*	*Very likely*	**Moderate**
	4	4	3	4	**2.9**
Visual impact on conservation areas	LOW	Long term	*Regional*	*Could Happen*	**Low**
	2	4	3	3	**1.8**
Visual impact of associated infrastructure	MODERATE	Long Term	*Local*	*Could Happen*	**Moderate**
	3	4	4	3	**2.2**
Visual impact of construction	MODERATE	Short Term	*Local*	*Very Likely*	**Moderate**
	3	1	4	4	**2.1**
Visual impact on	HIGH	Long term	*Regional*	*Impossible*	**Low**

Finding	Magnitude	Duration	Scale	Probability	Significance
scenic and sensitive topographic features	4	4	3	2	**1.5**
Visual impact on tourism	VERY HIGH	Long term	*Regional*	*Very Likely*	**High**
	5	4	3	4	**3.2**

Ferrum_Alternative 3E:

Ferrum_Alternative 3E runs along the power line to the south west along the existing 275kV power line. The alignment runs over the railway line, before swinging to the north west to link with the N14 and the Ferrum_Alternative 3A corridor. In addition to the visual exposure along this route, short stretches of the N10, R360 and R380 will be visually affected. Of note is that the N14, N10 and R360 are considered to be tourist access routes. Fifteen secondary roads also lie within the zone of potential visual exposure. The alignment does not cross over the Orange River, but a short stretch is visually impacted upon to the east of Upington. In addition, six non-perennial streams fall within the viewshed and the alignment traverses a high section of the Koranaberg south west of Kathu. It is likely that the Spitskop Nature reserve north of Upington lies within the zone of potential visual exposure. The town of Kathu will be visually exposed, as will a moderately high number of settlements and homesteads, especially in the vicinity of Kathu.

Table 8-20: Visual Additional Impact Assessment – Ferrum_Alternative 3E.

Finding	Magnitude	Duration	Scale	Probability	Significance
Visual impact on road users	VERY HIGH	Long term	*Local*	*Definite*	**High**
	5	4	4	5	**4.3**
Visual impact on residence in built up areas	VERY HIGH	Long term	*Regional*	*Probable*	**Moderate**
	5	4	4	3	**2.6**
Visual impact on residents of farmsteads	VERY HIGH	Long term	*Local*	*Very likely*	**High**
	5	4	4	4	**3.5**
Visual impact on sensitive receptors	HIGH	Long term	*Regional*	*Very likely*	**Moderate**
	4	4	3	4	**2.9**
Visual impact on conservation areas	LOW	Long term	*Regional*	*Could Happen*	**Low**
	2	4	3	3	**1.8**
Visual impact of associated infrastructure	MODERATE	Long Term	*Local*	*Could Happen*	**Moderate**
	3	4	4	3	**2.2**
Visual impact of construction	MODERATE	Short Term	*Local*	*Very Likely*	**Moderate**
	3	1	4	4	**2.1**
Visual impact on scenic and sensitive topographic features	HIGH	Long term	*Regional*	*Very likely*	**Moderate**
	4	4	3	4	**2.9**
Visual impact on tourism	VERY HIGH	Long term	*Regional*	*It's going to happen*	**High**
	5	4	3	5	**4.0**

Ferrum_Alternative 3A, 3B, 3C, 3D, 3F:

The description of the visual impact index has been combined for these corridor alternatives as they represent only small variations in a single part of the corridor. These alternatives run along the existing 275 kV power line south west of Kathu for varying distances before swinging west to the N14, and then south west, to follow the Ferrum_Alternative 3 alignment. All alignments follow the N14 for a stretch of about 120 to 140 km. In addition to the visual exposure along this route, short stretches of the N10, R360, R385 and R380 will be visually affected for all alignments, as the line crosses over. Of note is that the N14, N10 and R360 are considered to be tourist access routes. Thirteen secondary roads also lie within the zone of potential visual exposure of all alignments, except for Ferrum_Alternative 3D, which affects fourteen secondary roads. None of these alignments cross over the Orange River, but a short stretch is visually impacted upon to the east of Upington. It is likely that the Spitskop Nature reserve north of Upington lies within the zone of potential visual exposure. The town of Kathu will be visually exposed, as will a moderately high number of settlements and homesteads, especially in the vicinity of Kathu.

Table 8-21: Visual Additional Impact Assessment – Alternative 3A, 3B, 3C, 3D and 3F

Finding	Magnitude	Duration	Scale	Probability	Significance
Visual impact on road users	VERY HIGH	Long term	*Local*	*Definite*	**High**
	5	4	4	5	**4.3**
Visual impact on residence in built up areas	VERY HIGH	Long term	*Regional*	*Probable*	**Moderate**
	5	4	4	3	**2.6**
Visual impact on residents of farmsteads	VERY HIGH	Long term	*Local*	*Very likely*	**High**
	5	4	4	4	**3.5**
Visual impact on sensitive receptors	HIGH	Long term	*Regional*	*Very likely*	**Moderate**
	4	4	3	4	**2.9**
Visual impact on conservation areas	LOW	Long term	*Regional*	*Could Happen*	**Low**
	2	4	3	3	**1.8**
Visual impact of associated infrastructure	MODERATE	Long Term	*Local*	*Could Happen*	**Moderate**
	3	4	4	3	**2.2**
Visual impact of construction	MODERATE	Short Term	*Local*	*Very Likely*	**Moderate**
	3	1	4	4	**2.1**
Visual impact on scenic and sensitive topographic features	HIGH	Long term	*Regional*	*Could Happen*	**Moderate**
	4	4	3	3	**2.2**
Visual impact on tourism	VERY HIGH	Long term	*Regional*	*It's going to happen*	**High**
	5	4	3	5	**4.0**

Cumulative Impacts

Since the present visual landscape is one dominated by agriculture with intermittent rural residences, urban areas and industrial or mining activities, and the fact that the majority of the corridor alternatives are proposed along existing power line infrastructure and roads, the cumulative impact of the power lines would not be significantly higher than those identified for additional impact.

Mitigation/management measures

There are not many options as to the mitigation of the visual impact of the Transmission Lines. The infrastructure spans hundreds of kilometres and no amount of vegetation screening or landscaping would be able to hide structures of these dimensions.

The following mitigation is, however, recommended:

- Mitigation of visual impacts associated with the construction of access roads is possible through the use of existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.
- Access roads, which are not required post-construction, should be ripped and rehabilitated.
- Consolidate infrastructure and make use of already disturbed sites rather than pristine areas wherever possible.
- Mitigation of visual impacts associated with the construction phase, albeit temporary, entails proper planning, management and rehabilitation of all construction sites. Construction should be managed according to the following principles:
    - Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
    - Reduce the construction period through careful logistical planning and productive implementation of resources.
    - Plan the placement of lay-down areas and any potential temporary construction camps along the corridor in order to minimise vegetation clearing.
    - Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
    - Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
    - Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
    - Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
    - Ensure that all infrastructure and the site and general surrounds are maintained and kept neat.

- Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

- Monitor all rehabilitated areas for at least a year for rehabilitation failure and implement remedial action as required. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications. Where driftsand is present, rehabilitation will not be possible.

- After decommissioning, all infrastructure should be removed and all disturbed areas appropriately rehabilitated.

Residual Impact

Many of the impacts cannot be mitigated to such an extent that they are no longer significant. Many of the impacts will be short term, and disappear after the construction phase. Residual impacts that are mentioned are those impacts that will be long term or permanent. As a result the residual impact of the power lines will not be significantly higher than those identified for initial and additional impact.

Preferred route selection

In order to determine the preferred route the specialist compiled the table below to compare the potential impacts from each of the alternatives.

Potential visual impact on users of national roads (N14, N10), arterial roads (R325, R360, R380, R385) and secondary roads in close proximity of the proposed Transmission lines (i.e. within 500m) are expected to be of **moderate** significance for Ferrum_Alternatives 1 and 2, and of **high significance** for Ferrum_Alternatives 3, 3E and for 3A, 3B, 3C, 3D and 3F.

The potential visual impact on residents of residents of built-up centres and populated places (i.e. Kathu) within 500m of the proposed Transmission lines is expected to be of moderate significance for all Alternatives. The potential visual impact on residents of farmsteads and settlements within 500m of the proposed Transmission Lines is expected to be of **high significance** for all Alternatives.

The visual impact sensitive visual receptors (i.e. users of roads and residents of homesteads and settlements) within the region (i.e. beyond the 500m offset) are expected to be of moderate significance for all Alternatives. The potential visual impact on protected and conservation areas (the Spitskop Nature Reserve) is expected to be of **moderate significance** for all Alternatives. The potential visual impact of associated infrastructure on sensitive visual receptors in close proximity thereto is expected to be of low significance for all Alternatives.

The potential visual impact of construction on sensitive visual receptors in close proximity to the proposed infrastructure is likely to be of low significance for all Alternatives.

The anticipated visual impact of the Transmission Lines on the scenic and visually sensitive mountains and drainage lines of the study area is expected to be of **high significance** for Ferrum_Alternatives 1 and 3E, of **moderate significance** for Ferrum_Alternatives 3A, 3B, 3C, 3D and 3F and of **low significance** for Ferrum_Alternatives 2 and 3.

The anticipated visual impact of the Transmission lines and associated infrastructure on tourist access routes and tourist destinations within the region is expected to be of **moderate significance** for Ferrum_Alternatives 1 and 2, and of **high significance** for Ferrum_Alternatives 3, 3E and Ferrum_Alternatives 3A, 3B, 3C, 3D and 3F.

Overall considering all the relevant criteria from the impact assessment, Ferrum_Alternative 3B or 3C is considered to be the preferred alternative from a visual perspective, followed by Ferrum_Alternatives 3A and 3D.

Table 8-22: Comparative visual assessment of the Alternatives

Criteria	Ferrum_Alternative 1	Ferrum_Alternative 2	Ferrum_Alternative 3	Ferrum_Alternative 3E	Ferrum_Alternative 3A	Ferrum_Alternative 3B	Ferrum_Alternative 3C	Ferrum_Alternative 3D	Ferrum_Alternative 3F
Total length	**1** (252km)	**1** (248km)	**4** (282km)	**3** (270km)	**3** (266km)	**2** (262km)	**2** (263km)	**3** (267km)	**3** (270km)
Major roads	**1** (N10, N14, R360, R380)	**1** (N10, N14, R360, R380)	**2** (N10, N14, R360, R380)	**3** (N10, N14, R360, R380)	**3** (N10, N14, R360, R380, R385)	**3** (N10, N14, R360, R380, R385)	**3** (N10, N14, R360, R380, R385)	**3** (N10, N14, R360, R380, R385)	**3** (N10, N14, R360, R325, R380, R385)
Secondary roads	**1** (13)	**2** (17)	**2** (19)	**1** (15)	**1** (13)	**1** (14)	**1** (14)	**1** (14)	**2** (15)
Urban centres	**1** (Kathu)	**1** (Kathu)	**1** (Kathu)	**1** (Kathu)	**1** (Kathu)	**1** (Kathu)	**1** (Kathu)	**1** (Kathu)	**1** (Kathu)
Settlements	**1** (mod-high)	**1** (mod-high)	**1** (mod-high)	**1** (mod-high)	**1** (mod-high)	**1** (mod-high)	**1** (mod-high)	**1** (mod-high)	**1** (mod-high)
Protected areas	**1** (Spitskop NR)	**1** (Spitskop NR)	**1** (Spitskop NR)	**1** (Spitskop NR)	**1** (Spitskop NR)	**1** (Spitskop NR)	**1** (Spitskop NR)	**1** (Spitskop NR)	**1** (Spitskop NR)
Mountains and drainage lines	**3** (Koranaberg, 4 streams)	**1** (low hills, 6 streams)	**1** (low hills, 6 streams, Orange)	**4** (Koranaberg, 6 streams, Orange)	**2** (lower Koranaberg, 6 streams, Orange)	**2** (lower Koranaberg, 6 streams, Orange)	**2** (lower Koranaberg, 6 streams, Orange)	**2** (lower Koranaberg, 6 streams, Orange)	**2** (lower Koranaberg, 6 streams, Orange)
Existing infrastructure	**4** (short stretch power line)	**5** (none)	**3** (road & power line)	**2** (road & power line)	**1** (road & power line)	**1** (road & power line)	**1** (road & power line)	**1** (road & power line)	**1** (road & power line)
Remoteness	**4**	**4**	**3**	**2**	**1**	**1**	**1**	**1**	**1**
Tourism	**1** (N10, N14, R360, R380)	**1** (N10, N14, R360, R380)	**2** (N10, N14, R360, R380)	**3** (N10, N14, R360, R380)	**3** (N10, N14, R360, R380)	**3** (N10, N14, R360, R380)	**3** (N10, N14, R360, R380)	**3** (N10, N14, R360, R380)	**3** (N10, N14, R360, R380)
TOTAL	**18**	**18**	**20**	**21**	**17**	**16**	**16**	**17**	**18**

8.1.12 Archaeological, Cultural and Historical

Initial Impact

Impacts that could occur to historically significant structures are limited to the physical removal of graves and historical buildings, vandalism or renovations to these structures resulting in permanent damage. There is presently no indication that any existing impacts to any historical structures have taken place and therefore there is no initial impact rating.

Additional Impact

As already established impacts to heritage sites occur as a result of physical destruction / disturbance to the land surface and alteration of the sense of place of sites of heritage significance. Although power lines affect long sections of landscape, the impact of the power lines themselves is minimal when the effect on the ground is evaluated. The most direct impact on the surface of the landscape will be the construction of the footing for the pylons. These will consist of concrete platforms set into excavated foundations. The direct impacts of these could be mitigated through pylon placement, as well as through the selection of the type of pylon design. Short-term impacts are also anticipated during the construction phase of the power line when construction camps and other activities could directly affect the surface of the surrounding areas.

It is therefore anticipated that the direct surface impact of power lines will be with the largest impact expected on the cultural landscape character.

Table 8-23: Archaeological, Cultural and Historical Additional Impact Assessment

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Cultural, Archealogical and Historical	Low	*Site only*	Long-Term	*Unlikely*	Very Low
	2	**1**	**4**	**2**	**1**

The additional impact with regard to Archaeological, Cultural and Historical features are rated as very low on all the alternatives. The reason for this is that no sites of high value could be identified. Paleontological and Archaeological sites could be affected if bedrock was to be disturbed during excavation activities associated with the placement of pylons and associated infrastructure.

Provided an archaeologist is involved during the walk-down planning phase of the project, NO IMPACTS are anticipated for this alternative.

Mitigation/management measures

The following mitigation measures are recommended:

- Placement of infrastructure should avoid potential sites of high archaeological sensitivity such as pans, rocky ridges and river beds.
- On uncovering a possible grave or burial site it is imperative that construction be ceased immediately. The area should be marked and a heritage practitioner should be informed immediately.
- Paleontological monitoring during excavation activities if bedrock is to be disturbed.
- Subject final alignment choice to a walk-down investigation one pylon positions have been determined.
- Re-alignment of power line to avoid grave site by at least 50 m should a grave or burial site be discovered.

Cumulative impact

If the abovementioned mitigation measures are implemented successfully, the cumulative impact of the power lines and the existing impacts should not result in an impact larger than was assessed for the initial impacts.

Residual Impact

If the above mitigation measures are implemented, and adhered to then the residual impact on the cultural and archaeological sites will possibly have a VERY LOW impact.

Preferred route selection

Three alternative alignments were also investigated for the Ferrum Power Line (Ferrum_Alternatives 3A – F was considered variations of the Aries_Alternative 3 alignment). Of these, two showed no signs of any heritage sites and therefore Options 2 & 3 are equally suitable for the placement of the power line. None of the sites are of such high heritage significance that it would prohibit the use of the other corridors.

8.2 OPERATIONAL PHASE

Once operational the line will conduct power along the approved route to the various substations. Operational and maintenance activities can include inspections via vehicle or helicopter and maintenance and repairs along the lines. The main impacts during the operational phase are the electromagnetic fields 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 electromagnetic fields (Appendix N). Due to the limited operational impacts – only those areas where impacts are expected are discussed below.

8.2.1 Soils and Land Capability

During the operational phase of the proposed development the activities and impacts identified in the construction phase will remain. Access roads especially are the one feature that remains prominent on site. During this phase the roads will not be used as regularly as during construction and no further impacts should occur if the roads are designed to the specified Eskom standards. If the mitigation measures described in the construction phase have been successfully implemented then no erosion should be present and the road should have no further impact. However if any problems do arise then the impact will have to be mitigated and repaired, in which case the impact will be rated the same as for the construction phase.

8.2.2 Terrestrial Ecology and Biodiversity

Flora

Once the operational phase is entered the flora within the servitude should be managed according to the Eskom Vegetation Management guideline, amongst others, which are included in Appendix L for reference. This guideline describes how any vegetation that poses a fire risk should be removed or cut to manage the risk. This impact is identical to the servitude clearance described in Section 8.1 under the additional impact and hence the impact remains a Moderate Impact.

Fauna

During the operational phase the power lines will be energised and according to the document on electric and magnetic fields associated with power lines (included in Appendix N for reference), there are no negative impacts to humans or fauna associated with electromagnetic fields. Therefore the only potential impact will be the electrocution of fauna, which in this case is avifauna which is assessed separately. Therefore the impact during operations to terrestrial fauna remains as assessed in Section 8.1, i.e. a Low impact.

8.2.3 Avifauna

Initial Impact

The initial impact remains as assessed in Section 8.1.

Additional impact

Once constructed the risk to avifauna from the operation of the power line includes bird collisions and electrocutions.

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components. The electrocution risk is largely determined by the pole/tower design. Several tower design alternatives have been proposed for this project. Potential tower types that could be utilised are self-supporting towers, cross-rope suspension towers and guyed-V towers. The topography will largely dictate the type of tower that will be used. **Due to the large size of the clearances on overhead lines of 400 kV, electrocutions are ruled out as even the largest birds cannot physically bridge the gap between energised and/or energised and earthed components**.

Collisions are probably the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines.

The impact to avifauna during the operational phase of the power line will **probably** be of a HIGH significance, acting in the medium term, and affecting the local extent. The impact *is going to happen.* The impact is categorised as **High**.

Table 8-24: Additional Impact on Avifauna (All alternatives)

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Collisions with power lines	HIGH	*Regional*	Medium Term	*It's going to happen*	**High**
	4	4	3	5	**3.7**

Mitigation/management measures

Refer to mitigation measures documented in Section 8.1. All the mitigation measures required to reduce the impact have to be installed during construction as in most cases they cannot be installed post-electrification.

Cumulative impact

The operation of the power line will contribute to additional bird deaths through collisions, and retard population growth by through the impact to natural habitat. The cumulative impact of existing power lines and the additional impact during the operational phase of the power lines will not result in an increase to the impact rating as given above, given mitigation measures proposed have been successfully implemented.

Residual Impact

Mitigation will ensure the reduction of risk but not likely affect the significance of impact.

Table 8-25: Residual Impact on Avifauna (All Alternatives).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on avifauna	HIGH	*Local Area*	Medium Term	*Very Likely*	**Moderate**
	4	3	3	4	**2.7**

8.2.4 Surface water and wetlands

Once the power lines are constructed to the specification and mitigation measures as described then there should be no further impact to surface water.

8.2.5 Visual

Once the power lines are strung as described in Section 8.1 above, this impact will remain and hence the impact assessment will remain as assessed during construction.

8.2.6 Socio-Economic Impact Assessment

Initial Impact

The initial impacts of existing activities on the existing socio-economic fabric were not assessed.

Additional Impact

During the operational phase there will probably not be significant in-migration into the area, but the residual impact from the construction phase may remain.

Table 8-26 represents the social change processes that have been identified and the possible social impacts that may result because of these processes. It also identifies the stakeholder group that is most likely to be affected by the process. Please refer to the attached SIA specialist report in Appendix H.

Table 8-26: Summary of socio-economic impacts.

Social Change Process	Possible Social Impact	Affected stakeholder group
Change in land use	• Long term conflict about management of servitudes • Safety hazards • Communication and arrangements surrounding access to properties & management of servitude – can be positive or negative	• Industry • Farmers • Vulnerable communities
Deviant social behaviour	• Acts of sabotage	• Vulnerable communities • Farmers • Industry • Tourism • Surrounding towns

An assessment of the identified impacts is given below.

Table 8-27: Assessment of identified impacts

Finding	Magnitude	Duration	Scale	Probability	Significance
Management of Servitude	MODERATE	MEDIUM TERM	*Local*	*Will Occur*	**High**
	3	3	3	5	**3**
Safety Hazard	LOW	MEDIUM TERM	*Local*	*Unlikely*	**Low**
	2	3	3	2	**1.1**

Mitigation/management measures

Refer to the mitigation measures described in the construction phase.

Cumulative Impact

Potential cumulative impacts:

- Will be felt by landowners with more than one servitude on their farm i.e. additional people wanting to access the servitude; additional fire risk; and more opportunity for invader species to take over.
- In areas where people have had negative experiences with the management of servitudes their expectation will be to have similar experiences, should Eskom not improve their service the impact will be felt much more intensely.

Residual Impact

With mitigation measures implemented the residual impact to the social environment as a result of operational activities is **probably** VERY LOW, affecting only the local environment, and acting in the long term. The impact will *likely* occur, and as such is categorised as a **Low** impact.

8.2.7 Archaeological, Cultural and Historical

The will be NO IMPACT to the Cultural Heritage Environment as a result of operational activities associated with any of the alternative power lines.

9 ALTERNATIVE SENSITIVITY ANALYSIS

In order to identify the most preferred alternative for each of the route options the impacts described above have been considered and a matrix prepared to select the best and feasible alternatives. When considering the impacts described above, a score was given to each alternative in relation to the size of the impact of that route.

The scoring method assigned the lowest impact of all the alternatives a score of 1 point. Remaining alternatives were rated in terms of undesirability by adding a two points in order to ensure a clear distinction between more desirable and undesirable corridors.

For the **Ferrum to Solar Park corridor** four alternatives were identified thus scoring was done in the following manner:

- Lowest impact of the four alternatives 1 point;
- Second lowest impact of the four alternatives 3 points;
- Third lowest impact of the four alternatives 5 points;
- Highest impact of the four alternatives 7 points;

Where alternatives scored equal, they both were assigned the same points.

The scores are tabled below. From the totals illustrated in the table it can be seen that the preferred alternatives for each of the routes are shown in green, the second option in yellow and the least preferred options in orange and red.

Each of these alternative routes is assessed against the environmental and social criteria in a sensitivity matrix shown in the table below. In order to ensure that the comparison is consistent, the ratings are given assuming the implementation of all the mitigation measures proposed in this report.

The sensitivity criteria that have been given a sensitivity rating of 0 indicate that the impact of this element is regarded as negligible.

Table 9-1: Alternative Sensitivity Matrix.

Environmental Element	FERRUM_ALTERNATIVES								
	1	**2**	**3**	**3A**	**3B**	**3C**	**3D**	**3E**	**3F**
Geology	0	0	0	0	0	0	0	0	0
Climate and Air Quality	0	0	0	0	0	0	0	0	0
Soil, land capability and topography	5	5	3	1	3	1	3	3	1
Surface water and wetlands	3	3	1	1	1	1	1	1	1
Groundwater	0	0	0	0	0	0	0	0	0
Terrestrial ecology	3	3	1	1	5	3	5	1	1
Avifauna	5	7	7	3	1	1	3	5	3
Socio – economic	5	5	3	3	1	3	3	3	1
Traffic assessment	0	0	0	0	0	0	0	0	0
Noise assessment	0	0	0	0	0	0	0	0	0
Visual assessment	5	5	7	3	1	1	3	7	5
Archaeological, cultural and historical	3	1	1	1	1	1	1	1	1
Infrastructural requirements	5	5	3	3	5	3	5	5	1
Overall Sensitivity Total Score	**34**	**34**	**26**	**16**	**18**	**14**	**24**	**26**	**14**

The Ferrum to Solar Park route originally only proposed two corridor alternatives. However, during the public and stakeholder consultation process in the Scoping and Draft EIR phases, stakeholders suggested additional corridor alignments largely proposed next to existing road (e.g. N14), railway and existing transmission line infrastructure. Assessment of these stakeholder suggested alternative corridors indicated that these alternatives may be the most suitable alternative corridors. During the Draft and Final EIR phase the last of these additional corridor alternatives Ferrum_Alternatives 3A, 3B, 3C, 3D, 3E and 3F) were investigated by the specialist team and assessment of these alternatives indicated the following:

- **Ferrum_Alternatives 1 and 2 was the least preferred alternative alignments**. These corridor alignments are the shortest alignments (212 km and 245 km respectively), however, these corridors would affect the highest coverage of shifting sands and historic sand dunes compared to the other corridor alternatives. The potential impact on these soils and sand dunes, which are very sensitive to disturbance and ultimately erosion, is envisaged to be higher than for the other alternatives that follow linear infrastructure where an impact is already felt. This is especially relevant during the construction phase where long stretches of maintenance roads will need to be constructed. The prevalence of shifting sands in these areas also represent a potential risk to the stability of the pylons and the power line overall. A notable social impact is also anticipated as these corridors cuts through the interior of most farm portions along these routes, instead of being aligned along the farm boundaries, which would largely be uneconomical along Ferrum_Alternative 1 and 2 due to the number of strain towers that would be needed.

- **Ferrum_Alternatives 3 and 3E also emerged as undesirable corridor alternatives**. The benefit of Ferrum_Alternative 3 and all its variation alternatives (3A – 3F) lies in the fact that these alternative corridors align with the N14 national road for most of its length. The zone of influence is thus smaller compared to Ferrum_Alternatives 1 and 2 due to the fact that these corridors are aligned with infrastructure that already have an impact on the immediate surrounding environment. Ferrum_Alternative 3 and 3E however deviates northward Between Upington and Olifantshoek. As with the Ferrum_Alternatives 1 and 2 a notable potential impact exists on the soils and historic sand dunes northwest of Olifantshoek. Ferrum_Alternative 3E further meanders through a low valley in the *Langeberg* hills. Although this route is not technically unfeasible, the presence of sensitive vegetation and difficult terrain makes it a less preferred corridor alternative. Several landowners along this route also indicated their strong opposition to the authorisation of Ferrum_Alternative 3E due to reasons including issues with maintenance procedures associated with existing Eskom servitudes, presence of a game/hunting farm, opposition against bisecting of farm portions, personal preferences and a cumulative negative sentiment towards existing Eskom infrastructure, and existing and future mining activities.

- **Ferrum_Alternative 3B and 3D emerged as a feasible, but less desirable alternative**. The benefit with these alternatives is its alignment along the N14 and existing transmission line infrastructure which will result in a less significant negative environmental impact. Ferrum_Alternatives 3B and 3D both deviates from the N14 in an easterly to south-easterly direction and will run over the hills south of Olifantshoek. Impacts on soils are less significant in this area, however the hills around Olifantshoek have higher concentrations of sensitive and protected tree species when compared to the lower lying areas where Ferrum_Alternatives 3A, 3C and 3F crosses. This has proven to be the distinguishing factor between the corridor 3 variation alternatives. Potential avifauna and social impact exist along these two alternatives, but can be mitigated to acceptable levels if mitigation measures are implemented as recommended. The visual impacts along Ferrum_Alternative 3 and variation alternatives are notable and few mitigation measures can be implemented to minimise the impact. However aligning these alternatives along existing linear infrastructure is expected to have a cumulative impact not much more significant that the existing visual impact.

- **Ferrum_Alternatives 3C and 3A have been identified as suitable and feasible alternative** alignments when compared to the other corridor alternatives. The alignments of these two alternatives follow the N14 for most of their length. Where these two alternatives deviate from the N14 they cross the hills south of Olifantshoek through lower lying areas between the hills. These lower lying areas do have concentrations of protected tree species for which a permit will have to be applied for to trim or remove some of the trees, but the concentrations are lower than compared to the trees along Ferrum_Alternative 3B and 3D. Potential avifauna and social impact existing along these two alternatives, but can be mitigated to acceptable levels if mitigation measures are implemented as recommended. The visual impacts along Ferrum_Alternative 3 and variation alternatives are notable and few mitigation measures can be implemented to minimise the impact. However aligning these alternatives along existing linear infrastructure is expected to have a cumulative impact not much more significant that the existing visual impact.

- **Ferrum_Alternative 3F has emerged as the preferred corridor alternative.** Even though Ferrum_Alternative 3F and 3C was rated as the lowest in terms of their overall sensitivity score (see Table 9-1), the distinguishing factor between these two alternatives is the fact that Ferrum_Alternative 3F follows the N14 for the longest part of its length and where the corridor deviates from the N14 it meanders closely past the town of Olifantshoek within the municipality property where the vegetation sensitivity and concentration of protected trees are very low. The municipal property has been impacted considerably by urbanisation and overgrazing. Consultation with the municipality planning division and councillors have indicated a willingness to engage with Eskom in the development of the required infrastructure across municipal property, which is in contrast to the unwillingness of surrounding landowners to engage with Eskom.

  Potential avifauna and social impact exist along these two alternatives, but can be mitigated to acceptable levels if mitigation measures are implemented as recommended. The visual impacts along Ferrum_Alternative 3F are notable and few mitigation measures can be implemented to minimise the impact. However aligning these alternatives along existing linear infrastructure is expected to have a cumulative impact not much more significant that the existing visual impact.

  Consultation with stakeholders of the Kumba Sishen mine revealed that the mine have relocated the existing 275 kV line to a position along their western boundary (see letter received in Appendix E). The Kumba mine has indicated that they would prefer the proposed Ferrum to Solar Park transmission line infrastructure to be located within the corridor already approved. In subsequent consultation with the Kumba Sishen mine they have indicated that they do not support the crossing of the proposed power line across farms *Brooks* (568) and *Bredenkamp* (567), which has been acquired by the Kumba Sishen Mine. It is therefore proposed that for Ferrum_Alternative 3F multi-circuit towers be installed on the proposed 2^{nd} Ferrum-Garona 400 kV power line (along which this Solar Park-Ferrum power line would be routed) across farms *Brooks* (568/Re), *Bredenkamp* (567/Re), *Wright* (538/Re) and *Wright* (538/1), and thereafter returning to 2 separate power lines. The proposed 2^{nd} Ferrum-Garona 400 kV power line and the proposed Solar Park-Ferrum 400 kV power line will thus be housed on the same multi-circuit tower across these four farms.

10 CONCLUSION AND WAY FORWARD

Eskom appointed Zitholele Consulting to undertake the EIA for the proposed construction and operation of the 400 kV Solar – Ferrum power line. This EIA study was undertaken with the aim of investigating potential impacts both positive and negative on the biophysical and socio-economic environment and identifying issues, concerns and queries from I&APs. This Revised Final Environmental Impact Assessment Report documents the process followed and the findings and recommendations of the study. Additionally attached to this document is an Environmental Management Programme that has been developed in order to implement the proposed mitigation measures.

10.1 Impact Summary

The environmental impacts for each of the components for the proposed project alternatives have been summarised in Section 8 and 9. The following broad conclusions can be drawn from the impact assessment.

- The bulk of the study area is undisturbed grazing land with little existing infrastructure or impacts;
- The area around Kathu has been developed into urban and mining centres due to the availability of iron ore;
- Additional impacts sustained during the construction phase will not result in a more significant cumulative impact to the environment if mitigation measures suggested in this report is implemented;
- During the operational phase negative impacts sustained will be in the LOW to MODERATE range. The most significant impact will be to Avifauna and Visual; and
- For the route the respective Ferrum_Alternatives 3F is the preferred alternative, followed by suitable alternatives 3A and 3C.

10.2 ENVIRONMENTAL ASSESSMENT PRACTITIONER OPINION ON PREFERRED ALTERNATIVES

As discussed in this report the impacts associated with the power line alternatives are all relatively similar in nature, however **Ferrum_Alternative 3F (Figure 10-1) alternative is recommended for reasons as discussed in section 8 and 9 of this Revised Final Impact Assessment Report.** The EAP has no objection with the construction and operation of the 400 kV Solar – Ferrum power lines by means of the proposed alignments, provided that the Environmental Management Programme is implemented throughout construction and operation of the facility.

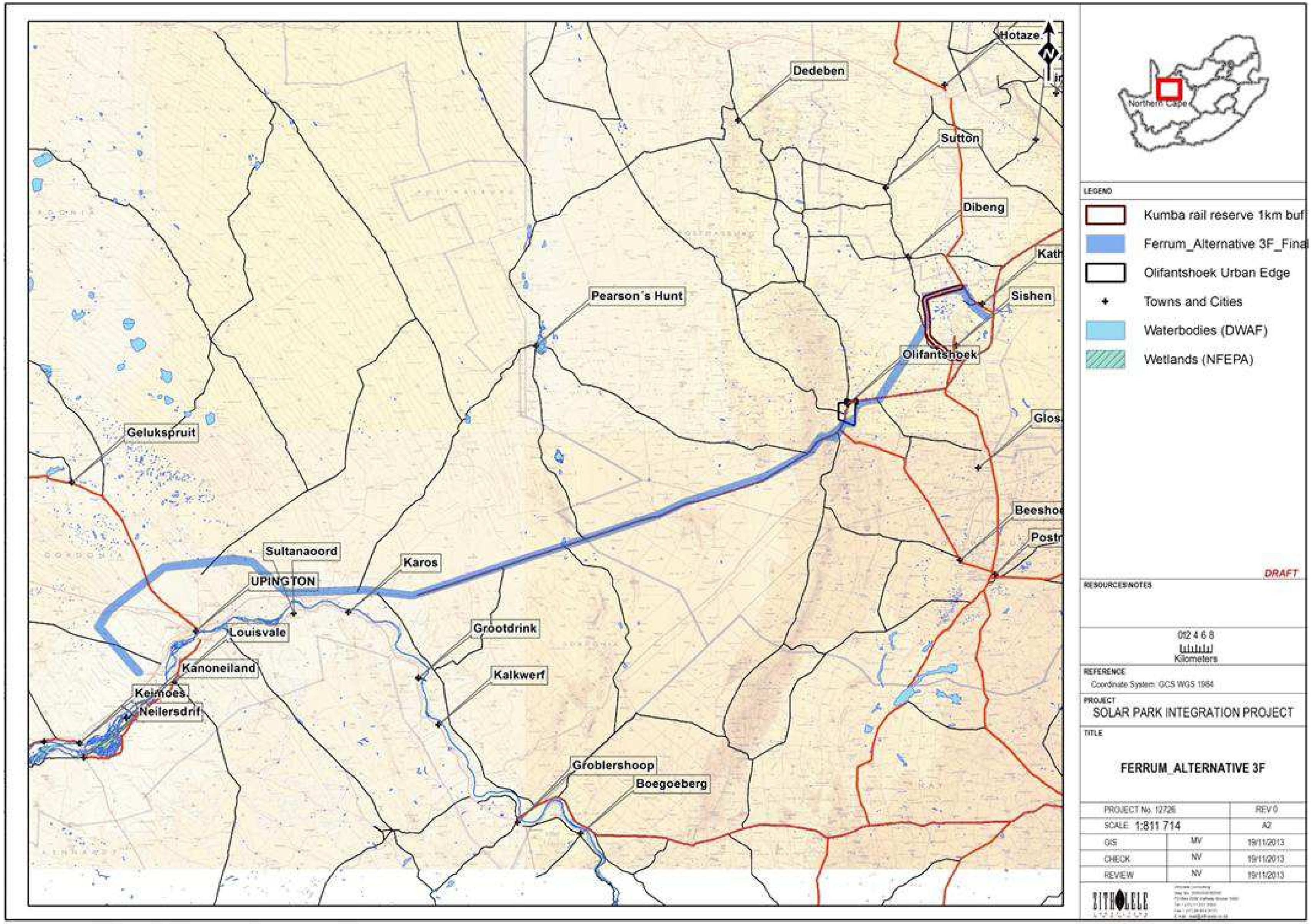

Figure 10-1: The preferred corridor alternative - Ferrum_Alternative 3F.

10.3 Way Forward

The way forward recommended by this study is as follows:

- The FEIR and EMPr is hereby submitted to the Competent Authority, DEA, commenting authorities and all registered I&APs for comment and review;
- All I&APs has a period of 30 days to review and submit comments to the EAP;
- Once all comments have been collated and responded to the updated information will be submitted to DEA for consideration;
- Upon receipt of the Environmental Authorisation Zitholele will notify all I&APs on the stakeholder database of the DEA's decision by means of letters and an advertisement in the local and regional newspapers; and
- The Eskom negotiation process with affected landowners will then commence.

ZITHOLELE CONSULTING (PTY) LTD

Dr Mathys Vosloo Warren Kok

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Appendix A: EAP CV

Appendix B: Integrated EIA Application Form, EAP Declaration and DEA acceptance letter

Appendix C: Newspaper Advertisements and Site Notices

Appendix D: I&AP Database

Appendix E: Comments and Responses Report

Appendix F: Background Information Document

Appendix G: Route Selection and Screening Report

Appendix H: Specialist Studies

Appendix I: Environmental Management Programme

Appendix J: EA and amended EA for the Solar Park CSP site

Appendix K: CSP "power island" and electrical infrastructure layout

Appendix L: Eskom Standards, Procedures and Guidelines

Appendix M: EIA Maps

Appendix N: Other Relevant Information