DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED MAHIKENG MAIN TRANSMISSION SUBSTATION AND A PROPOSED 400KV PLUTO-MAHIKENG POWERLINE WITHIN THE MERAFONG CITY LOCAL MUNICIPALITY OF THE GAUTENG PROVINCE AND THE DITSOBOTLA, RAMOTSHERE MOILOA, JB MARKS AND MAFIKENG LOCAL MUNICIPALITIES OF THE NORTH WEST PROVINCE

JULY 2018

Table 1: Document Control

Degree of Confidentiality	Client Confidentiality
Title	Draft Environmental Impact Assessment Report for the proposed Mahikeng Main Transmission Substation and a proposed 400kV Pluto-Mahikeng Powerline within the Merafong City, Ramotshere Moiloa, Ditsobotla, JB Marks And Mafikeng Local Municipalities, South Africa.
Date of Issue	July 2018
No. of Pages	360
Consultant details: **BAAGI ENVIRONMENTAL CONSULTANCY CC** PostNet Suite x412 Private Bag x4 Menlo Park, 0102 Tel: 012 993-0756 Fax: 012 993-0743 Email: tinashe@baagi.co.za	Client details: **ESKOM HOLDINGS SOC LIMITED** P.O Box 1091 Johannesburg, 2000 Tel: 011 800 4902 Fax: 086 574 0963 Email: VilakazS@eskom.co.za
Compiled by	Mr. Tinashe Maramba
Peer reviewed by	Mr. Lordwick Makhura
External Peer reviewed by	
Report Number	06/2018/Ver 2
Keywords	EIA, PPP, DSR, Specialist, I&APs, Gauteng,North West, Eskom,BOSA
Issue Number	1.0
Copy Number	1.0

The EAP and Specialists act as independent Practitioners in this process and perform the work relating to the project in an objective manner, even if this results in views and findings that are not favourable to the applicant.

Please submit your comments to the Public Participation Team:

Imaginative Africa (Pty) Ltd

P.O Box 61164

Pierre Van Ryneveld, 0157

Cell: 083 377 9112

Tel: 012 662 2843

Fax: 086 415 5011

Email: nicolene@imaginativeafrica.co.za

EXECUTIVE SUMMARY

1. INTRODUCTION

The growing demand for electricity places increasing pressure on Eskom Holdings SOC Limited's existing power generation and transmission capacity. Eskom is committed to implementing a sustainable energy strategy that complements the policies and strategies of National Government. The aim of the project is to mitigate the current electricity supply constraints and contribute towards energy security in the long run by enhancing the transmission of electricity in the North West area.

The Proposed Mahikeng Main Transmission Substation (MTS) and 1x400kV Pluto-Mahikeng Powerline Project includes the following activities, but are not limited to:

- Establishing the Mafikeng MTS and design for an end state of 3x 500MVA 400/132kV transformers and 2 of the 500MVA transformers on commissioning;
- Designing for an end state of 8x 132kV and equip 3 of the 132kV feeder bays on commissioning;
- The erection of a communication tower at the Mahikeng Main Transmission Substation;
- The construction of access roads; and
- The establishment of an approximately 250km 400kV transmission powerline from Pluto Main Transmission Substation to the proposed Mahikeng Main Transmission Substation.

2. WHY IS AN ENVIRONMENTAL IMPACT ASSESSMENT PROCESS NECESSARY?

The Department of Environmental Affairs (DEA) identified certain activities that may have a detrimental impact on the environment. In order to ensure that the potential negative and positive impacts are investigated, understood, and mitigated/enhanced the DEA promulgated regulations under the National Environmental Management Act (Act 107 of 1998) that (a) identify the activities that require a Basic Assessment (BA) or Full Scoping and Environmental Impact Assessment (S&EIA); and (b) govern how these studies must be conducted. These regulations are called the Environmental Impact Assessment (EIA) Regulations of the 8th of December 2014 as amended on the 4th of April 2017 and can be found in Government Gazette No. 40772.The regulations consist of the following:

- Regulation 326 – Environmental Impact Assessment Regulations.
- Regulation 327 – Listing Notice 1.
- Regulation 325– Listing Notice 2.
- Regulation 324 – Listing Notice 3.

These regulations are used by Applicants (Eskom in this case) and Environmental Assessment Practitioners (EAPs) to decide what and the nature of studies that need to be conducted.

In order to construct and operate a Transmission Power Line and a Substation, a number of the activities in Listing Notice 1, Listing Notice 2 and Listing Notice 3 are triggered. This means that Eskom needs to conduct a full Scoping and Environmental Impact Assessment and submit it to the Competent Authority (CA). The CA then uses the information in the report to decide whether the activity (the building and operation of a Transmission Power Line and Substation) can be authorised (given the go-ahead) and what conditions are necessary to protect the receiving natural and built environment, or if the proposed project will be too detrimental to the environment and must be stopped from being implemented.

3. ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

An EIA process consists of a number of phases (refer to the figure 1 below).

a. Scoping Phase

The EIA process commences with a Scoping Phase. The Scoping Phase is used to:

- Describe the proposed activity, including the need and desirability of the activity.
- Describe the alternatives that have been identified. (Alternatives are very important, since this allows the EAP to find the best possible environmental, social and economic solution to the project later on in the EIA).
- Inform and consult with the people directly affected and those who have interest or jurisdiction over the area where the proposed activity will take place. These people and organisations are called Interested and Affected Parties (I&APs). This process is called the Public Participation Process (PPP).
- Gather background information about the proposed activity, the receiving environment and the socio-economic setting of the area.
- Conduct basic reconnaiscance studies (mostly desktop studies) to understand the issues that that need to be investigated further and in more detail. This proces allows for the early identification of red flag or fatal flaws that could result in a change of scope and subsequently, would need to be communicated to the client and/or the competent authority.
- Identify if there are any sensitivities. These are project challenges that are severe and cannot be immediately mitigated against thereby posing a threat to the continuation of the project in its entiety or the use of a particular alternative.
- Describe what in-depth studies are required to investigate the issues identified. The aim is to find out exactly what the potential impacts are, how severe they are and how (if at all) they can be mitigated. In the same way, if there are positive impacts, ways are developed to enhance these positive impacts.
- Develop a Plan of Study (PoS) for the EIA phase of the study.

The outcome of the Scoping Study is a Final Scoping Report (FSR) that is submitted to the CA – in this case being the national department. Section 24 (c) (d) (iii) states that if an activity is carried out by a statutory body, excluding any municipality, performing an exclusive competence of the national sphere of government then the minister shall be identified as the competent authority.

The information that the Scoping Report (SR) should contain is described in Appendix 2 of Regulation 326 of the EIA Regultions, 2014, as amended.

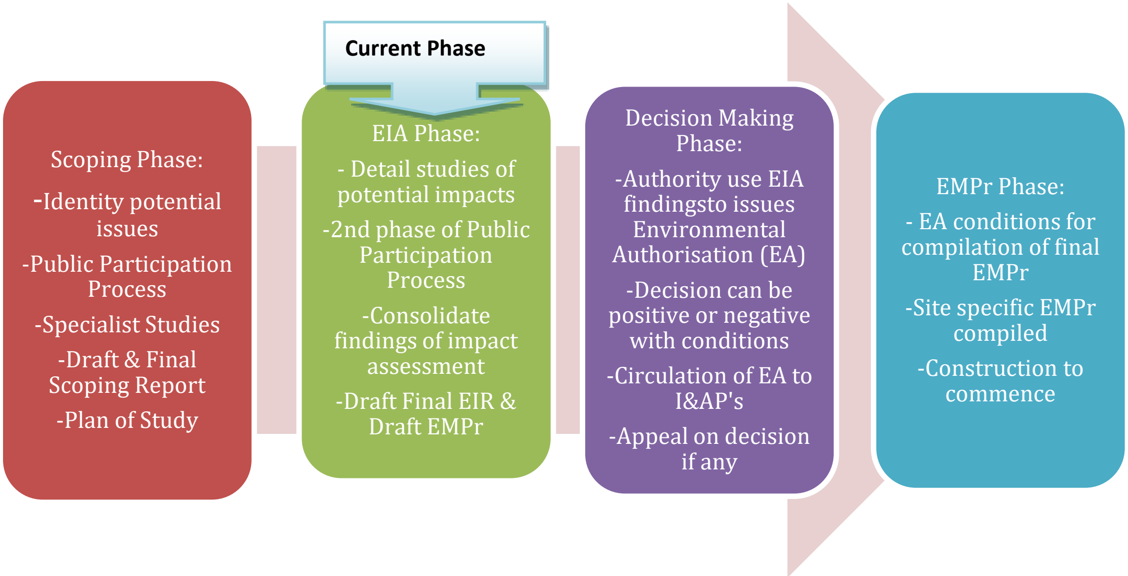


Figure 1: Phases of an Environmental Impact Assessment Phase

b. Environmental Impact Assessment Phase

During this phase a number of in-depth specialist studies (spanning both the biophysical environment and the social environment) are conducted. These studies focus on the potential negative impacts that the project may have and how these impacts can be eliminated, minimised, mitigated, or managed, and how positive impacts can be enhanced. The EAP uses this information, along with the information gathered during the Public Participation Process to compile a report that will allow the CA to make a decision as to whether the project should be allowed or not.

c. Decision-Making Phase

The outcome of this review by the CA is called an Environmental Authorisation (EA). Despite its name, it can be used to either authorise an activity (give the go-ahead) or decline an activity.

d. Appeal Phase

Once the EA is handed to the Applicant, all registered Interested and Affected Parties (I&APs) are informed and a copy of the EA is provided to them. Should any party or parties wish to contest the outcome of the EA they can lodge an Appeal against the Decision that was made by the Competent Authority. There are certain requirements that the appellant needs to adhere to. These can be found in Chapter 2 of the

National Appeal Regulations of 2014, as amended. The EA also contains a summary explaining how a party may appeal the decision.

e. Construction Environmental Management Programme Phase

Once the EIA phase has been completed, the EAP and the specialists conduct a "walk-down" of the entire site (or line) to assist in the compilation of a Construction Environmental Management Programme Report (CEMPr). At this stage, the EAP and specialist team already have the layout plan of the activity. They also have a document called a preliminary staking table which shows them where the engineers would ideally place each tower.

The function of the EAP and specialists is to look at each tower position and see what the impacts might be in that precise location. The EAP and specialists will then either (a) describe what special measures (if any) that need to be taken to ensure that the environment is protected, or (b) propose an alternative position for the tower position.

The findings of this "walk-down" are taken up into the CEMPr. This document is a "catch-all" that combines the conditions of the EA, the requirements of the various landowners and the recommendations of the EAP and specialists.

Once compiled, the CEMPr is submitted to the CA who reviews the document and authorises it. This now becomes a document that is legally binding to the applicant and subcontractors. The EMPr is a "living document" and can be altered to take into account situations that were not foreseen during the compilation of the document. These alterations must be submitted to the CA and authorised before it can be implemented.

At this time or before, certain permits and licenses are also applied for, such as a Heritage Permit, Tree Removal Permit, etc. as required.

f. Public Participation Process

A Public Participation Process (PPP) is required as part of an EIA as per Sections 39 to 44 of Chapter 6 of Regulation 326 of the 2014 EIA Regulations, as amended.

According to the 2014 Regulations, as amended in April, 2017, a process must be designed that will ensure that I&APs are given adequate information and allowed to participate (raise issues, make comments, ask questions, etc.) during both the Scoping and EIA Phases.

Furthermore, the Draft Environmental Impact Assessment Report (DEIAR) must be made available to Registered I&APs and the general public alike to study and comment on. These comments and the responses given thereto; are then worked into the Final Environmental Impact Assessment Report that will be submitted to the CA.

The following activities will be undertaken during this Environmental Impact Assessment Phase:

- Notice boards will be erected at places conspicuous to and accessible by the public at the boundary, on the fence or along the alternative corridors. Giving a written notice and placing an advertisement in at least one provincial newspaper or national newspaper.
- Registration of Interested and Affected Parties (I&APs).These are all persons who have submitted written comments or attended meetings with the proponent, applicant or the EAP.This also includes people that have requested the proponent, applicant or EAP, in writing, for their names to be placed on the register, and all organs of state that have jusridiction in respect of the activity to which the application relates.
- Distribution of a Background Information Document (BID) to the occupiers of the alternative substation sites and the alternative corridor routes, the owner or person in control of the land adjacent to the alternative substation sites and the alternative corridor routes, the municipality councillor of the wards affected, the municipality, the organs of state having jurisdiction in respect of any aspect of the activity and any other party as required by the competent authority.
- Public and Stakeholder Meetings will be held within the areas of the proposed alternative substation sites aswell as the alternative corridor routes.
- Compilation of an Issues and Responses Report (IRR). I&AP's are entitled to comment, in writing, on all reports or plans submitted to such parties during the public participation process and to bring to the attention of the proponent or applicant any issues which that party believes may be of significance to the consideration of the application, provided that the I&AP's disclose any direct business, financial, personal or other interest which they may have in the approval or refusal of the application. The applicant must ensure that the comments of I&AP's are recorded in reports and plans and that such written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority in terms of these Regulations.

The DEIAR will be available for public scrutiny for a period of at least 30 days. The comments received from I&AP's during the comment period must reach the EAP within 30days of making the DEIAR available.

The comments received on the DEIAR will be used in the preparation of the Final EIAR that will be submitted to the Competent Authority, for review and decision-making. The CA can make one of three decisions, namely:

- Request for further information that will assist in the CA making a decision.

- Issue the Environmental Authorisation i.e. give the go-ahead to Eskom to construct the powerline and substation or reject the continuation of the proposed development.

4. ALTERNATIVES

Alternatives, in relation to a proposed activity, relate to different ways of achieving the general purpose and requirements of the activity, which may include alternatives to the property on which or location where the activity is proposed to be undertaken, the type of activity to be undertaken, design or layout of the activity, technology to be to be used in the activity or the operational aspects of the activity and including the option of not implementing the activity. According to the EIA Regulations, it is required to investigate as many feasible alternatives as possible. This is also best practice in environmental management worldwide. During the EIA Phase, the EAP, Specialists and the I&AP's investigate all the possible alternatives and endeavour to find out if there are any "red flags". The alternatives that are not eliminated at this stage are taken forward to the EIA Phase.

In the case of this project, the following were considered to be the project alternatives:

- Technology Alternative (overhead power lines vs. underground power lines).
- Alignment Alternatives (there were three alternative corridors).
- No-Go Alternative (meaning the project is not executed and the status quo remains the same).
- Site alternatives (there are three site alternatives for the Substation at present).

5. CONCLUSION

The aim of this DEIAR is to provide the Interested and Affected Parties and authorities the opportunity to assess the proposed project, the receiving environment, the alternatives investigated, the preliminary issues identified, and the plan of how the Environmental Impact Assessment Phase will be dealt with (this is contained in the Plan of Study for EIA). All Interested and Affected Parties are invited to read and comment on this report within the specified timeframe (please refer to the figure below).

<u>Process as per December 2014 Regulation, as amended in April 2017</u>

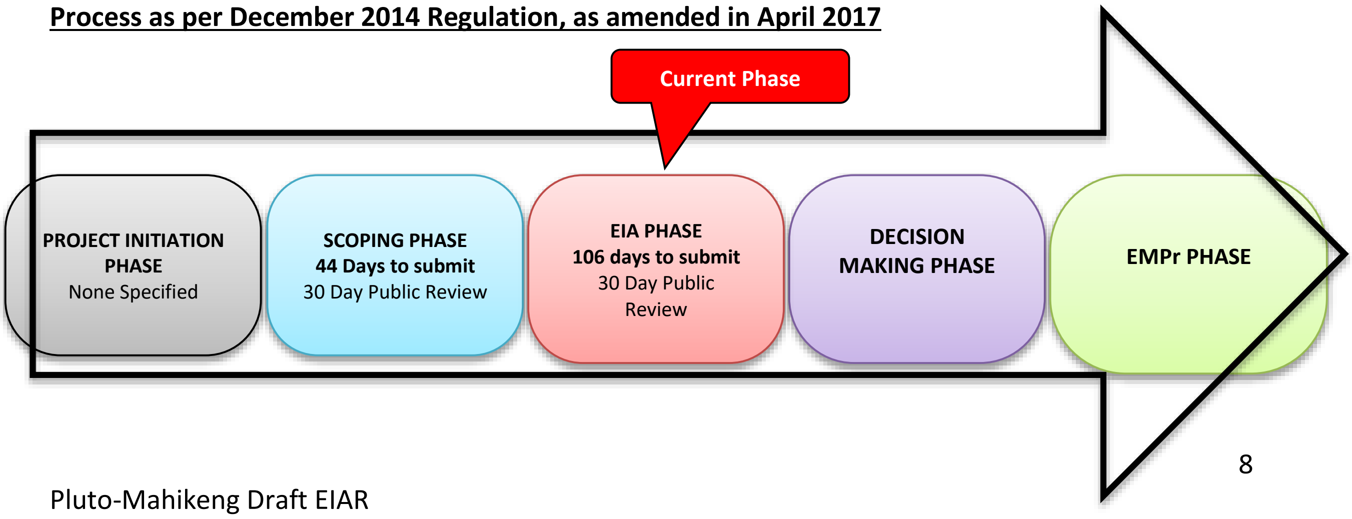


Figure 2: Times Frames of the Environmental Impact Process

Comments received on the DEAIR will be incorporated into the Final EIAR and will be submitted to the Competent Authority for review and subsequent decision-making.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Table 2: Abbreviations

BID	Background Information Document
BOSA	Botswana South Africa
BPC	Botswana Power Corporation
CA	Competent Authority
DEA	National Department of Environmental Affairs
DSR	Draft Scoping Report
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
FSR	Final Scoping Report
I&AP's	Interested and Affected Parties
IDC	Integrated Development Plan
IRR	Issues and Responses Report
kV	Kilovolt
MTS	Main Transmission Station
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEM:AQA	National Environmental Management Air Quality Act (Act No. 39 of 2004)
NEM:PA	National Environmental Management Protected Areas Act (Act 59 of 2003)
NEM:WA	National Environmental Management Waste Act (Act 59 of 2008)
NFEPA	Nation Freshwater Ecosystem Priority Area
NWA	National Water Act (Act No. 36 of 1998)
SABAP1	The Southern African Bird Atlas Project
SADC	Southern African Development Centre
SAHRA	South African Heritage Resources Agency
SAPP	South African Power Pool
SIA	Social Impact Assessment
SPP	Species pluralis
SR	Scoping Report
WHO	World Health Organisation
WM	With Mitigation
WOM	Without Mitigation

NAMES AND COLOUR CODES OF THE CORRIDOR ALTERNATIVES

Pluto-Mahikeng Alternative corridor 1 (Green Corridor)

Pluto-Mahikeng Alternative corridor 2 (Purple Corridor)

Pluto-Mahikeng Alternative corridor 3 (Orange Corridor)

NAMES AND COLOUR CODES OF THE SUBSTATION SITE ALTERNATIVES

Site A	Site Alternative 1 (Red Site)
Site B	Site Alternative 2 (Yellow Site)
Site C	Site Alternative 3 (Green Site)

Table 3: Table of Sections Based on the National Environmental Management Act, 1998 (Act 107 Of 1998), and the 2014 EIA Regulations of 08 December 2014, as amended on the 07th of April 2017.

Taken from Appendix 3 of The EIA Regulations of 08 December 2014		
Section in Regulation	**Description in EIA Regulation**	**Chapter in This Report**
An environmental impact Assessment Report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include -		
(a)	**Details of -**	
(a)(i)	The EAP who prepared the report; and	Chapter 1
(a)(ii)	The expertise of the EAP, including a curriculum vitae;	Appendix A
(b)	**The location of the activity, including -**	
(b)(i)	The 21-digit Surveyor General code of each cadastral land parcel;	Chapter 3
(b)(ii)	Where available, the physical address and farm name;	Chapter 3
(b)(iii)	Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Chapter 3
(c)	**A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is -**	
(c)(i)	A linear activity, a description and coordinates of the corridor in which the activity is to be undertaken;	Chapter 4
(c)(ii)	On land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Chapter 4
(d)	**A description of the scope of the proposed activity, including -**	
(d)(i)	All listed and specified activities triggered;	Chapter 2
(d)(ii)	A description of the activities to be undertaken, including associated structures and infrastructure;	Chapter 3

(e)	**A description of the policy and legislative context within which the development is proposed, including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process;**	**Chapter 2**
(f)	**A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location;**	**Chapter 4**
(g)	A motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	
(h)	**A full description of the process followed to reach the proposed preferred activity, site and location within the site, including -**	**Chapter 1**
(h)(i)	Details of all the alternatives considered;	Chapter 4
(h)(ii)	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Chapter 7 & 13
(h)(iii)	A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Chapter 7
(h)(iv)	The environmental attributes associated with the alternatives focusing on geographical, physical, biological, social, economic, heritage and cultural aspects;	Chapter 6
(h)(v)	**The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these -**	
(h)(v)(aa)	Can be reversed;	Chapter 8
(h)(v)(bb)	May cause irreplaceable loss of resources; and	Chapter 8
(h)(v)(cc)	Can be avoided, managed or mitigated.	Chapter 8
(h)(vi)	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives.	Chapter 13

(h)(vii)	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Chapter 13
(h)(viii)	The possible mitigation measures that could be applied and level of residual risk;	Chapter 11
(h)(ix)	If no alternative development footprints for the activity were investigated, the motivation for not considering such;and	Appendix f
(h)(x)	A concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	Chapter 14
(i)	**A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the site as contemplated in the accepted scoping report through the life of the activity, including -**	
(i)	A description of all the environmental issues and risks that were identified during the environmental impact assessment process; and	Chapter 13
(ii)	An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Chapter 13
(j)	**An assessment of each identified potentially significant impact and risk, including-**	
(i)	Cumulative Impacts;	Chapter 9
(ii)	The nature, significance and consequences of the impact and risk;	Chapter 13
(iii)	The extent and duration of the impact and risk;	Chapter 13
(iv)	The probability of the impact and risk occurring;	Chapter 13
(v)	The degree to which the impact and risk can be reversed;	Chapter 13
(vi)	The degree to which the impact and risk may cause irreplaceable loss of resources; and	Chapter 13
(vii)	The degree to which the impact and risk can be mitigated;	Chapter 13
(K)	**Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these**	**Chapter 11**

	Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	
(l)	An environmental impact statement which contains-	
(i)	A summary of the key findings of the environmental impact assessment;	Chapter 14
(ii)	A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers;and	Chapter 1
(iii)	A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Chapter 14
(m)	Based on the assessment, and where applicable, recommendations from specialists reports, the recording of proposed impact management ooutcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	Chapter 11
(n)	The final proposed alternatives which respond to the impact management measures, avoidance and mitigation measures identified through the assessment;	Chapter 11 & 13
(o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Chapter 11 & 13
(o)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	
(q)	A reasoned opinion as to whether the proposed activity should or should not be authorised , and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	
(r)	Where the proposed activity does not include operational aspects, the period for which the environmenetal authorisation is required	

	and the date on which will be concluded and post construction monitoring requirements finalised;	
(s)	**An undertaking under oath or affirmation by the EAP in relation to -**	
(i)	The correctness of the information provided in the report;	
(ii)	The inclusion of comments and inputs from stakeholders and interested and affected parties;	
(iii)	The inclusion of inputs and recommendations from the specialist reports where relevant;	
(iv)	Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties;	
(t)	**Where applicable, details of any financial provision for the rehabiliatation, closure, and ongoing post decommissioning management of negative environmental impacts;**	
(u)	**An indication of any deviation from the approved scoping report, including the plan of study, including-**	
(i)	Any deviation from the methodology used in determining the significance of potential environmental impacts and risk; and	
(ii)	A motivation for the deviation;	
(v)	**Any specific information that may be required by the competent authority; and**	
(w)	**Any other matters required in terms of section 24(4) (a) and (b) of the Act.**	

1. INTRODUCTION

Eskom Holdings SOC Limited is responsible for providing reliable and affordable power to the Republic of South Africa (RSA). The company is divided into Generation, Transmission and Distribution divisions and together Eskom generates approximately 95% of electricity used in South Africa. Eskom generates, transmits and distributes electricity to industrial, mining, commercial, agricultural, and residential customers and redistributors. The majority of the demand is however in South Africa, and therefore, additional power stations and power lines need to be constructed in order to meet the growing electricity demand.

This growing demand for electricity places increasing pressure on Eskom's existing power generation and transmission capacity, thus Eskom identified the need to develop more infrastructure in order to improve the reliability of electricity supply to the country, and in particular to provide for (a) the growth in electricity demand in the North West Province and (b) prepare the electricity grid for an injection of electricity from proposed pumped storage schemes in Botswana. In doing so, Eskom is committing to implementing a sustainable energy strategy that complements the policies and strategies of the National Government of RSA.

For this reason, Eskom has identified the need to develop a new 400kV Transmission Power Line that will run from the Pluto Substation near Carletonville in the Gauteng Province traversing the North West and will connect into the proposed Mahikeng Main Transmission Substation (MMTS) near Miga in the North West (Refer to figure 3). This development will ensure a steady electricity supply in the North West area.

The study area falls within the jurisdiction of three District Municipalities (namely the West Rand District Municipality (where the proposed line traverses the Merapong Local Municipality), the Ngaka Modiri Molema District Municipality (where the proposed line traverses the Ditsobotla and the Mahikeng Local Municipality) and Dr. Kenneth Kaunda District Municipality (where the proposed line traverses the JB Marks Local Municipality). The proposed Main Transmission Substation (MTS) site is located in the North West Province within the Ngaka Modiri Molema District Muncipality under the jurisdiction of the Mahikeng Local Municipality (refer to figure 6).

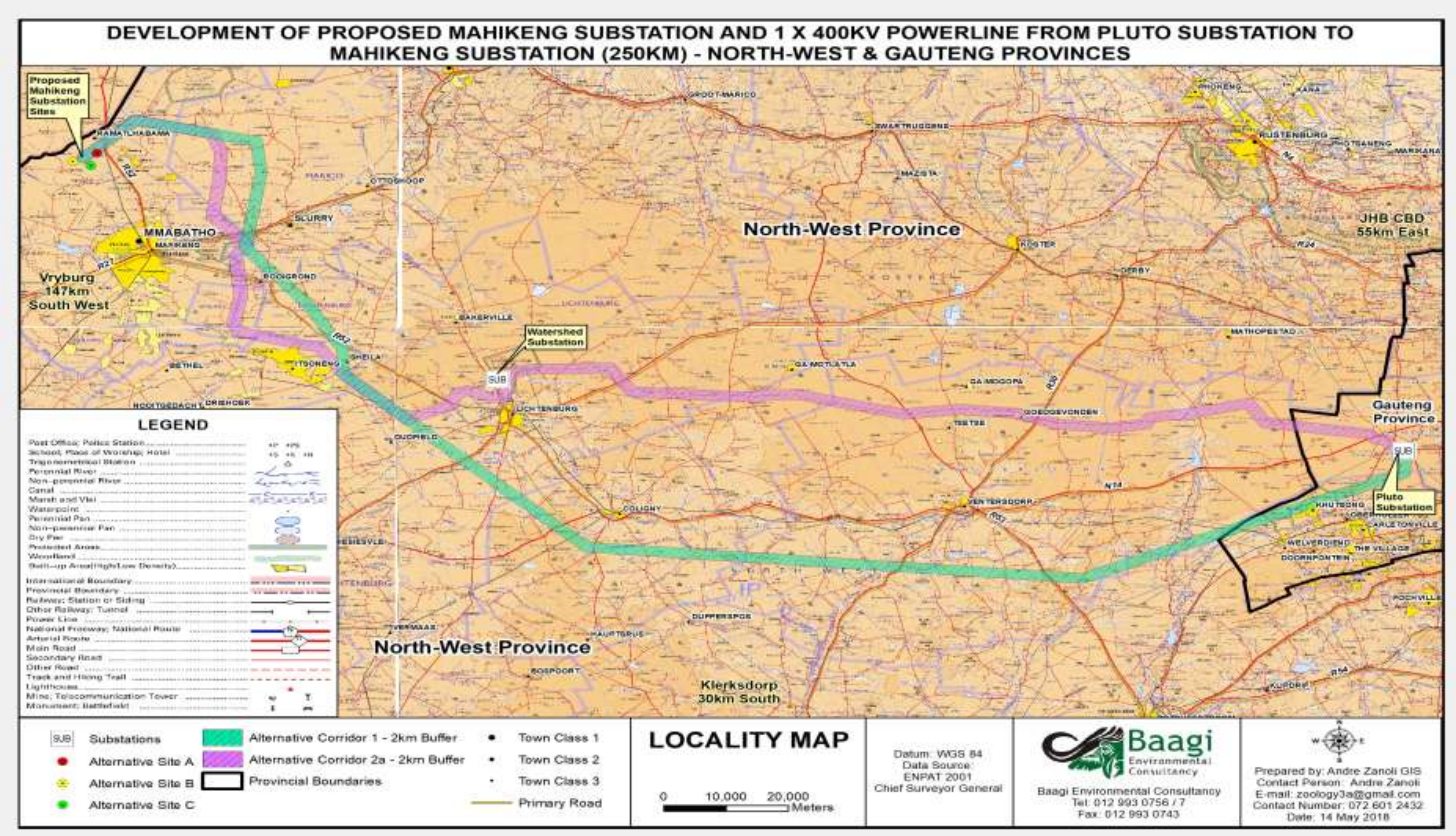


Figure 3: Locality Map

1.1 Assumptions and Limitations

The findings of this report are affected by the following factors:

- The level and scale of the information obtained during the site visit.
- The accuracy, relevance and regency of the information obtained from literature and desktop resources.
- The accuracy of the information provided by the sub-consultants. Baagi assumes that this information is accurate.
- The accuracy and validity of the technical information received from Eskom. It is likewise assumed that this information is accurate and valid.
- The accuracy of cadastral data that is assumed to have been updated.

1.2 Objectives of this Report

The following are the objectives of this report:

(a) Identify the relevant policies and legislation relevant to the activity.

(b) Motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location.

(c) Identify and confirm the preferred activity location through an impact and risk assessment and ranking process.

(d) Determine the significance of the preferred proposed alternatives and to what degree these impacts can be reversed, avoided, managed and mitigated.

(e) Identify the most ideal location for the preferred alternative based on the lowest level of environmental sensitivity.

(f) Identify, assess and rank the impacts the proposed activity will have on the approved site as contemplated in the accepted scoping report.

(g) Identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

(h) Identify residual risks that need to be managed and monitored.

In terms of South African Envionmental legislation, certain activities (called Listed Activities in terms of the Regulations promulgated under the National Environmental Management Act (Act 107 of 1998)) are deemed to be potentially detrimental to the receiving environment. Due to this perceived negative impact on the environment, by law, a Scoping&EIR process needs to be conducted for such proposed projects – and Environmental Authorisation needs to be given by the Competent Authority (CA - prior to commencement of construction. The construction of a Transmission Power Line and a Substation are such activities that need an Environmental Impact Assessment and Authorisation from a CA.

The overall objective of going through the Scoping&EIR Process is to ensure that development is environmentally and socio-economically sustainable. In order for developments to be environmentally sustainable, it is necessary for the parties involved to accept their responsibilities in terms of the:

a. Constitution of South Africa, 1996 (Act No. 108 of 1996) that states that everyone has the right:

- 'to an environment that is not harmful to their health or well-being', and
- 'to have the environment protected, for the benefit of present and future generations, thorough 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.'

b. National Environmental Management Act, 1998 (Act No. 107 of 1998) that requires socially, economically and environmentally sustainable projects.

Section 2 of Chapter 1 of the NEMA provides details of the environmental management principles that should be adhered to during all phases of the development. These need to be read as a whole, but Baagi Environmental Consultancy cc (Baagi) will make specific mention of the following:

- Avoidance/minimisation of the loss of biodiversity.
- Avoidance/minimisation of the disturbance of ecosystems.
- Avoidance/minimisation of pollution.
- Avoidance/minimisation of cultural and heritage sites.
- Avoidance/minimisation/recycling of waste.
- Responsible and equitable use of renewable and non-renewable resources.
- Avoidance/minimisation/mitigation of adverse impacts.

c. Environmental Impact Assessment Regulations of 08 December 2014, as amended on the 07th of April 2017 (2014 Regulations as amended in 2017).

The purpose of these regulations is to regulate the procedure and criteria as contemplated in Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) relating to the preparation,evaluation,submission,processing and consideration of,and decision on, applications for environmental authorisations for the commencement of activities,subjected to environmental impact assessment, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts and for matters pertaining thereto.

Baagi, as independent environmental consultants were appointed by Eskom to undertake the EIA process for the purpose of obtaining EA for the proposed project. (Note that the Environmental Authorisation does not necessarily give permission to continue with the project. The Environmental Authorisation may either accept or decline the proposed development). Baagi received the mandate to assess a suitable, least environmentally sensitive and most socially acceptable alignment for the proposed transmission line between the Pluto MTS and the proposed Mahikeng MTS.

1.3 Proponent Details

Table 4: Project Proponent/Applicant Details

PROPONENT DETAILS	
Company Name	Eskom Holdings SOC Limited
Contact Person	Mr. David Tunnicliff
Postal Address	P O Box 1091, Johannesburg, 2000
Physical Address	Maxwell Drive, Sunninghill Ext 3, Megawatt Park, Sandton
Telephone	011 800 4902/ 5145
Fax	086 602 9704
Email	David.tunnicliff@eskom.co.za

1.4 Environmental Assessment Practitioner Details

Table 5: EAP Details

ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)	
Company Name	Baagi Environmental Consultancy cc
Contact person	Mr. Tinashe Maramba
Physical Address	434 Lois Ave, Waterkloof Glen, 0181
Postal Address	PostNet Suite 412, P. Bag x4, Menlo Park, 0102
Telephone	012 993 0756/7
Fax	012 993 0743
Email	tinashe@baagi.co.za

For more details about his expertise and experience please refer to **Appendix A**.

1.5 Background

1.5.1 Approach to the Scoping Phase

A Scoping and EIR Process is a tool that allows the EAP to assess a proposed development from an integrated, multi-disciplinary and holistic perspective. In order to ensure that usable information on specific issues is obtained, the EAP appoints specialists (refer to table 57) in various fields of expertise to assist with assessing the potential impacts related to the proposed development on aspects like the social environment, avi-fauna, watercourses and wetlands, the local and regional economy, agriculture, flora and fauna, heritage and visual intrusion.

Alternatives are assessed so that we have a preferred alterntaive that causes the least environmental impact by means of meeting the general purpose and requirements of the activity. The following approach was applied during the Scoping phase in an attempt to identify possible alignment alternatives:

1.5.1.1 Literature Review and Desktop Study Analysis

Literature review is defined as a critical analysis of published sources, or literature, on a particular topic. It is an assessment of the literature and provides a summary, classification, comparison and evaluation. Desktop analysis is defined as the Gathering and analyzing of information, already available in print or published on the internet.

Eskom provided Baagi with the study area boundary, the localities of the substations and key towns within the study area in GIS format (ESRI: shape files). Geographic Information System (GIS) software (ESRI ArcGIS 9.2) was used to create a study area map, which indicated the location of the existing transmission power lines, distribution power lines and other infrastructure such as roads and railways. The developed map was used as a point of departure for a GIS analysis of the study area. The objective of GIS analysis was to develop maps of the possible corridors that were selected at the Training: BOSA Transmission Line Corridor Route Selection Process that was conducted by Eskom and Aurecon that would have the least environmental impact and be socio-economically viable.Literature review and a desktop analysis was also conducted by the specialists and the EAP.

1.5.1.2 Site Visit

A reconnaissance site visit took place from the 27th to the 29th of September 2017. The Baagi team (Project Manager and Project Leader), and the various socio-economic and environmental specialists were present during the reconnaiscance site visit. The specialists were involved early on at the scoping level and were asked to provide input based on their respective disciplines.

1.5.1.3 Post Site Visit Meeting

Data gathered during the site visit and desktop study was collated to facilitate a high level understanding of the study area and to provide an amalgamated view - from the points of view of the various specialists - of the possible alternative alignments and site alternatives that had to be investigated in more detail.

Below is a map that illustrates the alternatives that were investigated

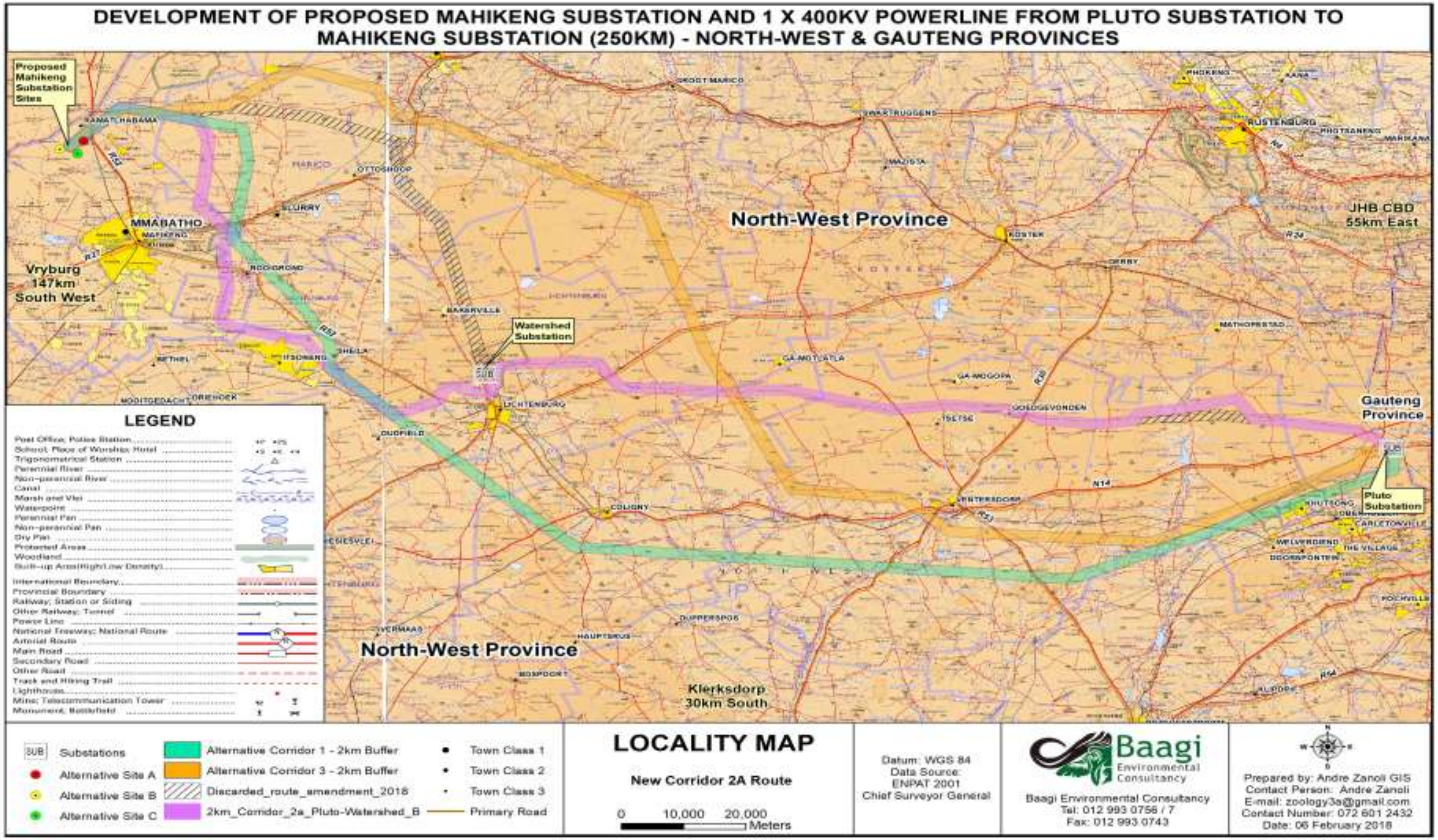


Figure 4: Alternatives investigated during Scoping Phase

1.5.1.4 Amendment of Draft Scoping Report

Baagi applied for extension, in line with Regulation 3(7) of the EIA Regulations as amended on the 07th of April 2017, for the submission period of the Scoping Report due to unforeseen circumstances that were picked up during the Public Participation period which took from the 22nd of November 2017 to the 23rd of January 2018 (first round of PP). The Public Participation period was then extended from the 23rd of January 2018 to the 31st of January 2018 (second round of PP) because there were incidents that impacted the attendance of community members at the public meetings e.g. Khutsong Community Hall was not available, and the next best suitable venue had to be secured. Villages / townships were located distances away from the centrally located venues and due to the lack of attendance at the series of eight (8) public meetings (first round of PP), the project team assessed the situation and made the decision to hold a second round of public meetings by focussing on the villages / townships within the study area, although the minimum requirements as prescribed in the EIA Regulations were followed. During the second round of meetings a Biotherm Solar Farm, Private Nature Reserve, Small Holdings and Game Farming within the corridors were observed. This led to portions of the proposed alternative corridor 2 for the 400kV being discarded and re-aligned. This exercise resulted in “new” communities possibly being affected by the project and therefore needed to be notified and consulted.

The exercise of discarding and re-aligning the proposed corridor routes was considered a change of scope and therefore required the “new” Stakeholders and I&APs to be notified. The review period for the ***Amended*** Draft Scoping Report was from the 12th of February 2018 to the 13th of March 2018 (third round of PP).

Figure 4 above refers to the resultant map which illustrated the re-aligned and the discarded portions of the proposed alternative corridors 2. The map shows that a small portion of Alternative corridor 2 was deviated around a privately owned Nature Reserve between Goedgevonden and Carletonville. The alternative corridor 2 continued west until it reached Litchenburg where the northerly deviating portion was faded out and subsequently discarded because it passed directly through the Molemane Nature Reserve. The “new” Alternative corridor 2 deviates left at the Watershed Substation avoiding the proposed Biotherm Solar Farm joining the proposed alternative corridor 1 in Dudfield and then diverging from alternative corridor 1 around Shiela and Rooigrond and rejoin alternative corridor 1 near Bauwel and Bhurmansdrif further splitting because of small Agricultural Holdings. The Alternative corridor 2 joins the Alternative corridor 1 again in Bewley until the corridors converge at the proposed Mahikeng Substation sites. The resultant proposed alternative corridor was termed Corridor 2a and shall be referred to as such in the EIA phase.

Alternative corridor 2a has multiple deviations which avoid I&AP's farms, Nature Reserves and proposed projects. This is advantageous as it will be less problematic when access is required for environmental and socio-economic /studies surveys and the construction and maintenance of the proposed power line.

1.6 Impact Assessment Methodology

The impact methodology will concentrate on addressing key issues. The methodology employed in this report thus results in a circular route, which allows for the evaluation of the efficiency of the process itself. The assessment of actions in each phase will be conducted in the following order:

- Assessment of key issues.
- Analysis of the activities relating to the proposed development.
- Assessment of the potential impacts arising from the activities, without mitigation.
- Investigation of the relevant measures to avoid, mitigate or manage negative impacts. Should irreplaceable harm to the environment (both the social and bio-physical) be expected, this will be stated as such.

Activities within the framework of the proposed project give rise to certain impacts. For the purposes of assessing these impacts, the project has been divided into three phases from which impact activities can be identified, namely:

1.6.1 Construction Phase

This phase is concerned with all the construction and construction related activities on site, until the contractor leaves the site. Thus, the main activities will be the establishment of construction camp sites, access routes, clearance of servitude to facilitate access, digging the foundations for towers, excavation of pits for transformer foundation, erection of transformers and associated structures, movement of construction workforce, equipment, construction vehicles and materials, etc. The above-mentioned activities result in different types of impacts and some contribute to cumulative impacts.

1.6.2 Operational Phase

This phase involve activities that are post construction, i.e. the transmission of power between substations. This phase requires a rehabilitation plan and monitoring system that will ensure the impacts of construction, such as vegetation pruning, erosion, colonisation of area by alien species, etc. are monitored and inspected as an ongoing process. This involves the maintenance of the facilities to ensure continuous proper functioning of the equipment or resource.

The impact rating is only clear once the impact is summarised in terms of its ratings. This approach enables analysis of the impact results, in terms of:

1. The number of severity criteria applicable as an indicator of influence / severity.
2. The changes in number of low, moderate and high ratings before and after avoidance, mitigation or management.
3. The changes in quantitative / weighted magnitude before and after mitigation.

The methodology also takes into consideration the three phases of development, construction and operational when applicable to the activity.

1.7 Impact Assessment Criteria

An **impact** can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need. The significance of the aspects / impacts of the process will be rated by using a matrix derived from Plomp (2004) and adapted to some extent to fit this process. These matrices use the consequence and the likelihood of the different aspects and associated impacts to determine the significance of the impacts.

The significance of the impacts will be determined through a synthesis of the criteria below:

Probability:	**This describes the likelihood of the impact actually occurring**
Improbable:	The possibility of the impact occurring is very low, due to the circumstances, design or experience.
Probable:	There is a probability that the impact will occur to the extent that provision must be made therefore.
Highly Probable:	It is most likely that the impact will occur at some stage of the development.
Definite:	The impact will take place regardless of any prevention plans and there can only be relied on mitigatory measures or contingency plans to contain the effect.
Duration:	**The lifetime of the impact**
Short Term:	The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
Medium Term:	The impact will last up to the end of the phases, where after it will be negated.
Long Term:	The impact will last for the entire operational phase of the project, but will be mitigated by direct human action or by natural processes thereafter.
Permanent:	The impact is non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.
Scale:	**The physical and spatial size of the impact**
Local:	The impacted area extends only as far as the activity, e.g. footprint

Site: The impact could affect the whole, or a measurable portion of the above-mentioned properties.

Regional: The impact could affect the area including the neighbouring residential areas.

Magnitude / Severity: Does the impact destroy the environment, or alter its function?

Low: The impact alters the affected environment in such a way that natural processes are not affected.

Medium: The affected environment is altered, but functions and processes continue in a modified way.

High: Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Significance: This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required

Negligible: The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.

Low: The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.

Moderate: The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.

High: The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

Table 6: Weights Assigned to Each Attribute

Aspect	Description	Weight
Probability	Improbable	**1**
	Probable	**2**
	Highly Probable	**4**
	Definite	**5**
Duration	Short term	**1**
	Medium term	**3**
	Long term	**4**
	Permanent	**5**
Scale	Local	**1**
	Site	**2**
	Regional	**3**
Magnitude / Severity	Low	**2**
	Medium	**6**
	High	**8**

Significance	**SUM (Duration, Scale, Magnitude) x Probability**	
	Negligible Impact	**≤ 20**
	Low Impact	**> 20 ≤ 40**
	Moderate Impact	**> 40 ≤ 60**
	High Impact	**> 60**

The significance of each activity is rated without mitigation measures (WOM) and with mitigation (WM) measures for both construction, operational and closure phases of the proposed development.

Colour Code for Tables 8 to 10:

Negligible Impact
Low Impact
Moderate Impact
High Impact

Table 7: Table of Impacts per Alternative for Alternative corridor 1 (Green Corridor)

Aspect	Mitigation Status	Probability	Duration	Extent	Magnitude / Severity	Significance
Agricultural Activities	Without Mitigation	5	3	1	8	60
	With Mitigation	4	3	1	6	40
Footprint (Servitude)	Without Mitigation	5	5	1	2	40
	With Mitigation	5	5	1	2	40
Solar Farm	Without Mitigation	1	1	1	2	4
	With Mitigation	1	1	1	2	4
Military Camp and/or Military No Fly Zone	Without Mitigation	1	1	1	2	4
	With Mitigation	1	1	1	2	4
Infrastructure (e.g. Aerodromes, Railways & Roads)	Without Mitigation	5	5	1	8	80
	With Mitigation	1	5	1	2	8
Highly Sensitive Habitats	Without Mitigation	5	4	1	6	50
	With Mitigation	4	4	1	2	28
Wetlands and Watercourses	Without Mitigation	5	5	3	8	80
	With Mitigation	4	5	1	2	32
Cultural, Heritage & Historical Aspects	Without Mitigation	1	1	1	2	4
	With Mitigation	1	1	1	2	4
Land Parcels	Without Mitigation	5	5	3	8	80

	With Mitigation	5	5	3	2	50
Economic Aspects	Without Mitigation	5	5	1	6	60
	With Mitigation	2	5	1	2	16

Table 8: Table of Impacts per Alternative for Alternative corridor 2a (Purple Corridor)

Aspect	Mitigation Status	Probability	Duration	Extent	Magnitude / Severity	Significance
Agricultural Activities	Without Mitigation	4	3	1	6	40
	With Mitigation	1	3	1	2	6
Footprint (Servitude)	Without Mitigation	5	5	1	2	40
	With Mitigation	5	5	1	2	40
Solar Farm	Without Mitigation	5	5	1	8	70
	With Mitigation	1	1	1	2	4
Military Camp and/or Military No Fly Zone	Without Mitigation	1	1	1	2	4
	With Mitigation	1	1	1	2	4
Infrastructure (e.g. Aerodromes, Railways & Roads)	Without Mitigation	1	1	1	2	4
	With Mitigation	1	1	1	2	4
Highly Sensitive Habitats	Without Mitigation	5	4	1	6	55
	With Mitigation	2	4	1	2	14
Wetlands and Watercourses	Without Mitigation	5	5	3	6	70
	With Mitigation	1	5	1	2	8
Cultural, Heritage & Historical Aspects	Without Mitigation	1	1	1	2	4
	With Mitigation	1	1	1	2	4
Land Parcel Sizes	Without Mitigation	5	5	3	8	80

	With Mitigation	5	5	3	2	50
Economic Aspects	Without Mitigation	4	5	1	6	48
	With Mitigation	1	5	1	2	8

Table 9: Table of Impacts per Alternative for Alternative corridor 3 (Orange Corrridor)

Aspect	Mitigation Status	Probability	Duration	Extent	Magnitude / Severity	Significance
Agricultural Activities	Without Mitigation	4	3	1	6	48
	With Mitigation	2	3	1	2	20
Footprint (Servitude)	Without Mitigation	5	5	1	2	40
	With Mitigation	5	5	1	2	40
Solar Farm	Without Mitigation	1	1	1	2	4
	With Mitigation	1	1	1	2	4
Military Camp and/or Military No Fly Zone	Without Mitigation	1	1	1	2	4
	With Mitigation	1	1	1	2	4
Infrastructure (e.g. Aerodromes, Railways & Roads)	Without Mitigation	1	1	1	2	4
	With Mitigation	1	1	1	2	4
Highly Sensitive Habitats	Without Mitigation	5	4	1	8	75
	With Mitigation	4	4	1	6	44
Wetlands and Watercourses	Without Mitigation	5	5	3	8	80
	With Mitigation	4	5	1	2	32
Cultural, Heritage & Historical Aspects	Without Mitigation	5	5	1	8	70
	With Mitigation	2	5	1	2	16
Land Parcel Sizes	Without Mitigation	5	5	3	8	80

	With Mitigation	5	5	3	2	50
Economic Aspects	Without Mitigation	5	5	1	6	60
	With Mitigation	2	5	1	2	16

1.8 Concluding Statement

Table 10: Summary of the Site Selection Matrix

Environmental and Socio-Economic aspects	**Overhead: Alternative corridor 1**	**Overhead: Alternative corridor 2**	**Overhead: Alternative corridor 3**
Without Mitigation (WOM)	462	415	465
Ranking	**2**	**1**	**2**
With Mitigation (WM)	226	142	230
Ranking	**2**	**1**	**3**

The ratings of the alternative corridors were based on the identified potential impacts associated within the study area. The purpose was to screen all the alignment alternatives in terms of the potential impacts that will eliminate unfeasible alignment alternatives and to provide the viable alignment alternatives that will be assessed during the Impact Assessment Phase.

Therefore, based on the assessment done in the Impact Tables (Table 8 to Table 10, the following alternatives will *NOT* be considered in the EIA Phase:

- Alternative corridor 3 (Orange): 230 Points (With Mitigation) and High Impacts that cannot be satisfactorily mitigated.

Chapter 1.7 describes how the Alternative corridors were rated to decide which should be investigated further.The following alternative corridors will therefore be investigated during the EIA Phase:

- The following alternative corridors (for overhead power lines) will be investigated in more detail:
  - Alternative corridor 1
  - Alternative corridor 2a

2. LEGAL FRAMEWORK APPLICABLE TO THE PROPOSED PROJECT

2.1 Relevant National Legislation

The Legal Framework highlighted below focuses on the parts of the legislation that have an implication on this project.

2.1.1 The Constitution of the Republic of South Africa Act (Act 108 of 1996)

The Constitution of South Africa is the overarching legislation against which all other legislation is measured. This crucial piece of legislation includes the Bill of Rights (Section 32), which states that everyone has the right to an environment that is not harmful to his or her health or well-being and to have the environment protected for the benefit of present and future generations.

The Act therefore implies that measures must be implemented to:

1. Prevent pollution and ecological degradation.
2. Promote conservation.
3. Secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development.

Furthermore, the Bill of Rights also states that everyone has the right to access –

(a) any information held by the state; and

(b) Any information that is held by another person and that is required for the exercise or protection of any rights.

<u>Relevance to Project</u>

The construction of the 400kV power line and the proposed substation, in accordance with the Constitution, should not be undertaken in a manner that will result in environmental pollution and ecological degradation. Therefore, the design and planning, construction and decommissioning phases should be carried out in a sustainable manner, preventing unjust harm to the environment or human life. Furthermore, the information pertained in this report is available for public scrutiny at any given time throughout the assessment and decision making processes.

2.1.2 National Environmental Management Act, 1998 (Act 107 of 1998)

There are various elements within the National Environmental Management Act (NEMA) that are relevant to the proposed project. The 'polluter pays' concept is enforced to ensure that any party or parties, which undertake(s) any activity that may cause, causes or caused any pollution, must prevent, mitigate or remedy the effects.

Section 2 of Chapter 1 of the NEMA provides details of the environmental management principles that should be adhered to during all phases of the development. These need to be read as a whole to include:

- Avoidance/minimisation of the loss of biodiversity.
- Avoidance/minimisation of the disturbance of ecosystems.
- Avoidance/minimisation of pollution.
- Avoidance/minimisation of cultural and heritage sites.
- Avoidance/minimisation/recycling of waste.
- Responsible and equitable use of renewable and non-renewable resources.
- Avoidance/minimisation/mitigation of adverse impacts.

The NEMA also states that there are certain human activities that may have a significant detrimental effect on the environment. For this reason, the Act makes provision for the Minister to – from time to time – announce certain activities that need to be assessed to ascertain their potential environmental impact before these activities may be undertaken. (These activities are called "Listed Activities"). Refer to the process as per the New December 2014 Regulations as Amended April 2017 below:

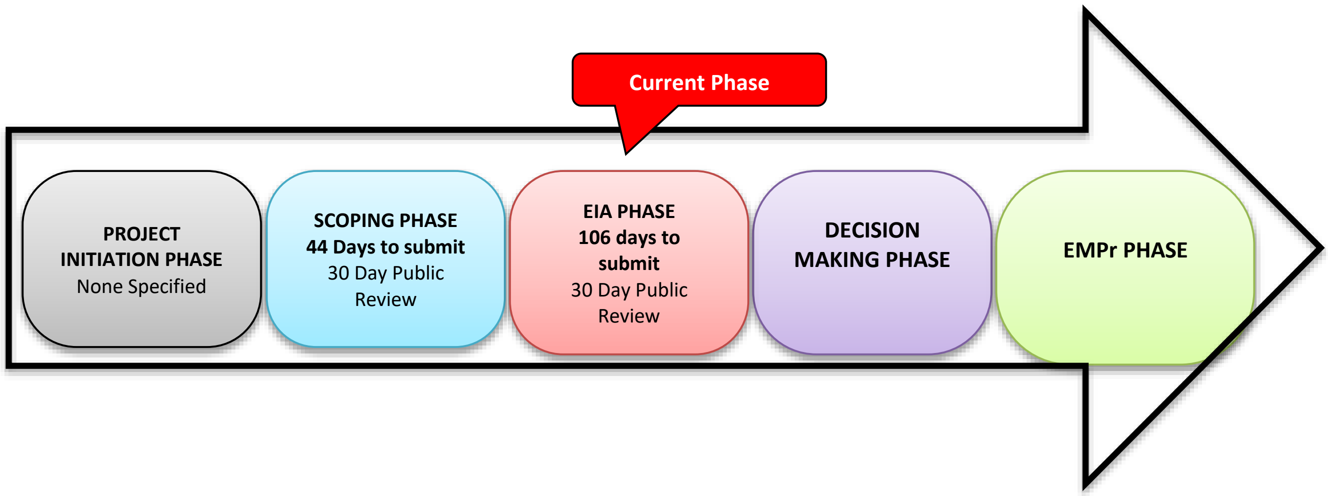


Figure 5: New EIA Regulations

In terms of the EIA Regulations (04th December 2014, as amended on the 07th of April 2017), a number of activities are listed as requiring a full Scoping&EIR process. The listed activities that are associated to this project are listed in Table 4 below.

Table 11: Listed Activities Applied for by the Proponent

Relevant Notice and Activity Number	Activity Description	Relevance to Project
No. 327 item 12:	The development of – (ii) Infrastructure or structures with a physical footprint of 100 square metres or more.	The proposed project will involve construction of a Substation with a physical footprint of approximately 1000000 square metres.
No. 327 item 24:	The development of a road— with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;	The proposed project will involve the construction of an access road that is approximately 2 kilometres long and 9 metres wide.
No. 325 item 9:	The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex	The proposed project will involve the construction of a 400 kilovolts transmission power line and a substation outside an urban.
No. 324 item 12 (c)(h):	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. **C.Gauteng** i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; ii. Within Critical Biodiversity Areas or Ecological Support Areas identified in the Gauteng Conservation Plan or bioregional plans; or iii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning. **H. North West**	The construction of the proposed transmission line and proposed substation will involve the clearing of vegetation for the final preferred route and site. **C. Gauteng:** (i) According to data sourced from SANBI, four vegetation types are regarded as Vulnerable (Soweto Highveld Grassland, Klerksdorp Thornveld, Carletonville Dolomite Grassland and Mafikeng Bushveld) with the Vaal-Vet Sandy and the Western Highveld Sandy Bushveld regarded as Endangered. (ii) According to Biodiversity Sector Plan, SANBI and EGIS alternative corridor 1 is least affected by CBA 1, CBA 2, ESA 1 and ESA 2. Corridor 2a is mostly affected by the CBA 1, CBA 2, ESA 1 and ESA 2.

	ii. A protected area including municipal or provincial nature reserves as contemplated by NEMPAA or other legislation; iv. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority; v. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; or vi. Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland.	(iii) Abe Bailey Nature Reserve falls under the conservation and protected areas. **North West:** (ii) The Botsoland Game Park, Lichtenberg Game Breedings Centre as well as the Mafikeng Game Reserve fall under conservation areas. Whereas the following fall under Municipal or Provincial nature reserves: • Drupenella Private Nature Reserve • Fred Coetzee Private Nature Reserve • J.H Klopper Private Nature Reserve • Makokskraal Private Nature Reserve • Olyvenbult Private Nature Reserve • Somerville Private Nature Reserve; and • Witkraans Private Nature Reserve. (iv) According to Biodiversity Sector Plan (2015), SANBI and EGIS alternative corridor 1 is least affected by CBA 1, CBA 2, ESA 1 and ESA 2. Corridor 2a is mostly affected by the CBA 1, CBA 2, ESA 1 and ESA 2. (v) The proposed project will involve sensitive areas as identified in an environmental management framework. According to Biodiversity Sector Plan (2015), SANBI and EGIS alternative corridor 1 is least affected by CBA 1, CBA 2, ESA 1 and ESA 2. Corridor 2a is mostly affected by the CBA 1, CBA 2, ESA 1 and ESA 2. (vi) Alternative Corridor 1 is located with 68 instream wetlands and riparian areas, wheres Alternative 2a is located within 82 instream and riparian areas.

No. 324 item 3:	The development of masts or towers of any material or type used for telecommunication broadcasting or radio transmission purposes where the mast or tower- (a) Is to be placed on a site not previously used for this purpose; and (b) Will exceed 15 metres in height- **<u>h. North West</u>** <u>(i)Outside urban areas</u> (aa) a protected area identified in terms of NEMPAA; (bb) sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority. (dd) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority (ff)Areas within 5 kilometres from protected areas identified in terms of NEMPAA or a biosphere reserve.	(a) and (b) The proposed project will involve the erection of a communication tower, not higher than 55 metres in height where it will be placed on a site not previously used for this purpose. **North West:** (i) (aa) According to the South African Protected Areas Database (SAPAD Q2, 2017) Fred Coetzee Private Nature Reseerve and Somerville Private Nature Reserve fall under protected areas. (bb) The proposed project will involve sensitive areas as identified in an environmental management framework. According to Biodiversity Sector Plan (2015), SANBI and EGIS alternative corridor 1 is least affected by CBA 1, CBA 2, ESA 1 and ESA 2. Corridor 2a is mostly affected by the CBA 1, CBA 2, ESA 1 and ESA 2. (dd) The proposed project will involve Critical Biodiversity Areas as identified in systematic biodiversity plans. Alternative corridor 1 is least affected by CBA 1, CBA 2, ESA 1 and ESA 2. Corridor 2a is mostly affected by the CBA 1, CBA 2, ESA 1 and ESA 2. (ff) According to the South African Protected Areas Database (SAPAD Q2, 2017) Fred Coetzee Private Nature Reseerve and Somerville Private Nature Reserve fall under protected areas.

2.1.3 National Water Act (Act 36 of 1998)

The National Water Act (NWA) is the main legislative piece that controls both private and public water use within South Africa. Section 19 of the National Water Act provides that:

- If there is land where there is an activity or process, which causes has caused or is likely to cause pollution of water resources, the person in control must take all reasonable measures to prevent such pollution from occurring, continuing or recurring.

Pollution is defined as the altering of the physical, chemical or biological properties of water rendering it less fit for anticipated beneficial use or making it potentially harmful to humans, aquatic and non-aquatic organisms, to the resources quality or to property.

In accordance with Section 21 of the National Water Act the following are considered as water uses and therefore need to be licensed:

a) Taking water from a water resource.
b) Storing water.
c) Impending or diverting the flow of water in a watercourse.
d) Engaging in a stream flow reduction activity.
e) Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1).
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit.
g) Disposing of waste in a manner which may detrimentally impact on a water resource.
h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process.
i) Altering the beds, banks, course or characteristics of a watercourse.
j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.
k) Using water for recreational purposes.

Relevance to Project

The Act calls for actions that will prevent and remedy the effects of pollution generated by the operations of a water user and of those that will address emergency incidences. Water uses that are applicbale to the construction of power lines and the substation include:

- Constructing pylons within a watercourse as well as within the drainage area of a watercourse. This would cause an impediment or alteration of the watercourse.
- The taking of water from a watercourse for construction purpopses.

- The accidental spillage and/or purposeful discharge of hazardous substances and/or waste generated during construction and decommissioning phases, into a watercourse or disposed in such a way it may be detrimental to a water resource.

If the abovementioned water uses are undertaken during either the construction or decommissioning phase of the development, A General Authorisation (accompanied with a risk assessment matrix) will need to be applied for at the Department of Water and Sanitation. The Department has exempted all Eskom power line projects because Eskom's mitigation measures have been found to be effective in minimising impacts.

2.1.4 National Heritage Resources Act (Act 25 of 1999)

This Act is concerned with the protection of the Heritage Resorces. Section 38 of the National Heritage Resources Act specifically focuses on the management of these resources; furthermore, Section 36 of the National Heritage Resources Act states that:

> (3) Any person who discovers archaeological or paleontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
>
> (3)(a) No person may, without a permit issued by South African Heritage Resources Agency (SAHRA) or provincial heritage resources Authority -
>
> (a) destroy, damage, alter, exhume, or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
>
> (b) destroy, damage, alter, exhume, or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
>
> (c) Bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

Relevance to Project

A Heritage Resource Permit from SAHRA will be required for the disturbance, removal or destruction of any heritage site, archaeological site or paleontological site, burial ground, grave, or any public monument or memorial that may be affected by the proposed project. The use of existing old farm houses, older than 60 years, for offices or other facilities within the construction camps, may require a Heritage Resource Permit if any alterations are undertaken to the building.

2.1.5 National Environmental Management: Biodiversity Act (Act 10 of 2004)

The Biodiversity Act chapter provides for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was established. The Biodiversity Act chapters 3, 7 and 8 further require landowners to manage and conserve South Africa's biodiversity for current and future generations. The National Spatial Biodiversity Assessment classifies areas as worthy of protection based on their biophysical characteristics, which are ranked according to priority levels.

Relevance to Project

The proposed power lines and substation should be aligned in a manner that avoids threatened or protected ecosystems, and should not use any plants categorised as either a weed or an invasive plant in the undertaking of mitigation, preventative or rehabilitation measures. Protected species found within the servitude and individual tower positions are to be taken into consideration and the respective Protected Trees Removal Permit and Indigenous Vegetation Clearing Permit should be applied for prior to the commencement of indigenous vegetation clearing activities.

2.1.6 National Environmental Management: Air Quality Act (Act 39 of 2004)

Chapter 4 of the National Environmental Management: Air Quality Act provides for the management of air quality in South Africa. It also works towards reforming the law regulating air quality in order to protect the environment by providing reasonable measures for the prevent of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures; and for matters incidental thereto.

Relevance to Project

The construction of the 400kV power line and the substation will cause the generation of emissions and dust, which is governed under the regulations stipulated in the NEM: AQA. Construction activities such as the removal of vegetation and construction vehicles within the area wil cause the generation of emissions and dust.

2.1.7 National Environmental Management: Waste Act (Act 59 of 2008)

The National Environmental Management: Waste Act is the main legislative piece that aims to consolidate waste management within South Africa. Part 2 of the Waste Act details the general duty in respect to the management of waste by the holder of the waste. In accordance to Section 16(1) of the Waste Act, a holder of waste must, within the holder's power, take all reasonable measures to:

a) avoid the generation of waste and where such generation cannot be avoided to minimise the toxicity and amounts of waste that are generated;
b) reduce, re-use, recycle and recover waste;
c) where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
d) manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts;
e) prevent any employee or any person under his or her supervision from contravening this Act; and
f) Prevent the waste from being used for an unauthorised purpose.

Relevance to Project

The NEM: WA requires classification of the waste that will be generated from the construction activities associated with the proposed project. Methods for reduction, re-use, recycling and recovery of the waste should be followed as well as specific requirements set out within the act for the storage, collection and transportation of waste and the use of authorised methods for the treatment, processing and disposal of the waste.

2.1.8 National Environmental Management: Protected Areas Act (Act 59 of 2003)

The main objective of this Act is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. It is also for the establishment of a national register of all national, provincial and local protected areas. The act serves as a tool for management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas.

Relevance to Project

Certain parts of the proposed project will be constructed within protected areas (for e.g Sommerville Private Nature Reserve and Fred Coetzee Private Nature Reserve). The construction activities, therefore, will have to be undertaken with consideration to the any standards and regulations stipulated within the NEM: PAA.

2.1.9 Conservation of Agricultural Resources Act, 1983 (Act No. 84 of 1983)

The Act provides manages the utilisation of natural agricultural resources in the Republic of South Africa in order to promote the conservation of soil, water resources, vegetation and the combating of weeds and invader plants.

Relevance to Project

The proposed power lines and substation should be aligned in a manner that avoids agricultural land and should not use any plants categorised as either a weed or an invasive plant in the undertaking of mitigation, preventative or rehabilitation measures.

2.1.10 National Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)

The National Minerals and Petroleum Resources Development Act (MPRDA) makes provision for equitable access to and sustainable development of the mineral and petroleum resources within South Africa.

Relevance to Project

The proposed project will be constructed within Afrisam and PPC operations. The MPRDA regulates the construction of any infrastructure within mining areas and therefore certain requirements, stipulated within the Act will need to be taken into consideration.

2.2 Other Relevant Legislation or Policies Applicable to Eskom

2.2.1 Eskom Act, 1987 (Act No. 40 of 1987)

The Act sets out the objectives of Eskom, being the provision of a system by which the electricity needs of the consumers must be satisfied in the most cost effective manner, subject to resource constraints and the national interest. The National Energy Regulator of South Africa (NERSA) exercises control over the performance of Eskom's functions and the execution of its powers and duties. The functions, powers, and duties of Eskom are set out in Section 12 of the Act.

2.2.2 Electricity Regulation Act, 2006 (Act No. 4 of 2006)

The Act governs the control of the generation and supply of electricity in South Africa and the existence and functions of the Electricity Control Regulator.

2.2.3 National Energy Act, 2008 (Act No. 34 of 2008)

The aim of this Act is to ensure that the diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors; to provide for energy planning, increased generation and consumption of renewable energies, contingency energy supply, holding of strategic energy feedstock and carriers, adequate investment in, appropriate upkeep and access to energy infrastructure; to provide measures for the furnishing of certain data and information regarding energy demand, supply and generation; to establish an institution responsible for promotion of efficient generation and consumption of energy and energy research; and to provide for all matters connected herewith.

2.2.4 Fencing Act, 1963 (Act No. 31 of 1963, as amended by Act 108 of 1991)

The Act regulates matters with regard to boundary fences of farms and makes provisions for the erection, alteration, maintenance, damage and repair of fences. It also spells out the rights of owners or lease holders where the land is subject to certain servitudes and outlines procedures for settling of disputes due to wilful actions including leaving gates opened and unauthorised entry to private land.

2.3 Municipal Development and Planning Frameworks

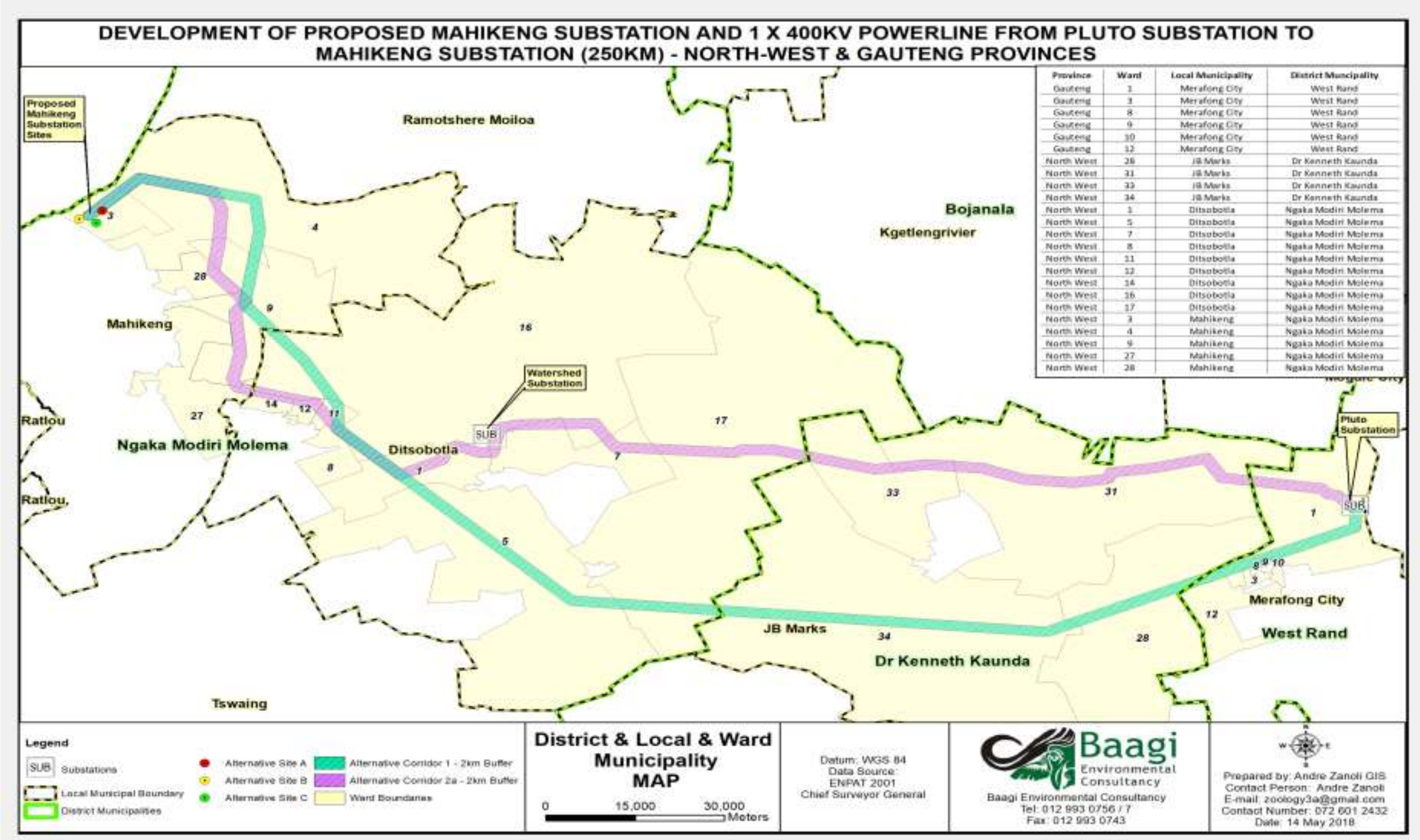
It is important to note that there are other documents that provide the Environmental Assessment Practitioner (EAP) with guidance when conducting an Environmental Impact Assessment (EIA). These include the Integrated Development Plans (IDPs) of the various municipalities and Eskom Transmission Development Plans (TDPs).

3. PROJECT OVERVIEW

3.1 Study Area

The proposed 400kV transmission power line will be located within the Gauteng and North West Provinces, starting at Pluto MTS near Carletonville, towards North West running in a predominantly northwesterly direction towards Miga, near Mahikeng, where the site of the proposed Mahikeng MTS will be. The footprint for the Mahikeng MTS will be $1km^2$ in extent. The proposed transmission line will be approximately 250km in length.

Below is a map that shows the various municipal boundaries within the study area. The proposed project affects several municipalities which are highlighted in the map (Refer to figure 6 below).



Province	Ward	Local Municipality	District Muncipality
Gauteng	1	Merafong City	West Rand
Gauteng	3	Merafong City	West Rand
Gauteng	8	Merafong City	West Rand
Gauteng	9	Merafong City	West Rand
Gauteng	10	Merafong City	West Rand
Gauteng	12	Merafong City	West Rand
North West	28	JB Marks	Dr Kenneth Kaunda
North West	31	JB Marks	Dr Kenneth Kaunda
North West	33	JB Marks	Dr Kenneth Kaunda
North West	34	JB Marks	Dr Kenneth Kaunda
North West	1	Ditsobotla	Ngaka Modiri Molema
North West	5	Ditsobotla	Ngaka Modiri Molema
North West	7	Ditsobotla	Ngaka Modiri Molema
North West	8	Ditsobotla	Ngaka Modiri Molema
North West	11	Ditsobotla	Ngaka Modiri Molema
North West	12	Ditsobotla	Ngaka Modiri Molema
North West	14	Ditsobotla	Ngaka Modiri Molema
North West	16	Ditsobotla	Ngaka Modiri Molema
North West	17	Ditsobotla	Ngaka Modiri Molema
North West	3	Mahikeng	Ngaka Modiri Molema
North West	4	Mahikeng	Ngaka Modiri Molema
North West	9	Mahikeng	Ngaka Modiri Molema
North West	27	Mahikeng	Ngaka Modiri Molema
North West	28	Mahikeng	Ngaka Modiri Molema

Figure 6: Municipal Map

The study area affects the following Municipalities' jurisdictions (refer to Municipal map Figure 6):

- **West Rand District Municipality:**
  - Merafong Local Municipality
- **Dr. Kenneth Kaunda District Municipality.**
  - JB Marks Local Municipality
- **Ngaka Modiri Molema District Municipality:**
  - Ditsobotla Local Municipality
  - Mahikeng Local Municipality

3.2 Project Description

The Proposed Mahikeng Main Transmission Substation (MTS) and 1x400kV Pluto-Mahikeng Powerline Project entails the following:

- Establishing the Mafikeng MTS and design for an end state of 3x 500MVA 400/132kV transformers and 2 of the 500MVA transformers on commissioning;
- Designing for an end state of 8x 132kV and equip 3 of the 132kV feeder bays on commissioning;
- The erection of a communication tower at the Mahikeng Main Transmission Substation;
- The construction of access roads; and
- The establishment of an approximately 250km 400kV transmission powerline from Pluto Main Transmission Substation to the proposed Mahikeng Main Transmission Substation.

3.3 Technical Specifications for the Project

3.3.1 Servitude

The proposed transmission power line will require a servitude of 55m in width, i.e. 27.5m both sides of the centre line and cover a distance of approximately 250km in length. The servitude is required for the safe operation and maintenance of a 400kV power line. The preliminary/scoping level studies assessed a 2km wide corridor per alignment/corridor alternative. This 2km corridor provides sufficient coverage for the assessment of the power line, servitude and associated infrastructure such as access roads. The 2km corridor also makes provision for the manouvering of the powerline if any problems are experienced.

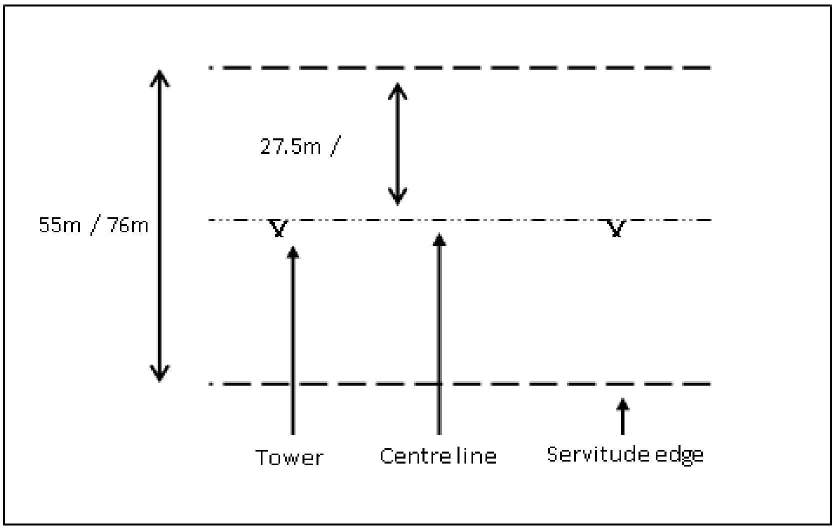


Figure 7: Design of servitude

There are primarily five teams responsible for the construction of a power line, namely: (a) excavation of foundations, (b) concrete works, (c) erection of steel structures, (d) stringing of transmission cables, and (e) rehabilitation. All activities, including vehicular access and the pylon anchors, are required to take place within the negotiated servitude. New roads may need to be constructed (depending on which route is selected) in order to access the transmission lines for construction and subsequent maintenance activities.

3.3.2 Construction Camps

The location of the construction camp will be determined during the CEMPr phase of the project once the alignment has been finalised. The construction camp will, when feasible and viable, utilise existing houses/offices not too far from the working areas instead of erecting new temporary offices.

3.3.3 Towers

Transmission line towers will be constructed in accordance with the latest designs available. Different towers are utilised under different circumstances. In the case of this project, it is envisaged that the following tower types will be implemented:

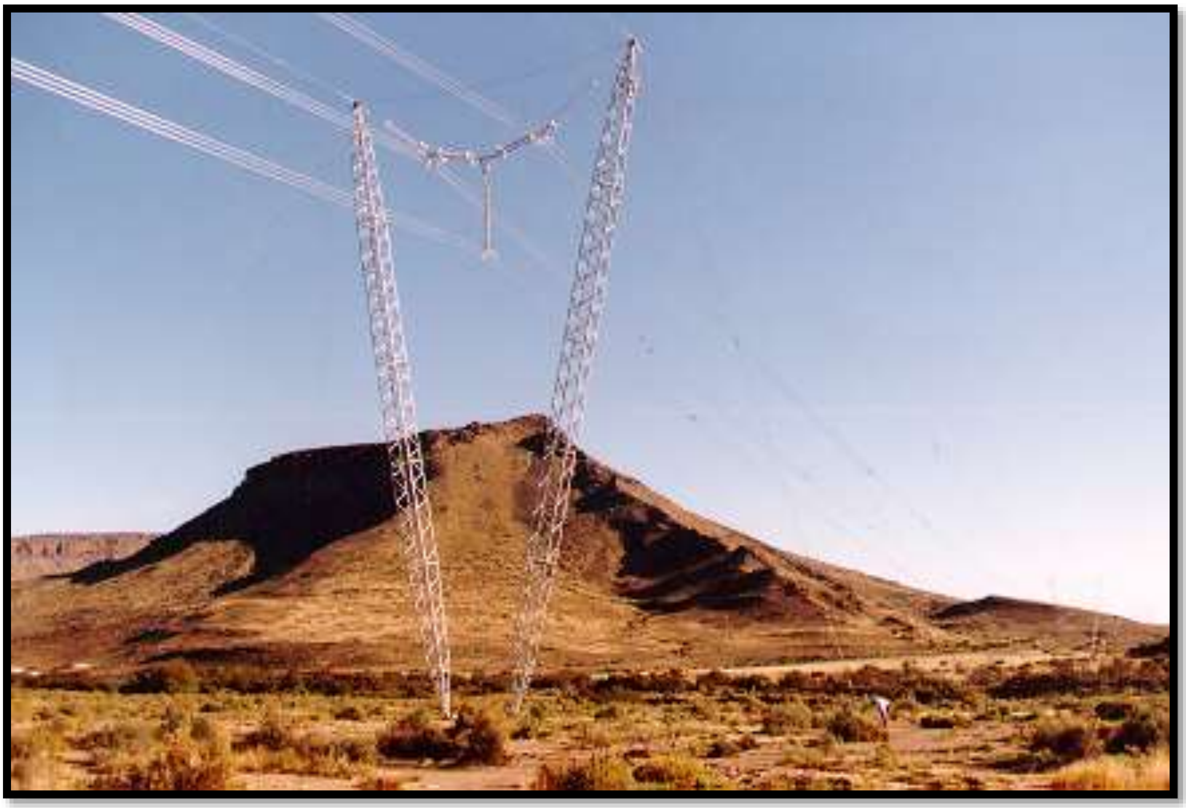


Figure 8: Guyed V structure

Figure 9: Bend/Strain structure

Figure 10: Cross Rope Structure

3.3.4 Infrastructure Requirements

During construction, there will be a need for bulk services and infrastructure:

- **Water** - will be required for potable as well as construction use.
- **Sewerage** - A negligible sewerage flow is anticipated for the duration of the construction period. Management of sewage will be undertaken through the use of chemical toilets and/or septic tank facilities which will be collected by a registered Company regularly.
- **Storm Water** - Care will be taken in making sure that storm water drainage is carefully designed on all access roads. Storm water will have to be diverted into the surrounding environment at low energy levels, to make sure that significant erosion problems are avoided. Storm water will be managed according to the Eskom Guidelines for Erosion Control and Vegetation Management, as well as the provisions of the EMPr.
- **Waste** - All solid waste will be collected at a central location at the construction site and will be stored temporarily until removal to an appropriately permitted landfill site. Recyclable materials will be stored and removed to appropriate recycling facilities.
- **Generators** - Diesel generators will be utilised for the provision of electricity where there is no electricity connection nearby.

3.3.5 Access Roads

Existing roads will be utilised as far as possible during the construction and operational periods. The use of roads on private property is subject to the provisions of an Environmental Management Programme (CEMPr) that will be prepared for the project (with individual landowner specifications being determined during discussions with landowners during the servitude negotiation process). The flow of traffic to the site during the construction period will be relatively high due to the addition of construction vehicles and during operation there will be virtually light traffic.

Access roads will be aligned and constructed within the provisions and specifications of private landowners. This is considered important for three primary reasons:

- The access road should fulfil multipurpose functions serving the needs of Eskom and the landowners.
- Landowners are acutely aware of sensitivities on their land, and will be in an excellent position to inform Eskom of optimum alignments.
- During and post construction, Eskom will be responsible for the maintenance of the access road.

The specifications for the access road will be contained within the CEMPr that will be prepared for construction and which will become legally binding on Eskom and contractually binding on Eskom-appointed contractors.

3.3.6 Hazardous Substances

The hazardous substances referred to comprise of fuels, oils and lubricants that will be stored and dispensed off at the construction camps. Specifications for the storage and dispensing of fuels, oils and lubricants include the following:

- Types of fuels, oil and lubricants:
  - Diesel.
  - Petrol.
  - Paint thinners.
  - Insulating oil.
- Fuels, oil and lubricants must be kept in specifically designated areas.
- All fuels, oils and lubricants shall be stored above ground and under cover.
- Each designated area will be equipped with adequate fire protection equipment appropriate for the nature of the fuels, oils and lubricants that are stored and dispensed.
- All areas shall be properly signed in all applicable languages.
- All employees must be properly trained in the storage and dispensing of specific fuels, oils and lubricants.

- A specific procedure for emergency situations, including accidental spills, must be formulated and must be available on site at all times.

Specifications will be contained within an EMPr that will be prepared for construction. This will become legally binding on Eskom and contractually binding on all Eskom-appointed contractors.

3.3.7 Contractors

Most contractors have teams of between 40 and 50 people. The construction of transmission lines is a fairly technical activity and therefore the majority of contractors use their own teams of skilled and trained personnel for construction purposes. The opportunities for new/additional people are, therefore, fairly limited, although there will be a number of activities such as bush clearing and fencing with which local contractors can be involved in.

3.3.8 Substation

A substation is an important element of electricity generation, transmission and distribution system. Its function is to transform voltages from high to low or vice versa, using transformers and other heavy-duty electric switchgear. Substations perform the following tasks:

- Transform voltage from high to low field site substations transform voltage from high to low for factories or other field site applications.
- Provide flexible voltage for a variety of electric applications field sites may host many different electric-powered applications that all use different voltages. Field site substations should be able to transform the voltage necessary for each specific application.
- Provide a reliable and stable power supply at the field sites Field site substations should work independently to create a reliable and stable power supply system. If one substation should happen to experience a problem, the connection between it and the rest of the substations should be cut immediately to isolate the problem and prevent any damage to the broader power supply chain.

3.5 Construction, Operation and Decommissioning Activities in Sequence

The actual construction phase for this transmission line and substation will start in 2021 and be completed in 2024. It should be noted that construction activities are not continuous and people will be employed throughout the process for long, but intermittent, periods of time. Therefore, it is anticipated that any impacts associated with construction are likely to be minimized due to the low level of activity over a long period of time this will be assessed in the EIA phase.

Specifications necessary for the construction camps will be contained within the EMPr, with specialist input where required. A summary of the different construction phases is outlined below:

3.5.1 Access Negotiations

Negotiations between landowners, contractor and Eskom are undertaken in order to determine access routes. Access routes are established through recurring use of the route(s) (i.e. they are not specially constructed roads) and are only constructed or upgraded under special circumstances.

3.5.2 Tower Pegging

The contractor appoints a surveyor to undertake this process. Once central line pegging has taken place, the surveyor sets out the footprint of the transmission line and towers. The centre points of the proposed route and pylons are marked and the position of the tower peg is marked. The surveying team makes the first basic track to the proposed site and pegs the position of the tower.

3.5.3 Gate Installation

Gates are installed, where necessary, to breach existing fence lines. This is required to help with the access of roads that are utilized for operational and maintenance purpose of the power line. The EMPr will specify the criteria used for installation of the farm gates that will provide the access to the Eskom servitude.

3.6.4 Excavation of Foundation

Excavation is required for the tower foundations; the size of the excavated area depends on the tower type and soil conditions. During construction, fences will be temporarily erected around the excavated area as a safety precaution. The anchor holes will be covered with a safety plate to avoid livestock, fauna or human beings falling in.

3.5.5 Foundation for Steelwork

The foundation structures are positioned into the excavated holes, which are tied together for support.

3.5.6 Foundation Pouring

A "ready-mix" truck, which contains 6m^3 of concrete, moves onto site and concrete is poured into the foundation holes. If there are difficulties in gaining access for the truck, concrete will be mixed on site.

3.5.7 Delivery of Steel to Tower Site

The steelwork is usually delivered to the site approximately one month after the foundation has been poured. Where possible, the steel is transported to the site by a truck. Access roads are clearly marked to facilitate this process.

3.5.8 Assembly Team, Punch and Paint

A team will assemble the galvanized steel towers. The tower is assembled whilst it is lying on the ground. Every nut is screwed into the framework and painted with a non-corrosive paint ("punch and paint") first. This team also does the stringing of the conductors once the steel towers have been erected.

3.5.9 Operation and Maintenance

During operation, Eskom transmission requires access to the servitude to enable maintenance of the transmission line. This is likely to require access to the private properties. Maintenance is carried out at regular intervals, and is often done by helicopter so that supply is not disrupted. Maintenance activities are highly specialized and are therefore carried out by specially trained Eskom Transmission employees/contractors.

It is important that the servitude is cleared of vegetation occasionally to ensure that the vegetation does not interfere with the operation of the line.

3.5.10 Decommissioning

The process of decommissioning any transmission line and a Substation will contain the following:

- The physical removal of the transmission line, towers and substation infrastructure would entail the reversal of the construction process which includes dismantling of structures and separating materials into groups of recyclables, reusables and materials that will go to landfill sites.
- A rehabilitation programme would have to be agreed upon with the landowner before being implemented.
- The disposal of materials from decommissioned structures (steel, cabling, concrete, etc.) would be at an approved waste disposal facility. Alternatively, recycling opportunities could be investigated and implemented.
- Specific considerations regarding servitude and landowner rights would need to be negotiated with the landowner at the time of decommissioning and fall outside the scope of this EIA.

3.6 Use of Services and Resources during Construction

3.6.1 Water

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

3.6.2 Sanitation

Adequate facilities and services for the safe disposal of human urine and faeces will be supplied.The supplier will service the chemical toilets periodically. A clear plan to control the temporary toilets will be outlined in the EMPr.

3.6.3 Roads

Existing roads and proposed gravel raods will be utilized as far as possible during the construction and operational periods. The use of roads on landowner property is subject to the provisions of EMPr that will be prepared for the project with individual landowner specifications being determined during discussions with landowners as part of the negotiation process.

3.6.4 Storm Water Control

Storm water will be managed according to the Eskom Guidelines for Erosion Control and Vegetation Management, as well as the provisions of the project specific EMPr.

3.6.5 Solid Waste Disposal

Eskom has a strong commitment to waste minimisation and recycling. All solid waste will be collected at a central location at each construction site and will be stored temporarily until removal for recycling or disposal at an appropriately permitted landfill site in the vicinity of the construction site. If waste categorised or listed within the National Environmental Management Waste Act (Act 59 or 2008) is generated, specific requirements to deal with such waste will be included in the EMPr.

3.6.6 Electricity

Given that Eskom is the main supplier of electricity in South Africa, it is well placed to provide electricity for use during the construction period. In addition, diesel generators will be utilised during the construction period where necessary.

3.6.7 Economics and Job Creation

Eskom will make use of a contractor or sub-contractors to carry out the construction. These will include Small, Medium and Micro Enterprises (SMMEs) as well as Affirmative Business Enterprises (ABEs). There will be an emphasis on job creation during the construction period of this proposed project.

It is important to note that the construction of transmission lines is a specialized undertaking and requires skilled people. It is therefore the appointed contractors will bring in skilled labour from other areas. By implication, job opportunities for local people will be limited to semi-skilled and unskilled jobs on site and in construction camps. Apart from direct employment however, local people and businesses will benefit through supply of goods and services to the appointed contractors.

3.7 The Need and Desirability of the Project

The study area in this report is part of the Carletonville Customer Load Centre (CLC), with special focus on the Watershed MTS supply area near Litchenburg. The Watershed MTS is fed by two 275kV powerlines from the Pluto MTS. The Watershed MTS supply area is currently experiencing technical constraints in the form of substation capacity and voltage regulation constraints on these 2x 275kV in-feeds from Pluto MTS. The Watershed MTS is strained as it supplies the greater Lichtenburg area all the way to Mahikeng and Vryburg with power.

The integration of Mookodi and Ngwedi MTSs in 2016, coupled with the Watershed Strengthening project which will be completed around 2018, will provide limited alleviation of the said constraints. A sizable amount of load (approximately 180MVA) will be shifted from Watershed MTS and shared between Mookodi and Ngwedi MTSs. While Watershed Strenghthening will create sizeable transformation capacity at Watershed and relieve the 275kV voltage constraints, this will last for only a limited time i.e. until the year 2020 due to anticipated load growth in the Mahikeng area.

N-1 is a sequence of events consisting of the initial loss of a single generator or transmission component (Primary Contingency), followed by system adjustments, and followed by another loss of a single generator or transmission component (Secondary Contingency). The 275kV network experiences low voltage constraints under N-1 conditions (worse contingency is the loss of Pluto-Watershed 275kV lines), with the N-1 transformation capacity being approximately 480MVA at Watershed MTS. A secondary problematic N-1 contigency is that of a Watershed 350MVA 275/88kV transformer loss. This N-1, limits the load that can be connected at Watershed 132kV bus to 280MVA and 200MVA on the 88kV busbar.

The purpose of this study is to address the low voltages i.e. 275kV and capacity constraints at Watershed MTS beyond 2020. The two types of constraints are:

- The poor voltage profile observed on the 275 kV Watershed busbar as a result of the worst N-1 line contingency , i.e Pluto-Watershed 275 Kv powerlines.
- Transformation capacity constraints caused by the possible loss of one of the 315 MVA 275/88kV transformers at Watershed MTS.

It is important to note that the proposed project forms part of Eskom's larger regional Botswana-South Africa (BOSA) Transmission Interconnecting Project. The Southern African Power Pool (SAPP) coordinates planning, generation and transmission of electricity for national electricity suppliers in the Southern African Development Community (SADC) region. SAPP identified the Botswana-South Africa (BOSA) Transmission Interconnection Project as one of the initiatives to reduce regional electricity supply constraints and assist in improving distribution of electricity in the region. Eskom of South Africa (Eskom) and the Botswana Power Corporation (BPC) will be the beneficiaries of the project. The project is for a proposed 210 km transmission line that will stretch from the proposed Mahikeng Main Transmission Substation to Isang in Botswana.

4. ALTERNATIVES

It is a legal requirement to consider various alternatives until a feasible alternative is chosen. During the identification and assessment of alternatives to be considered for the proposed project, the project team, comprised of the proponent, the EAP and specialists all played a role in selecting the viable alternatives.

Taking into consideration the nature, type and extent of the project, the following alternatives were identified: Technology Alternatives, Alignment Alternatives, Site Alternatives and the No-Go Alternative. The criteria for selecting a suitable and/or viable alternative will take into consideration environmental constraints and social and economic factors.

4.1 Alternatives Considered

According to National Environmental Management Act (Act 107 of 1998), the term alternatives in relation to a proposed activity means different means of meeting the general purpose and requirements of the activity which may include alternatives to the:

- Property on which or location where the activity is proposed to be undertaken
- Type of activity to be undertaken
- Design or layout of the activity
- Technology to be used in the activity
- Operational aspects of the activity
- And includes the option of not implementing the activity

Below are the different alternatives to be considered:

4.1.1 Technology Alternatives

4.1.1.1 Overhead vs. Underground Power Lines Alternative

4.1.1.1.1 Underground Power Line

Underground Powerlines have the following advantages:

- It is commonly stated that there are distinct visual impact benefits in using underground cables. This is seen to be true, especially in the urban environment where the observer is closer to the line and the land cover is largely disturbed from its natural state.

Underground Powerlines have the following disadvantages:

- It must be noted that underground transmission lines are oil cooled, requiring sealed conductors significantly larger in diameter than overhead conductors, which are air-cooled. The larger conductors will automatically require a larger servitude to keep the conductors apart.
- Of significance with the servitude for an underground power line is that the line would need to be buried to a depth of between 1.5m and 2m, generating significant spoil that will need to be disposed of. Additionally, the potential for pollution to underground water resources in case of oil spills, etc. is extreme and highly probable.
- Underground cables are difficult to maintain, it may take days to find the exact fault with the lines as opposed to overhead lines, which can be done within a few hours.
- Importantly, the servitudes would need to be kept in an open, grassed fashion. Not only is this inappropriate for some parts of the study area, but, importantly for landowners, the servitude area becomes sterile for the purposes of continued agricultural activities as absolutely no activity can be allowed on the servitude.
- It is not economically viable to place a transmission line of this high voltage underground as the cost is estimated at 10 times more than the conventional overhead transmission lines.
- Underground powerlines need to be insulated against the surrounding soil.

Taking into consideration the sterilisation of the entire servitude, the potential for severe oil pollution, the negative environmental impacts during construction, the technical complexities as well as the significant additional economic burden incurred by the underground power lines, this alternative will therefore not be investigated further in this EIA process.

4.1.1.1.2 Overhead Power Line

Overhead Powerlines have the following advantages:

- Overhead power lines cost less to maintain and construct than underground power lines.
- Overhead powerlines are only insulated at the pylons or posts that support them. Provided there is sufficient distance between the exposed cable and any earthed object, the air provides sufficient insulation. The air also cools the cable that gives off heat as current passes through it.
- Overhead power lines can be modified easily to meet customer requirements and maintenance and upgrading can be done just as easily.
- Another important factor is that overhead lines can generally span and not disturb sensitive features such as cultural resources sites, streams, wetlands, isolated steep slopes, and sensitive species habitat.

Overhead Powerlines have the following disadvantages:

- Overhead powerlines disturb the natural state of an area and might be visually polluting to observers.
- Overhead powerlines require vegetation clearance and in some instances ecological habitats area disturbed.

This alternative will therefore be investigated further in this EIA process.

4.1.2 Source of Energy Alternative: Renewable Energy

Renewable energy is defined as energy from a source that is not depleted when used. Renewable energy sources include wind, solar, water (hydropower), biomass and geothermal. Wind, solar and hydropower are all regarded as clean energy, because no pollution is generated during the energy generation process.

Renewable Energy has the following advantages:

- Renewable energy are inexhaustible, it is therefore sustainable and so will it never run out.
- Renewable energy facilities generally require less maintenance than traditional generators. Their fuel being derived from natural and available resources reduces the costs of operation.
- Renewable energy produces little or no waste products such as carbon dioxide or other chemical pollutants, so has minimal impact on the environment.

Renewable Energy has the following disadvantages:

- It is difficult to generate the quantities of electricity that are as large as those produced by traditional fossil fuel generators. This may mean that we need to reduce the amount of energy we use or simply build more energy facilities which has cost implications as well as available land for the facilities.
- Renewable energy often relies on the weather for its source of power. Hydro generators need rain to fill dams to supply flowing water, wind turbines need wind to turn the blades, and solar collectors need clear skies and sunshine to collect heat and make electricity. When these resources are unavailable so is the capacity to make energy from them. This can be unpredictable and inconsistent.
- The current cost of renewable energy technology is also far in excess of traditional fossil fuel generation. This is because it is a new technology and as such has extremely large capital cost.

Most energy in South Africa is generated through the use of coal-fired power stations mostly situated in the Mpumalanga Province. The aim of proposed project is to strengthen the electricity network in the North West Region in order to be able to increase power in the areas.

Therefore, despite the great opportunities created by operational and planned solar plants in the area, it will not be able to supply enough electricity for the additional demand in the areas. Furthermore, Transmission Lines will inevitably be needed to evacuate the power from Carletonville to Mahikeng. Due to the magnitude of the electricity required and the need for extending and upgrading the MTS'relying on solar energy that is generated in the area is not sufficient. In addition, the current supply of electricity into the Pluto MTS is from Matimba Power Station which is coal fired. As such, the lack of technical viability for renewable energy as a feasible alternative renders this option null and void. In light of this, this alternative will therefore not be investigated further during Impact Assessment Phase.

4.1.3 Alignment Alternatives

All the proposed route alignments identified for the project have a 2km (2 000m) wide corridor that is being investigated. However, only a 55m wide servitude will be needed to service the powerline. It needs to be noted that the current alignment alternatives do not represent the final scenarios as further alignments can be proposed by I&APs and government departments (e.g. SAHRA) in an attempt to find the best possible corridor for the construction of the proposed power line. The following sections contain descriptions of the current proposals under investigation. The final alignment may even include a cross combination of the proposed alternatives.

Overall, specialist findings and inputs from I&APs play a big role in determining which route is more suitable and which is less suitable. Detailed specialist studies of the various alignments and consultation with I&APs will be undertaken during the EIA phase.

4.1.3.1 Alignment Selection Criteria

Alternative corridors 1 to 3 were selected using the BOSA Transmission Line Corridor Route Slection Process (See appendix C). The proposed corridors and site alternatives were based on the following criteria:

- Length of proposed alignment
- Number of power line crossings
- Number of "bend points" in the alignment
- Existing infrastructure (roads, railways, etc.)
- Existing land use
- Topography
- Accessibility
- Environmental perspective
- Social perspective
- Strategic perspective

4.1.3.1.1 Pluto - Mahikeng Alternative corridor 1 (Green Corridor)

Alternative corridor 1 is approximately 258.5 km and it is located on the southern part of the study area where it runs from Carletonville south-westwards towards Coligny, Dudfield, Shiela, Tshoneng, Rooigrond and finally reaching Mahikeng (refer to figure 3).

Alternative corridor 1 passes near the Abe Bailey Nature Reserve and passes near maize farms in the Carletonville area. It continues in a south westerly direction where an Irrigation Scheme is observed in Rysmierbult area. There is a presence of dolomitic lime and mottles in the soil and area is dominated by the Carletonville Dolomitic grassland and camel thorns. The powerline then changes direction and travels in a north westerly direction. The vegetation observed within the area is the Marikana Thornveld, drought resistant *Rhus Lancea, Acacia tortilis, Ziziphus* species and the tuica grass are observed.

4.1.3.1.2 Pluto- Mahikeng Alternative corridor 2a (Purple Corridor)

Alternative corridor 2 is approximately 236.5 km and runs westwards from Carletonville, through Fred Coetzee and Somervillle Private Nature Reserves. The line continues in a westerly direction towards

Lichtenburg, where it changes direction in a south-westerly direction towards Dudfield. It then travels in a north westerly direction from Dudfield towards the proposed Mahikeng substation.

The proposed Alternative corridor 2a runs parallel to an existing 275V power line from Pluto substation to Watershed substation. Commercial cattle farms are observed east of the existing 275kV power line between the Watershed substation and Goedgevonden town. The existing Watershed Substation is visible from the tarred road near Litchenburg, a coal depot and game farms are observed along proposed corridor 2a. (Refer to figure 3).

4.1.4 No-Go Alternative

As a norm for any proposed development, the No-Go option should be considered as an alternative. To maintain the status quo is an attractive option for the reasons outlined below, but by not taking any action, Eskom would not be able to supply the needed electricity to North West area.

This would reduce the impact on the aesthetic value of the natural environment, because the introduction of power lines into the landscape changes the sense of place (tourism impacts). It would also benefit the status quo of the biophysical environment. However, the need for electricity is a national concern and not increasing the capacity to generate electricity within the North West Province could potentially stunt economic growth in South Africa in general. Considering the need for a steady supply of electricity in the province and country in general, this option will be investigated.

4.1.4 Substation Site Alternatives

The substation site alternatives are located 20.5 km from Mahikeng's CBD and 4.2km from the Botswana border. The study area falls under the Mahikeng Bushveld and is situated in Knowles Park owned by the Municipal.

The substation site alternative coordinates are as follows (refer to figure 3):

4.1.4.1 Substation Site Alternative 1 Red

Center Coordinate:
S25^{0}41' 12.09" E25^{0}33' 48.44"

Corner Coordinates of the proposed Substation Sites:
S25°40'55.15" E25°33'29.027";

S25°40'55.15" E25°34'05.62";

S25°41'30.09" E25°34'05.62";

S25°41'30.09" E25°33'29.027"

4.1.4.2. Substation Site Alternative 2 Yellow

Center Coordinate:
S25^{0}43’ 01.1” E25^{0}31’18.0”

Corner Coordinates of the proposed Substation Sites:
S25°41'47.57" E25°31'23.83";

S25°41'47.57" E25°32'00.22";

S25°42'22.32" E25°32'00.22";

S25°42'22.32" E25°31'23.83"

4.1.4.3 Substation Site Alternative 3 Green

Center Coordinate:
S25^{0}43’23.4” E25^{0} 33’11.3”

Corner Coordinates of the proposed Substation Sites:

S25°42'14.09"S E25°32'55.52";

S25°42'14.09"S E25°33'32.11";

S25°42'49.04"S E25°33'32.11";

S25°42'49.04"S E25°32'55.52"

(Refer to Appendix 3 for the Bend Co-ordinates of the Corridors).

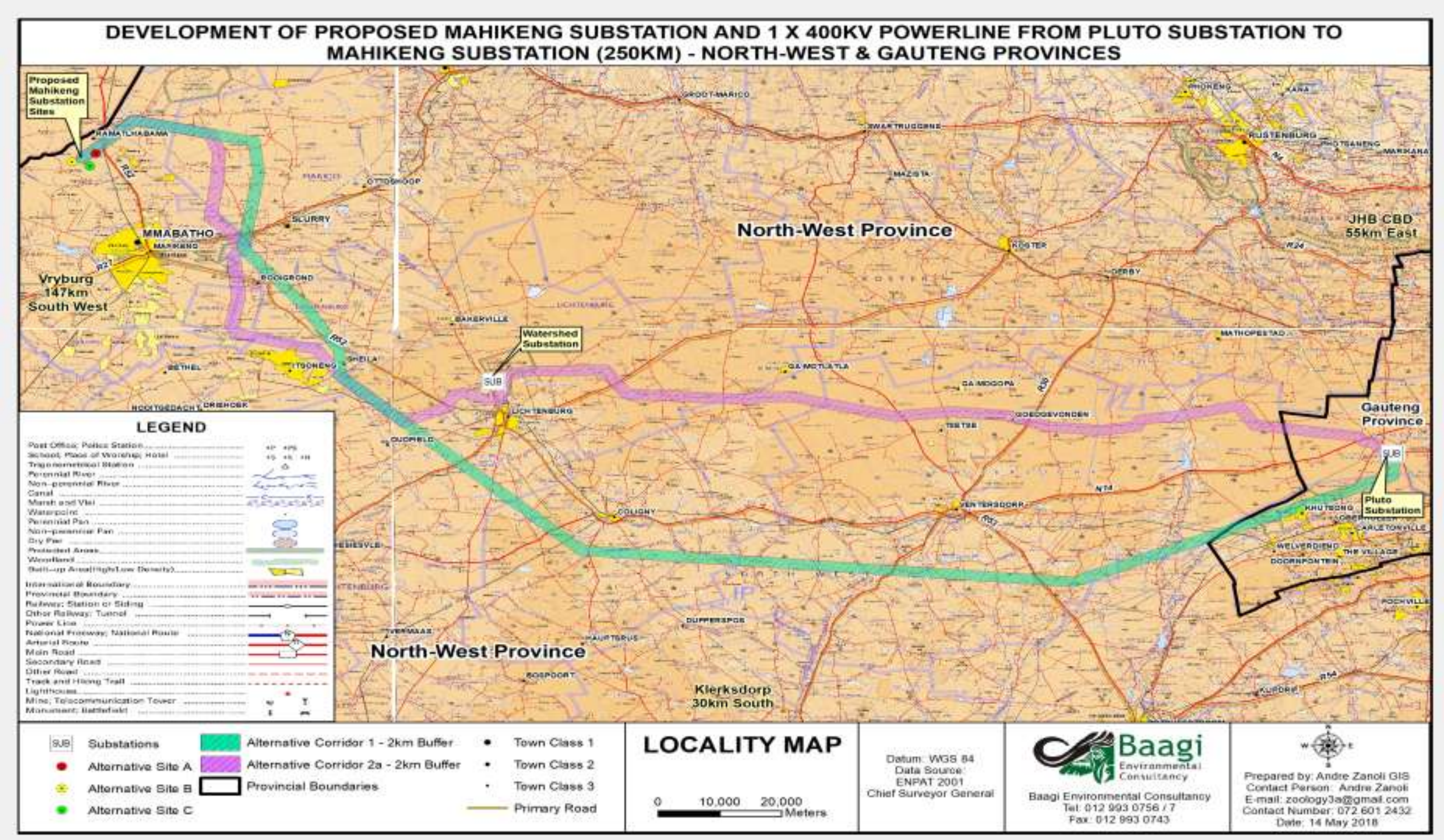


Figure 11: Alternative corridors to be assessed during the EIA Phase

5. DESCRIPTION OF THE RECEIVING ENVIRONMENT OF THE STUDY AREA

5.1. Ngaka Modiri Molema District Municipality

This section describes the socio-economic character of the local municipalities in which the proposed sites are situated.

Figure 12: Ngaka Modiri Molema District Municipality Map

5.1.1. Mahikeng Local Municipality

The Mahikeng Local Municipality (previously Mafikeng Local Municipality) is a Category B municipality located within the Ngaka Modiri Molema District in Mahikeng (previously Mafikeng), the capital city of the North West Province. It is situated next to the Botswana border, and is just a three-hour drive from Johannesburg and about 294km from Pretoria.
Mahikeng is the smallest of the five municipalities in the district. It is the seat of the Provincial Legislature and the majority of the National State Departments regional offices. It was brought about by the new Local Government transformation in South Africa.
Its rich and diverse history dates back to 1852, when the town was founded and 1899 to 1902 during the Anglo-Boer War, the Mafikeng Siege. Its town is home to the Mahikeng Museum, with its antique steel ceiling, old town clock, Sol Plaatje’s history, and display of rock species. The Mahikeng Airport,

situated 5km west of the Mmabatho CBD, boasts a landing strip of 4.6km, one of the longest runways in the world. The airport is one of the reasons that has necessitated the project. The main economic sectors are Agriculture, mining, manufacturing, trade and tourism.

The Population of the Study Area: (Source: www.localgovernment.co.za)

Table 12: Population ratio of Mahikeng Local Municipality

Population	314 394

The Age structure of the Study Area: (Source: www.localgovernment.co.za)

Table 13: Age structure of Mahikeng Local Municipality

Population under 15	24.4%
Population 15 to 64	71.3%
Population over 65	4.3%

Dependency Ratio of the Study Area: (Source: www.localgovernment.co.za)

Table 14: Dependency ratio of Mahikeng Local Municipality

Per 100 (15-64)	40.2

Sex ratio of the Study Area: (Source: www.localgovernment.co.za)

Table 15: Sex ratio of Mahikeng Local Municipality

Males per 100 females	94.9

Population growth: (Source: www.localgovernment.co.za)

Table 16: Population growth ratio of Mahikeng Local Municipality

Per annum	1.72%

Education: (Source: www.localgovernment.co.za)

Table 17: Education ratio of Mahikeng Local Municipality

No schooling	7.1%
Matric	29.8%
Higher education	10.9%

Household Dynamics: (Source: www.localgovernment.co.za)

Table 18: Household dynamics of Mahikeng Local Municipality

Households	103 333
Average household size	3.0
Female headed households	44.1%
Formal dwellings	86.8%
Housing owned	72.5%

Household Services: (Source: www.localgovernment.co.za)

Table 19: Household services ratio of Mahikeng Local Municipality

Flush toilet connected to sewerage	24.5%
Weekly refuse removal	58.6%
Piped water inside dwelling	23.1%
Electricity for lighting	92.4%

5.1.2 Ditsobotla Local Municipality

The Ditsobotla Local Municipality is a Category B municipality situated within the Ngaka Modiri Molema District in the North West Province. It is one of the five municipalities in the district, making up almost a quarter of its geographical area. The seat of the local municipality is Lichtenburg. The municipality was established through the amalgamation of the former Lichtenburg, Coligny and Biesiesvlei Transitional Councils.

Its main attractions are cultural, heritage and agricultural museums; the burning vlei – a unique vlei consisting of the thick layers of subterranean peat that burnt for years, creating a rare natural phenomenon; the Lichtenburg Game Breeding Centre; Eufees and Duch Roode Dams, situated between the CBD, Burgersdorp and Molopo Oog/Wondergat. The main economic sectors are manufacturing (38.5%), agriculture (16.5%), wholesale and retail (7.4%). (Source: www.localgovernment.co.za)

The Population of the Study Area: (Source: www.localgovernment.co.za)

Table 20: Population ratio of Ditsobotla Local Municipality

Population	181 865

The Age structure of the Study Area: (Source: www.localgovernment.co.za)

Table 21: Age structure of Ditsobotla Local Municipality

Population under 15	27.0%
Population 15 to 64	68.3%
Population over 65	4.8%

Dependency Ratio of the Study Area: (Source: www.localgovernment.co.za)

Table 22: Dependency ratio of Ditsobotla Local Municipality

Per 100 (15-64)	46.5

Sex ratio of the Study Area: (Source: www.localgovernment.co.za)

Table 23: Sex ratio of Ditsobotla Local Municipality

Males per 100 females	105.6

Population growth: (Source: www.localgovernment.co.za)

Table 24: Population growth ratio of Ditsobotla Local Municipality

Per annum	1.94%

Education of the Study Area: (Source: www.localgovernment.co.za)

Table 25: Education ratio of Ditsobotla Local Municipality

No schooling	8.9%
Matric	25.4%
Higher education	5.9%

Household Dynamics of the Study Area: (Source: www.localgovernment.co.za)

Table 26: Household dynamics of Ditsobotla Local Municipality

Households	54 154
Average household size	3.4
Female headed households	33.5%
Formal dwellings	80.5%
Housing owned	64.2%

Household Services of the Study Area: (Source: www.localgovernment.co.za)

Table 27: Household services ratio of Ditsobotla Local Municipality

Flush toilet connected to sewerage	55.0%
Weekly refuse removal	36.5%
Piped water inside dwelling	31.8%
Electricity for lighting	88.1%

5.2. Dr Kenneth Kaunda District Municipality

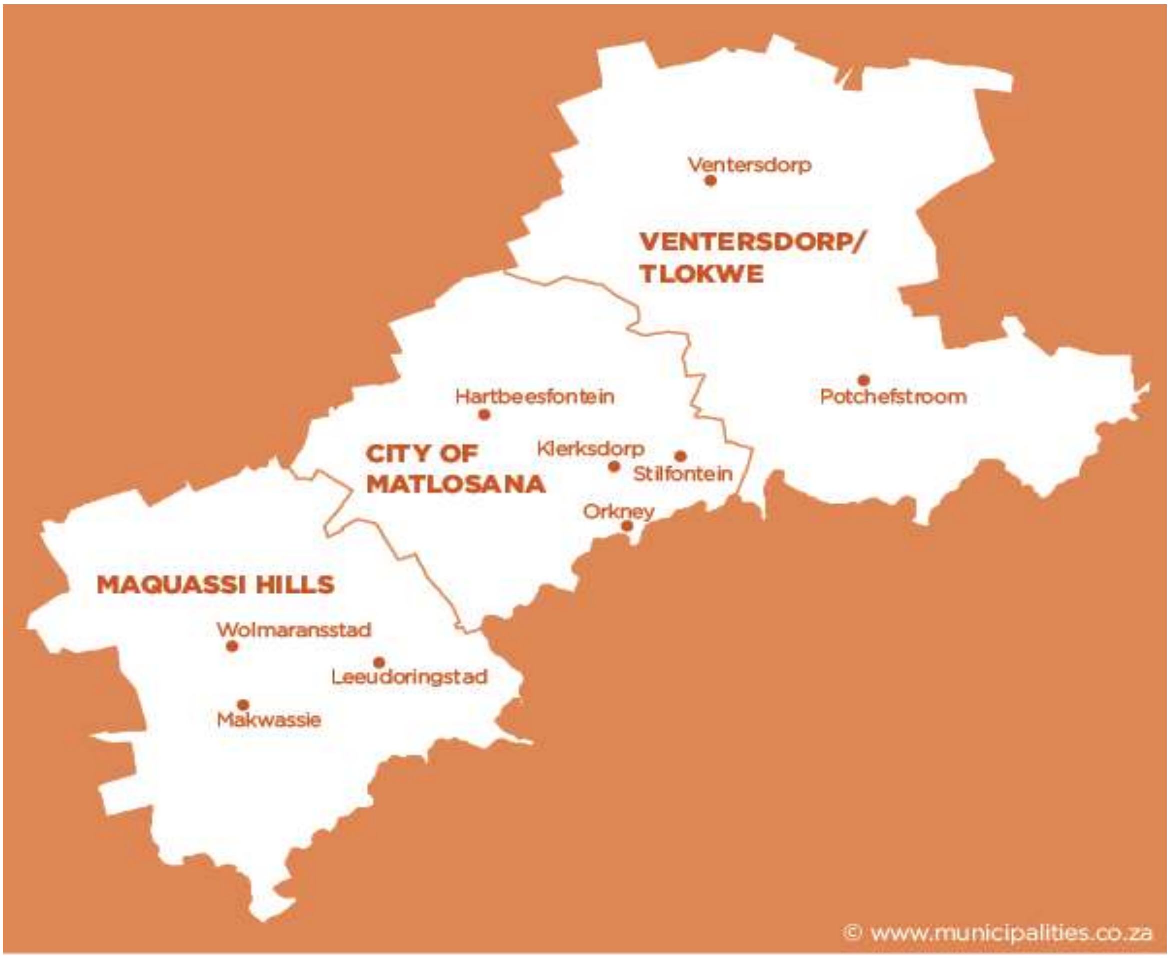


Figure 13: Dr. Kenneth Kaunda District Municipality Map

5.2.1 JB Marks Local Municipality

The JB Marks Local Municipality is a Category B municipality situated within the Dr Kenneth Kaunda District in the North West Province. It is the largest municipality of three in the district, making up almost half its geographical area. It was established by the amalgamation of the Ventersdorp and Tlokwe City Council Local Municipalities in August 2016.

The N12 route that connects Johannesburg and Cape Town via the city of Kimberley runs through the municipality. The main railway route from Gauteng to the Northern and Western Cape also runs through one of the municipality's main cities, Potchefstroom. The city of Potchefstroom is situated 145km south-east of OR Tambo International Airport but has its own airfield, which can accommodate bigger aircraft and was formerly a military air base.
Gold mining is the dominant economic activity in the district, with Potchefstroom and Ventersdorp being the only exceptions. While Ventersdorp to the north-west of Potchefstroom focuses on agricultural activity, Potchefstroom's economic activity is driven by services and manufacturing. A big role-player in the provision of services in Potchefstroom is the world-class North-West University, which has its main campus in Potchefstroom.

Potchefstroom's industrial zone has many companies, focusing mainly on the industries of steel, food and chemicals, with big entities such as King Korn, Kynoch, Naschem and the Soya Protein Process (SPP) Company. Within the city centre, the infrastructure of Potchefstroom supports roughly 600 businesses. The main economic sectors are Agriculture, community services, manufacturing, trade, finance, transport and mining. (Source: www.localgovernment.co.za)

Population of the Study Area: (Source: www.localgovernment.co.za)

Table 28: Population ratio of JB Marks Local Municipality

Population	243 52

The Level of Education of the Study Area (aged 20+): (Source: www.localgovernment.co.za)

Table 29: Education ratio of JB Marks Local Municipality

No schooling	9.2%
Matric	26.6%
Higher education	11.4%

Age Structure of the Study Area: (Source: www.localgovernment.co.za)

Table 30: Age structure ratio of JB Marks Local Municipality

Population under 15	28.2%
Population 15 to 64	66.9%
Population over 65	4.9%

<u>Sex Ratio of the Study Area:</u> (Source: www.localgovernment.co.za)

Table 31: Sex ratio of JB Marks Local Municipality

Males per 100 females	101.5

<u>Dependency Ratio of the Study Area:</u> (Source: www.localgovernment.co.za)

Table 32: Dependency ratio of JB Marks Local Municipality

Per 100 (15-64)	49.5

<u>Household Dynamics of the Study Area:</u> (Source: www.localgovernment.co.za)

Table 33: Household dynamics ratio of JB Marks Local Municipality

Households	80 572
Average household size	3.0
Female headed households	37.1%
Formal dwellings	82.0%
Housing owned	52.6%

<u>Household Services of the Study Area:</u> (Source: www.localgovernment.co.za)

Table 34: Household services of JB Marks Local Municipality

lush toilet connected to sewerage	75.9%
Weekly refuse removal	70.9%
Piped water inside dwelling	46.2%
Electricity for lighting	87.5%

5.3. West Rand District Municipality

Figure 14: West Rand District Muncipality Map

5.3.1. Merafong City Local Municipality

The Merafong City Local Municipality is a Category B municipality situated within the West Rand District in the Gauteng Province. It is the largest of three municipalities in the district, making up almost half of its geographical area. It is situated about 65km from Johannesburg and is serviced by a number of major roads, including the N12 from Johannesburg to Cape Town and the N14, which is the main road between Gauteng and Mahikeng (previously Mafikeng) via Ventersdorp. Its boundaries enclose some of the richest gold mines in the world.

Formerly a cross-border municipality, the entire municipality was transferred to the North West Province following the abolition of cross-border municipalities by an amendment to the South African Constitution in 2005. The municipality was part of the North West Province from 2005 to 2009, when it was reincorporated into the Gauteng Province by another amendment to the Constitution, following often violent protests in the township of Khutsong.
Merafong's historical development is closely knit with the discovery of rich gold deposits in the early

1930s. Fochville is the oldest town in the region, and was declared a town in 1951. The town Carletonville was named after Guy Carleton Jones, an engineer from the Gold Fields Ltd mining company, who played a prominent role in the discovery of the West Wits gold field, of which Carletonville forms a part. The mining company decided, in November 1946, to establish the town. Carletonville was proclaimed in 1948 and attained Town Council Status on 1 July 1959. The main economic sectors are Mining (50.7%), trade (9.7%), finance and business services (9.9%), community services (9.2%) and general government (9.1%). (Source: www.localgovernment.co.za)

The Population of the Study Area: (Source: www.localgovernment.co.za)

Table 35: Population ratio of Merafong City Local Municipality

Population	188 843

The Age structure of the Study Area: (Source: www.localgovernment.co.za)

Table 36: Age structure ratio of Merafong City Local Municipality

Population under 15	23.3%
Population 15 to 64	72.2%
Population over 65	4.5%

Dependency Ratio of the Study Area: (Source: www.localgovernment.co.za)

Table 37: Dependency ratio of Merafong City Local Municipality

Per 100 (15-64)	38.5

Sex ratio of the Study Area: (Source: www.localgovernment.co.za)

Table 38: Sex ratio of Merafong City Local Municipality

Males per 100 females	115.3

Population growth: (Source: www.localgovernment.co.za)

Table 39: Population growth ratio of Merafong City Local Municipality

Per annum	-1.02%

Education: (Source: www.localgovernment.co.za)

Table 40: Education ratio of Merafong City Local Municipality

No schooling	4.1%

Matric	29.4%
Higher education	9.0%

Household Dynamics: (Source: www.localgovernment.co.za)

Table 41: Household dynamics ratio of Merafong City Local Municipality

Households	79 834
Average household size	2.4
Female headed households	29.2%
Formal dwellings	81.3%
Housing owned	36.9%

Household Services: (Source: www.localgovernment.co.za)

Table 42: Household services ratio of Merafong Local Municipality

Flush toilet connected to sewerage	85.8%
Weekly refuse removal	75.2%
Piped water inside dwelling	62.1%
Electricity for lighting	86.7%

5.4 Infrastructure

5.4.1 Airfields

The propsed study area consists of several Aerodromes, Transport Airports and Landing Strips (Refer to figure 16 below).

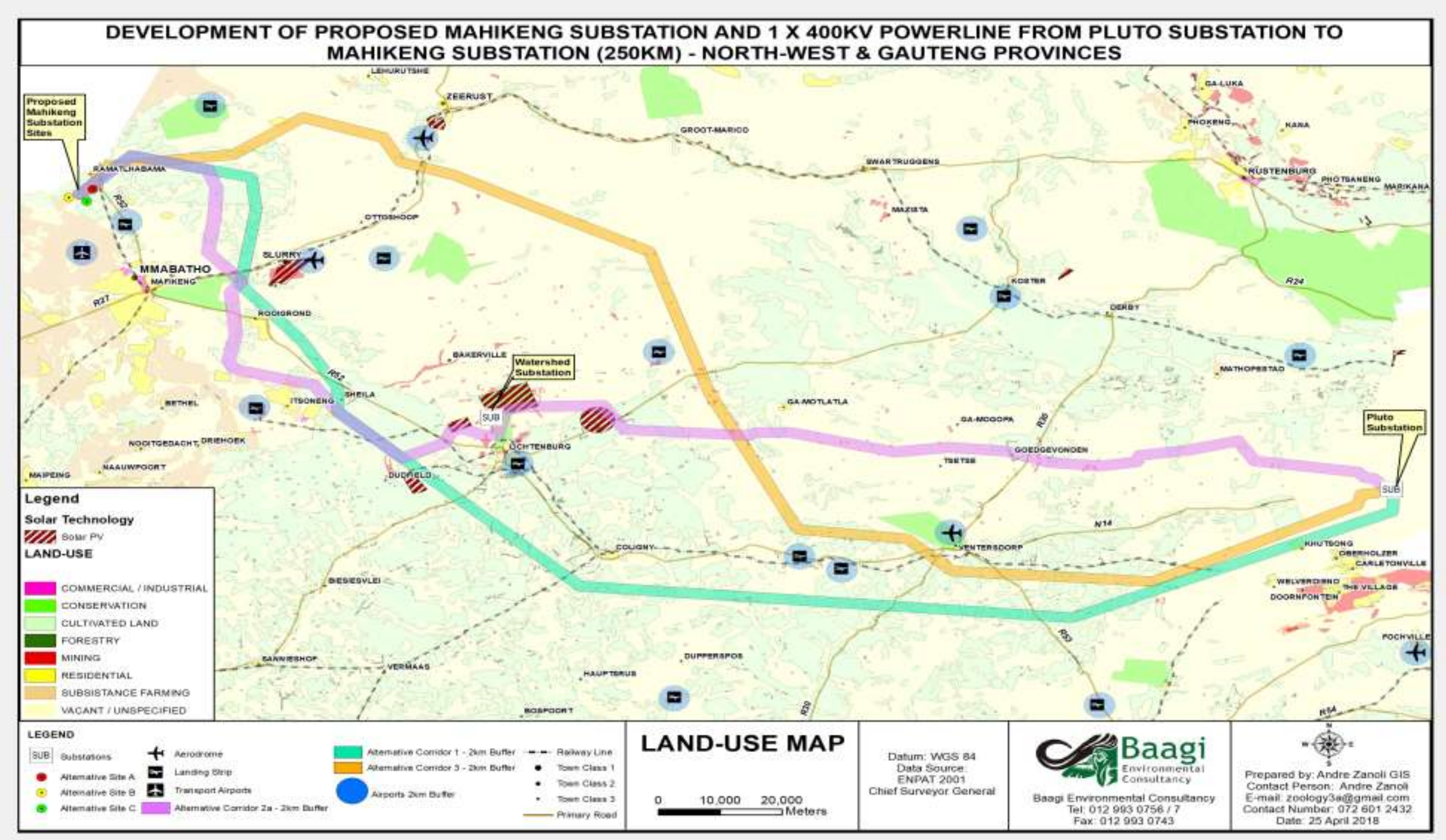


Figure 15: Land-use Map

5.4.2 Power Lines

There are various existing transmission power lines within the study area, including an existing 2*275kV transmission line between Pluto Substation and Watershed Substation, which is in Lichtenburg.

5.4.3 Road

The study area consists of several national, regional and local roads namely; the R30, R53, R27, and N14. A number of gravel roads that lead to nature reserves, game farms and mines are also observed.

5.4.4 Buildings Heritage Artifacts and Developments

Buildings such as mining facilities, depots, churches, cultural sites and old mud huts were observed through out the study area. The study area also consists of maize farms, game farms and Nature Reserves. (Refer to the figures 16 to 20 below)

Figure 16: Silo's

Figure 17: Mining Facilities

Figure 18: Molemane Eye Nature Reserve

Figure 19: Existing 275kV Power line

Figure 20: Farms

Figure 21 below is a Cultural Site map that illustrates all the cultural heritage sites found within the study area.

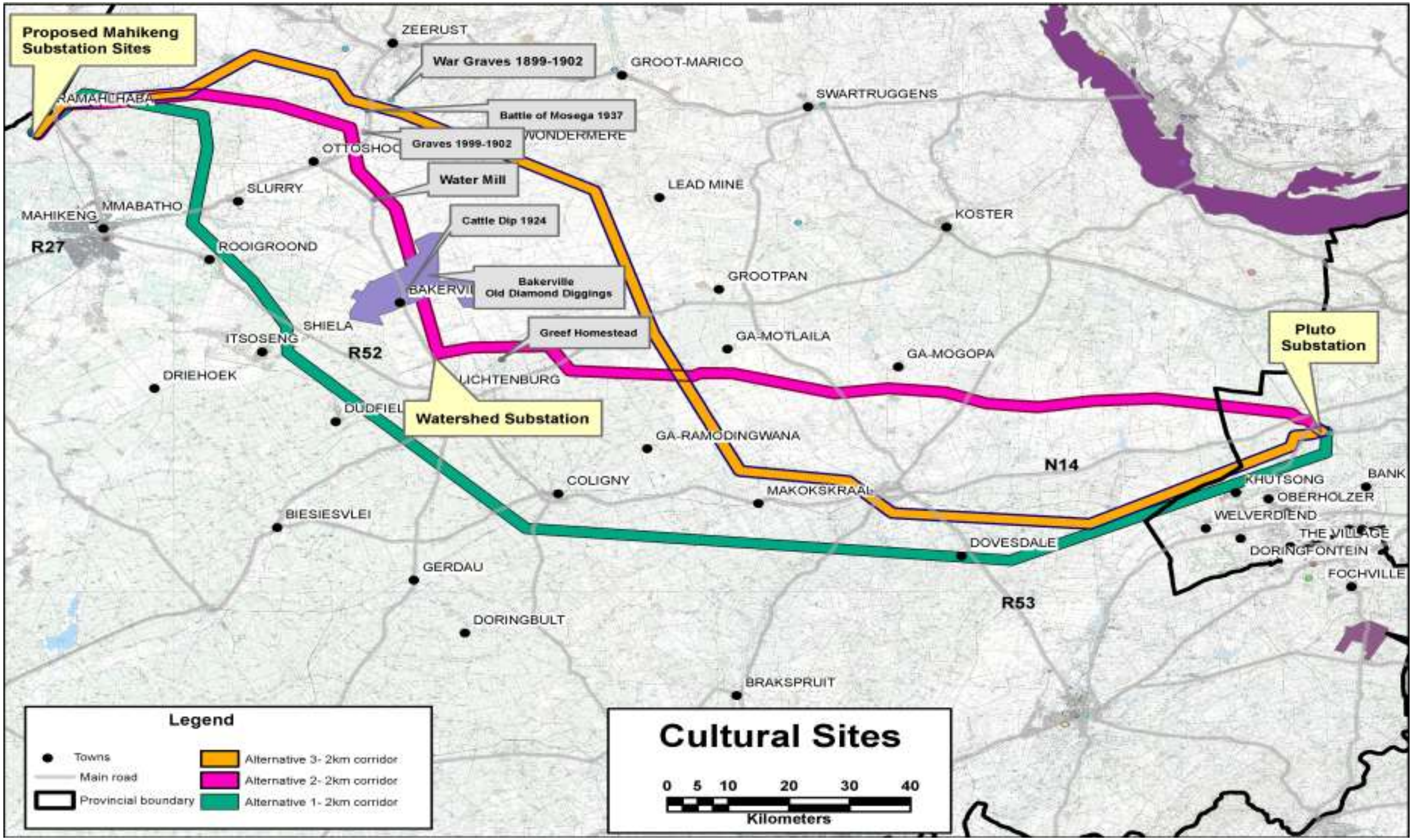


Figure 21: Cultural Sites

6. DESCRIPTION OF THE BIOPHYSICAL ENVIRONMENT

This section of the Assessment Report provides a description of the environment that is affected by the proposed development. This information is provided in order to assist the reader / authorities/ I&APs in understanding the receiving environment within which the proposed development is to take place. Features of the biophysical, social and economic environment that may be directly or indirectly affected, or could be affected by the proposed development have been described. This information has been sourced from both existing information available for the area (desktop studies) as well as collected data from the study area with the aim of proving the context within which this DEIAR is being conducted.

6.1 Climate

The climate in Carletonville is warm and temperate. When compared with winter, the summers have much more rainfall. This location is classified as Cwb by the Köppen and Geiger Climate Classification. The average annual temperature is 15.9 °C in Carletonville. The average annual rainfall is 660 mm.

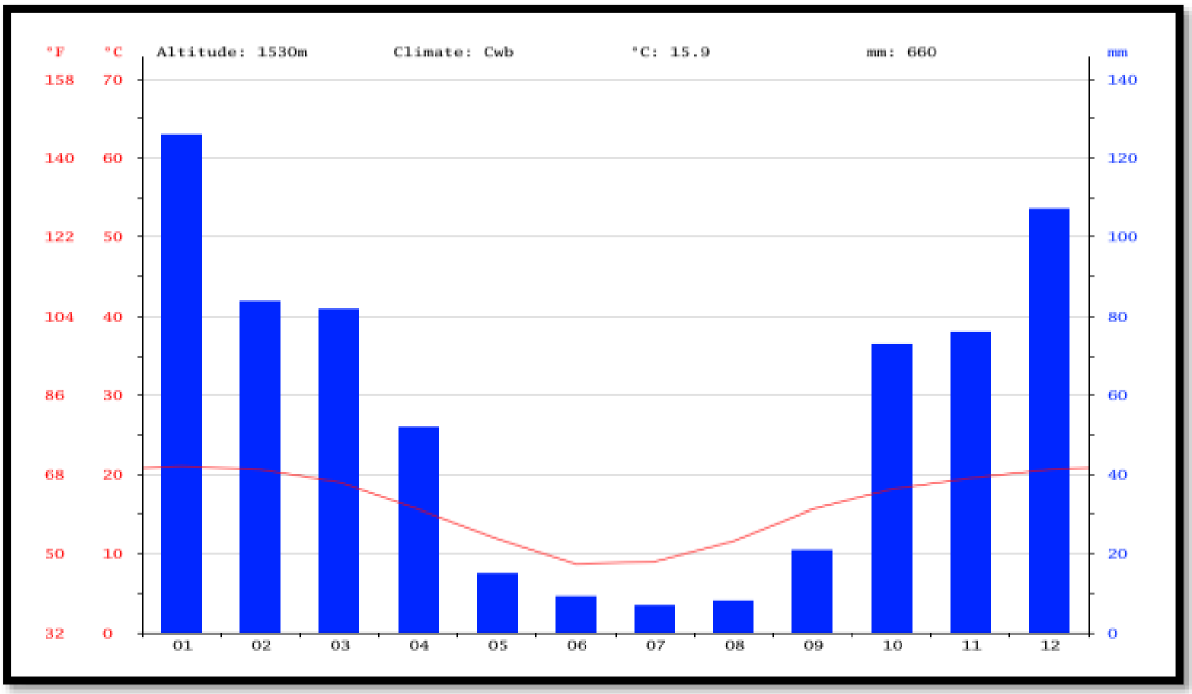


Figure 22: Climate of Carletonville (Period 1982 – 2012)

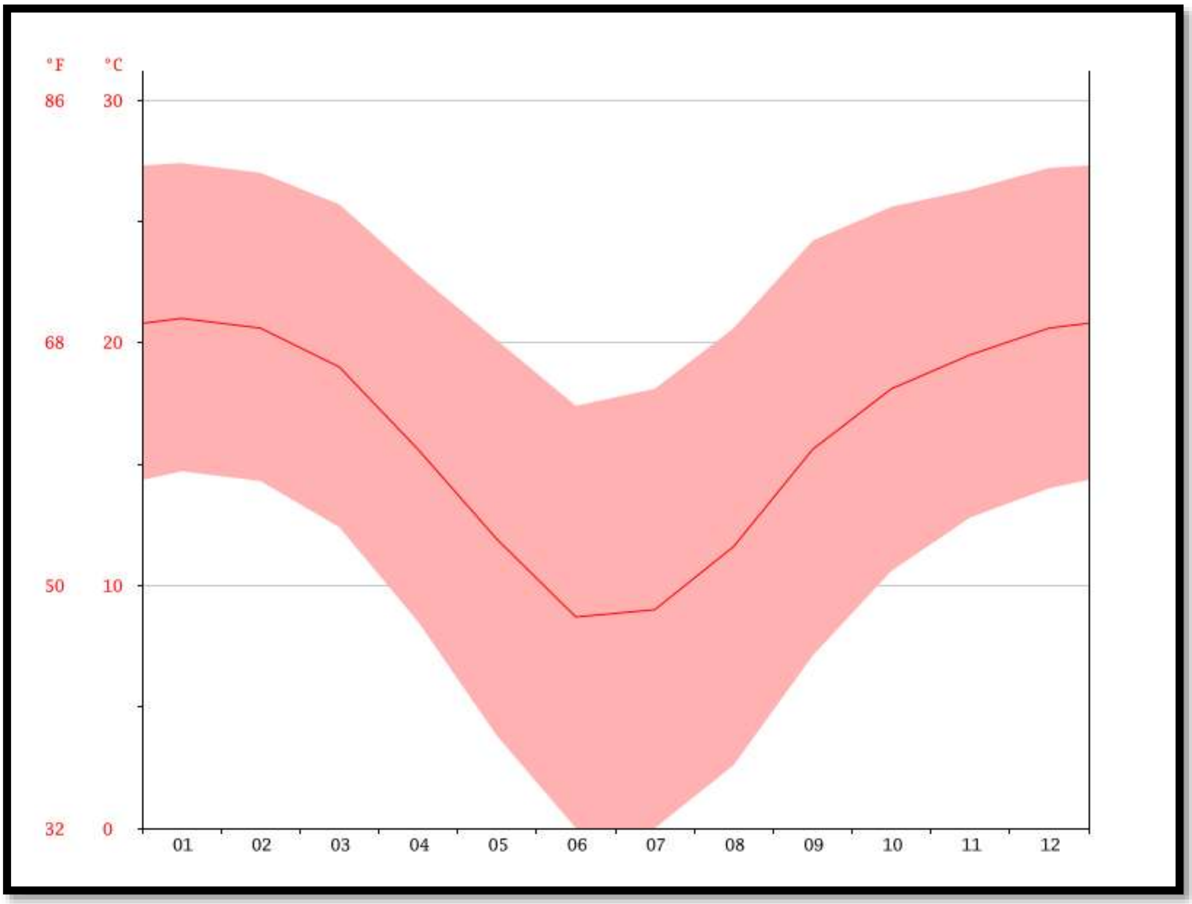


Figure 23: Temperature of Carletonville ((Period 1982 – 2012)

January is the warmest month of the year. The temperature in January averages 21.0 °C. At 8.7 °C on average, June is the coldest month of the year.

Ventersdorp normally receives about 490mm of rain per year, with most rainfall occuring mainly during mid summer. It receives the lowest rainfall (0mm) in June and the highest (96mm) in January. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Ventersdorp range from 17.3°C in June to 29°C in January. The region is the coldest during June when the mercury drops to 0°C on average during the night.

Lichtenburg normally receives about 447mm of rain per year, with most rainfall occuring mainly during mid summer. It receives the lowest rainfall (0mm) in June and the highest (88mm) in January. The average daily maximum temperatures shows that the average midday temperatures for Lichtenburg range from 17.7°C in June to 30°C in January. The region is the coldest during June when the mercury drops to 0°C on average during the night.

Mafikeng's climate is a local steppe climate. During the year there is little rainfall. This location is classified as BSh by Köppen and Geiger. The temperature here averages 18.5 °C. The average annual rainfall is 541 mm.

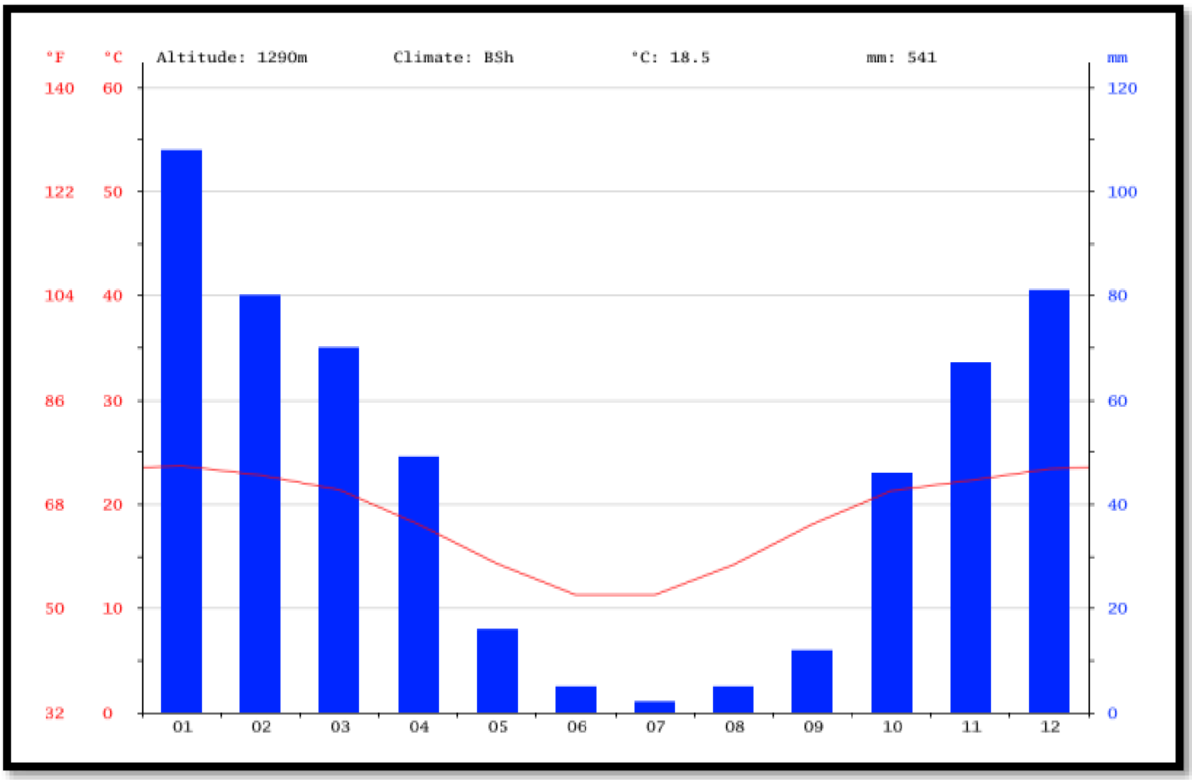


Figure 24: Climate for Mahikeng ((Period 1982 – 2012)

Precipitation is the lowest in July, with an average of 2 mm. Most of the precipitation here falls in January, averaging 108 mm.

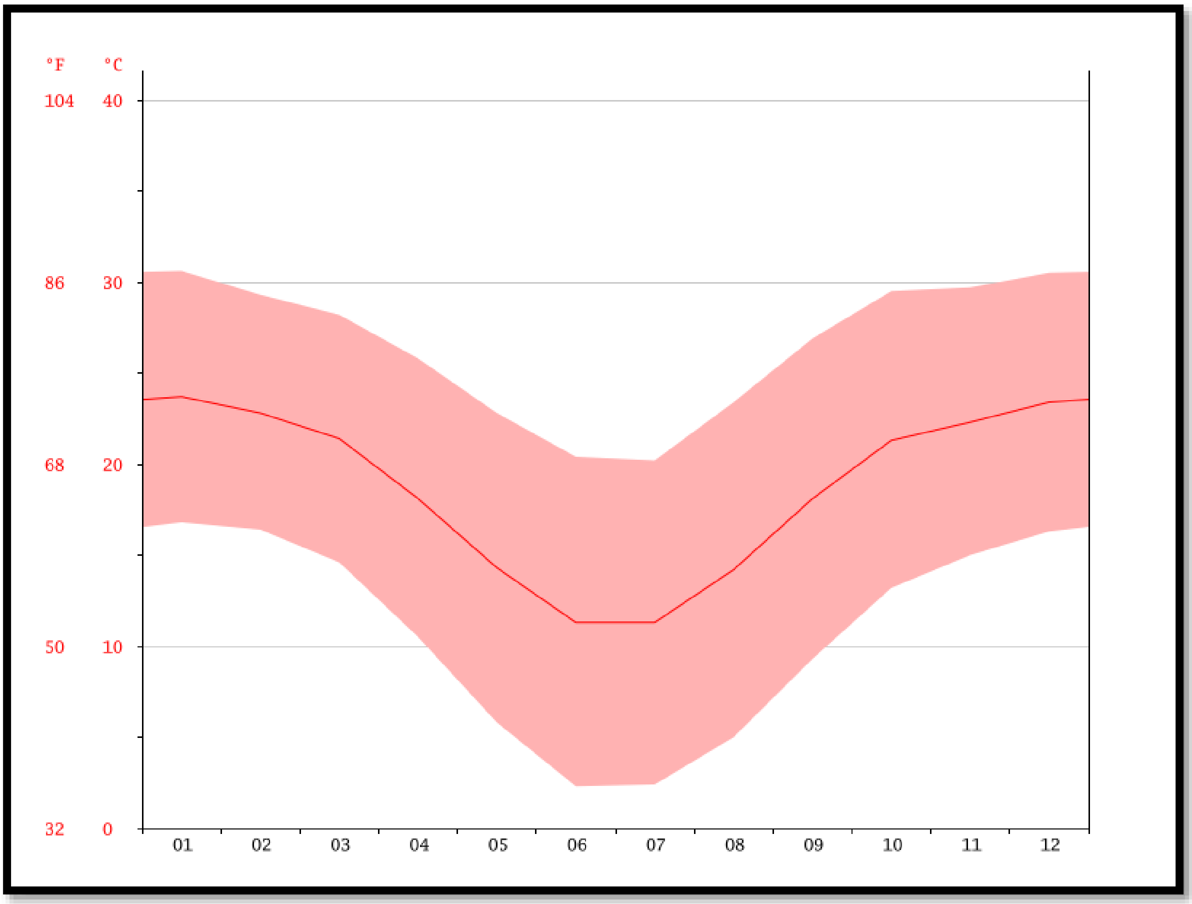


Figure 25: Temperature for Mafikeng (Period 1982 – 2012)

At an average temperature of 23.7 °C, January is the hottest month of the year. June is the coldest month, with temperatures averaging 11.3 °C.

Zeerust normally receives about 439mm of rain per year, with most rainfall occuring mainly during mid summer. It receives the lowest rainfall (0mm) in June and the highest (83mm) in January. The monthly average daily maximum temperatures shows that the average midday temperatures for Zeerust range from 19.4°C in June to 30.8°C in January. The region is the coldest during July when the mercury drops to 0.6°C on average during the night.

6.2 Hydrology

The proposed project falls within the Oranje, Vaal and Limpopo Primary Catchment areas.

The surface waters in the North West area are in the form of rivers, dams, pans, wetlands and dolomitic eyes fed by aquifers. Perennial surface water resources are generally scarce, particularly in the semi-arid western portion of the Province. Runoff as a percentage of the precipitation ranges from less than 1% in the west to approximately 7% in the eastern region, with the average runoff (6%) being below the national average of 9%. The main rivers are the Crocodile, Groot Marico, Hex, Elands, Vaal, Mooi, Harts and Molopo rivers. (Source: tourismnorthwest.co.za)

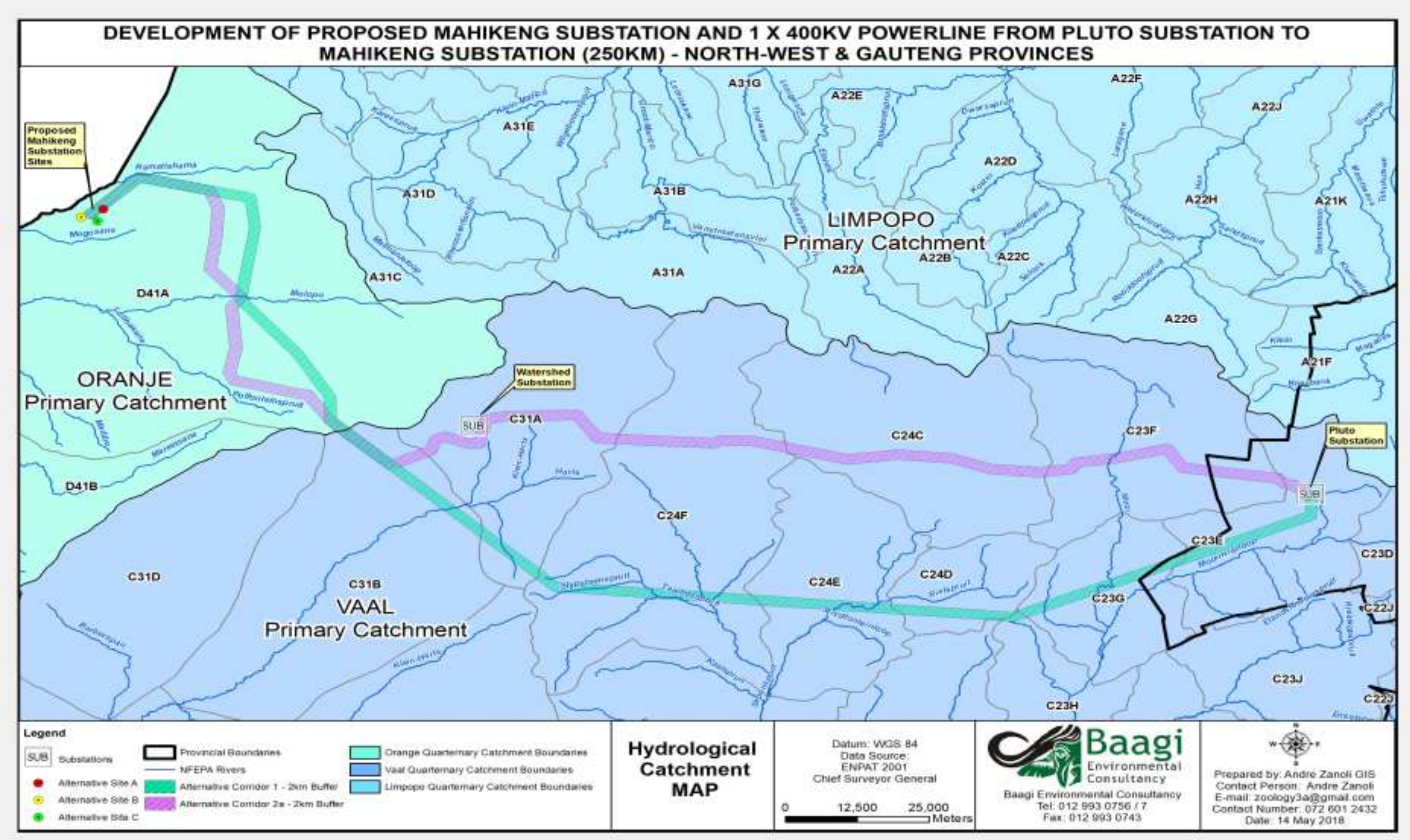


Figure 26: Hydrological Catchment Map

6.2.1 Wetland and drainage line crossings

The proposed corridors are located within the Vaal River Catchments. The important rivers and drainage lines to be crossed by the proposed corridors are the Mooi River, Skoonspruit River, Taaibosspruit, Harts River and the Klein-Marico River (Figure 26). It is evident that Alternative corridor 1 comprehends the highest number of river and drainage lines (c. 60.96 km) followed by Corridor 3 (c. 45.25 km), while Corridor 2 only traverses approximately 5.14 km of drainage lines. Alternative corridor 2a holds the lowest number of waterbodies (n=41). These waterbodies also include a number of small pans, and may be regarded as important ephemeral foraging habitat for dispersing near threatened flamingo species. These inland waterbodies are also important foraging and breeding habitat for a number of waterfowl taxa.

A number of dolomitic springs or "eyes" are also prominent along Alternative corridor 2a such as the Marico Oog, Molopo Oog and the Molemane's Oog.

Table 43: Summary of properties for different river datasets in each corridor

	Corridor 1	Corridor 2
Number of sub-quaternary river reaches present in each corridor (I 2015)	12	3
Number of sub-quaternary river reaches that have A and B PES classes	1	0
Range in PES of sub quaternary river reaches in each corridor (DWS, 2C	B-E	C-D
Number of sub-quaternary river reaches that have a Very high or Hi and ES	2	1
Number of NFEPA river reaches present	25	5
River types (Nel *et al.,* 2011)	Permanent or seasonal lower foothills (majori rivers) to Not permanent and flashy lower foc (10 river reaches), permanent or seasonal u foothill (3 river reaches)	Not permanent/flashy lower foothills (majorit rivers) to permanent and seasonal lower foothills river)
Range in Present Ecological State of river reaches in corridor (Nel e 2011))	C (Moderately modified) to D (Largely modified	C (Moderately modified)

	Corridor 1	Corridor 2
River condition (Nel *et al.,* 2011)	AB (None), C (23 river reaches) and Z (2 reaches)	AB (Intact) (2 river reaches) and C (3 river reaches
Conservation status (Driver *et al.,* 2004)	Critically Endangered (majority of rivers arour Endangered (4 river reaches), Non threatene river reaches)	Critically Endangered (1 river reach), Endangere river reach) and Non threatened (one reach)
Combined NFEPA river length in each route corridor (calculated)	60.96 km	5.14 km

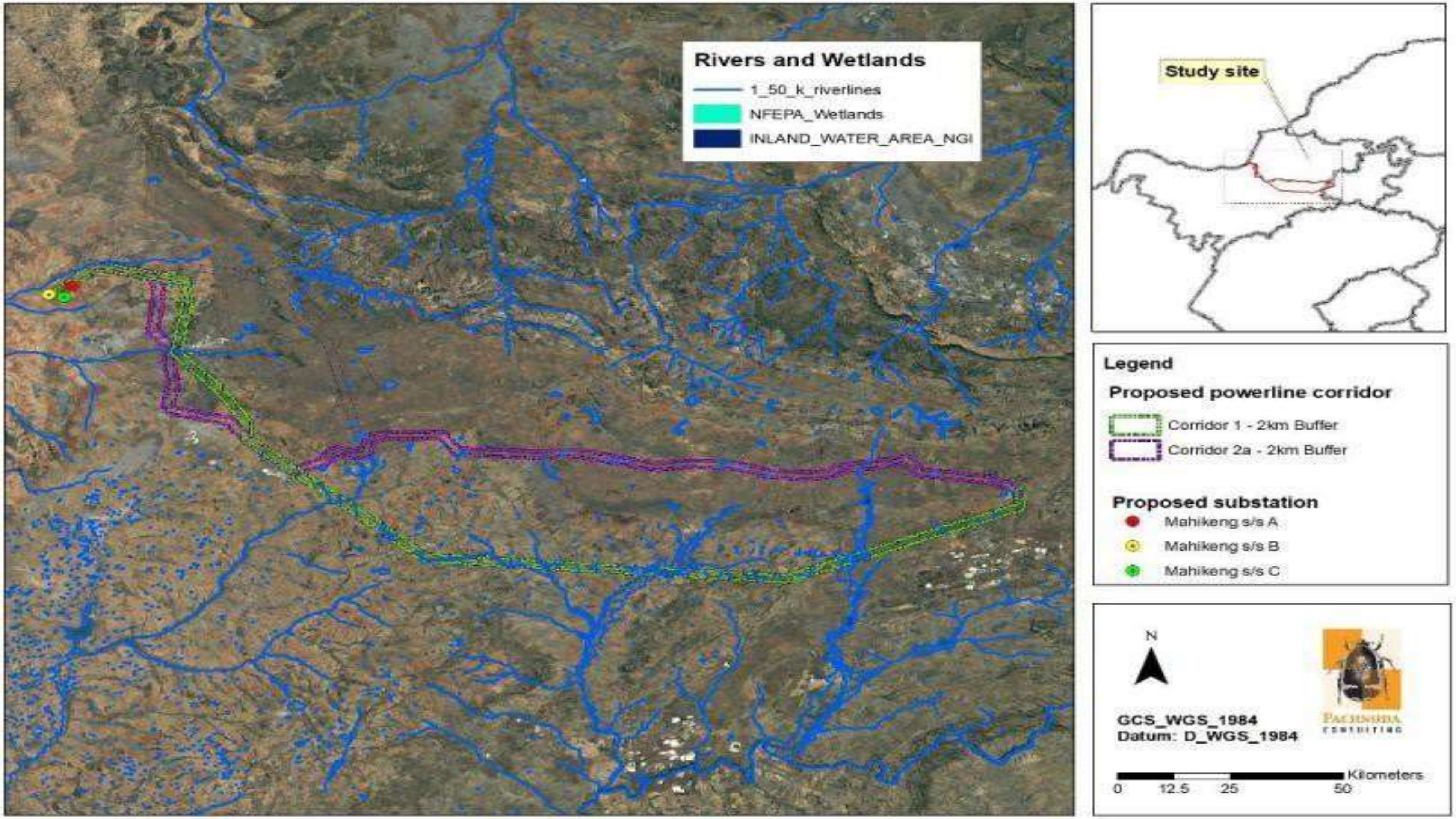


Figure 27: Rivers and Wetland Map

6.3 Ecology

Ecology is defined as the branch of biology that deals with the relations of organisms to one another and to their physical surroundings.

6.3.1 Fauna

Red Listed, Endemic and Conservation Important Faunal Taxa

It is evident from Figure 28 and Figure 29 that the highest number of mammal taxa and mammal species of conservation concern are confined to the north-western and south-eastern parts of the study area. High numbers of mammal species have been recorded from Alternative Corridor 2a, north of Lichtenburg and within the Klein-Marico River catchment. In addition, high numbers of mammal species were also recorded from grassland near the Pluto substation. One particular area which holds high numbers of both mammal species and conservation important species is the Abe Bailey Nature Reserve in Gauteng.

The proposed Alternative corridors traverse through extensive areas of open dolomite and sandy grassland which provide suitable habitat for a variety of mammal species as well as a variety of bushveld types. It is likely to support 13 mammal species of conservation concern. Likewise, the perennial rivers and seeps provide suitable habitat for near-threatened taxa that are wetland-dependant (e.g. shrew taxa of the genus *Crocidura,* the Cape Clawless Otter *Aonyx capensis* and Serval *Leptailurus serval*). However, the area also supports two large carnivores of global and national significance (Brown Hyaena *Parahyaena brunnea* and Leopard *Panthera pardus*) and two globally threatened taxa (Black-footed Cat *Felis nigripes* and White-tailed Rat *Mystromys albicaudatus*). Apart from the aforementioned species, the mesic Highveld grassland types on the eastern parts of the study area also provide habitat for the nationally near threatened Vlei Rat (*Otomys auratus*) and Grey Rhebok (*Pelea capreolus*). In addition, the Mafikeng Bushveld on the western parts of the study area was one of a few vegetation types on the study area where the vulnerable Temminck's Ground Pangolin (*Smutsia temminckii*) was recorded.

The study area also supports (based on known historical and extant distribution ranges) habitat for 19 frog species, 56 reptile taxa, 12 Odonata (dragonflies and damselflies) and 132 diurnal butterfly species.

Most mammal species are generally highly mobile (except those that live in burrows or dens, or those with small body size) and therefore, able to vacate areas should adverse environmental conditions prevail. Therefore, direct impacts associated with construction activities on adult mortality are less likely to occur, although indirect impacts will have consequences on their “fitness” (e.g. the ability of a species to reproduce). However, persistent disturbances across extended temporal scales will eventually affect any population’s ability to sustain itself, and will more than likely result in total abandoning of a particular area.

Species most likely to be affected are habitat specialists e.g. Black-footed Cat *F. nigripes,* Temminck's Ground Pangolin *Smutsia temminckii* and White-tailed Rat *M. albicaudatus*.

Faunal compositions are believed to remain the same irrespective of the intensity of the construction activities (e.g. road construction) associated with the power lines, but the distribution and abundance of species could effectively change. Many habitat specialists could suffer from local range contraction.
In addition, construction activities go hand in hand with high ambient noise. Although the construction phase is considered to be of short duration, many of the larger terrestrial species will vacate the study area during the construction phase and will become temporarily displaced.

Table 52 provides a list of threatened, near-threatened and conservation important faunal species with geographic distribution ranges sympatric (overlapping) to the study area. It is evident that most of the taxa are evenly distributed across the study area owing to the extensive and vast occurrence of open grassland. However, many of the habitat specialists are either located on the sandy Bushveld in the west, mountainous carst systems in the north (Marico area) or the mesic Highveld grassland on the eastern extremity of the study area. Many are also partial towards the grassland of untransformed ecological condition and termitaria.

Table 44: A list of threatened, near threatened and conservation important faunal species likely to occur on the study area (excluding introduced game).

Scientific Name	Common Name	Global Conservation Status	National Conservation Status		Probability of Occurrence	Habitat
	Mammals					
Leptailurus serval	Serval		Near threatened		Known to be present.	Along moist grassland near rivers and dams.
Felis nigripes	Black-footed Cat	Vulnerable	Vulnerable		Known to be present.	Widespread, although partial to habitat with shelter (aardvark burrows or termitaria) and a high abundance of murid prey and terrestrial passerine birds.
Parahyaena brunnea	Brown Hyaena	Near threatened	Near threatened		Known to be present.	Widespread.
Poecilogale albinucha	African Weasel		Near threatened		Could occur. Known from 2627AD	Mainly open grassland with an abundance of rodent prey.
Atelerix frontalis	South African Hedgehog		Near threatened		Known to be present	A widespread species that prefer dry habitat types and will often utilise urban gardens.
Mystromys albicaudatus	White-tailed Rat	Endangered	Endangered		Could occur, status uncertain. It was recorded from 2627AD and 2626AA.	Late-successional Themeda triandra grassland on sandy soils. Most probably restricted to the Vaal-Vet Sandy Grassland type on the western parts of the study area.
Crocidura mariquensis	Swamp Musk Shrew		Near threatened		High.	Mainly moist or inundated grassland and sedge along the edges of pans, dams and vleis.
Otomys auratus	Vlei Rat		Near threatened		High, mainly in east of study area corresponding to vegetation types of the Grassland Biome	Moist grassland bordering wetland feautres.
Panthera pardus	Leopard	Near threatened	Vulnerable		High, mainly confined to the northern parts of the study area consisting of Bushveld and Thornveld vegetation types	Varied, although partial to broken or mountainous terrain.
Aonyx capensis	Cape Clawless Otter	Near threatened	Near threatened		High	Mainly perennial rivers, streams, dams and pans.
Pelea capreolus	Grey Rhebok		Near threatened		Localised, confirmed from 2525DB, 2626CB, 2526CC, 2627AD.	Open undulating grassland at high altitudes.
Redunca fulvorufula fulvorufula	Mountain Reedbuck		Endangered		High, mainly from northern parts of study area,	Broken or mountainous terrain in both grassland and savanna.

Scientific Name	Common Name	Global Conservation Status	National Conservation Status		Probability of Occurrence	Habitat
Smutsia temminckii	Temminck's Ground Pangolin	Vulnerable	Vulnerable		Could occur in western part of study area (2525DA, 2525DB, 2626CB & 2525DB)	Open arid sandy savanna with a high abundance of prey (mainly ants).
Frogs						
Pyxicephalus adspersus	Giant Bullfrog		Near threatened		Could occur, known from three records on the study area.	Partial to seasonal pans and depressions.
Reptiles						
Homoroselaps dorsalis	Striped Harlequin Snake		Near threatened		Could occur, although not confirmed from the study area.	Partial to outcrops and termitaria.
Invertebrates						
Ceratogyrus darlingi			Specially Protected (in NW Prov.)		Could occur on western parts of study area	Mainly dry sandy bushveld.
Idiothele nigrofulva			Specially Protected (in NW Prov.)		Could occur .	Mainly in bushveld on clayey soils.
Harpactira hamiltoni			Specially Protected (in NW Prov.)		Could occur on eastern parts of study area	Mesic highveld grassland.
Opistophthalmus pugnax			Specially Protected (in NW Prov.)		Could occur on eastern parts of study area	Mesic highveld grassland.

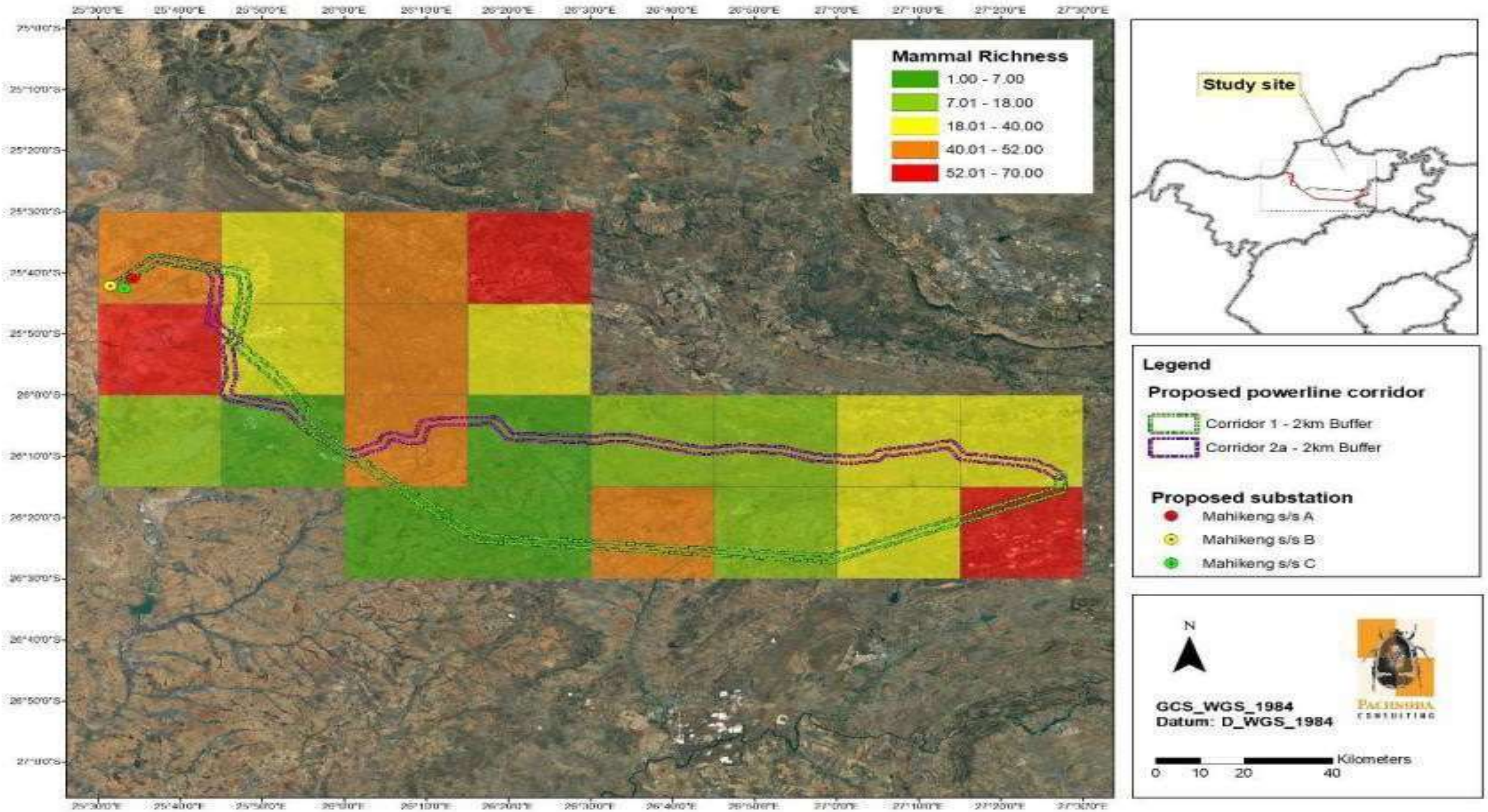


Figure 28: A map illustrating the preliminary (approximated) mammal species richness (number of species) on the study area (sensu Mammal Map)

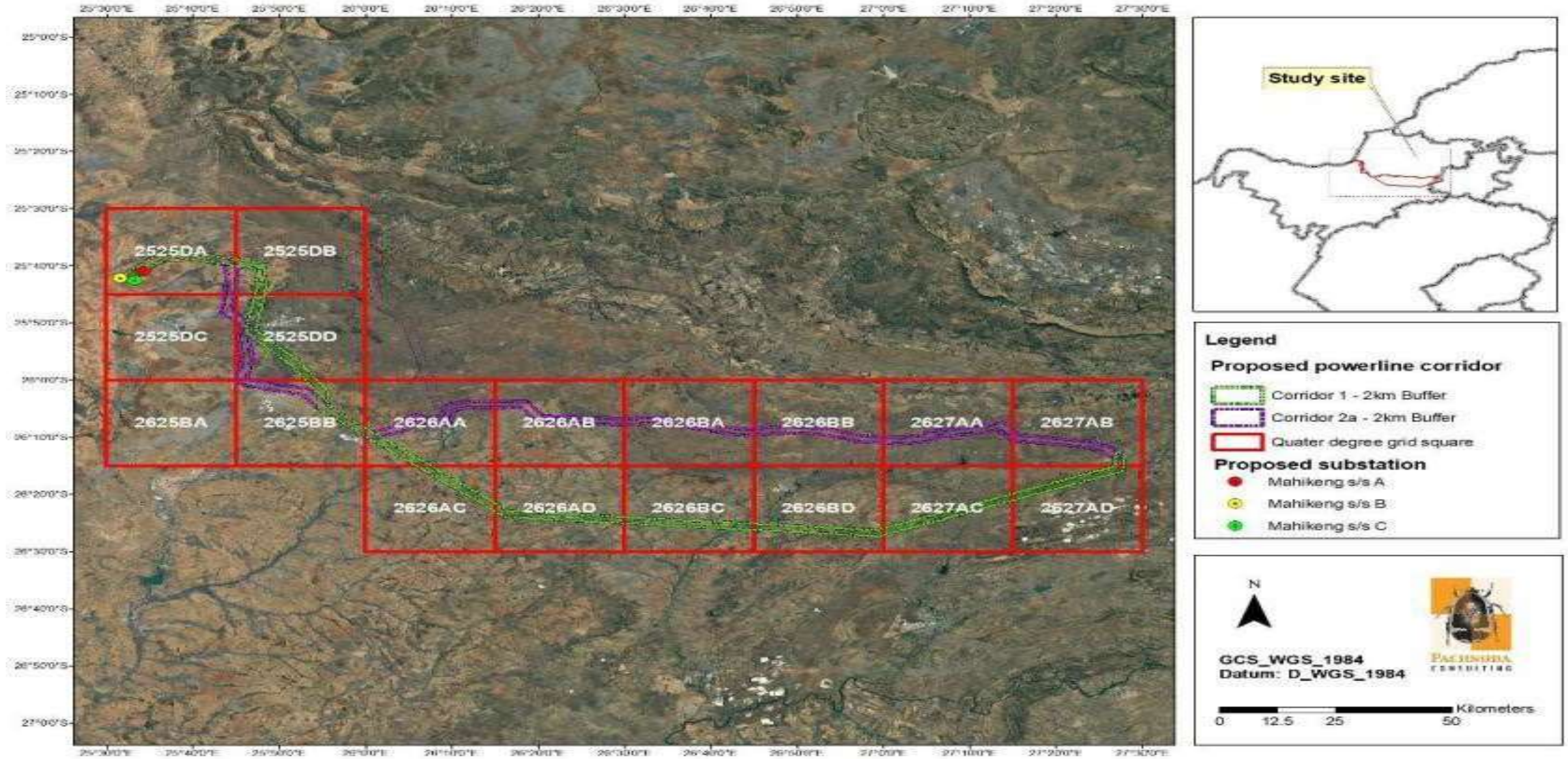


Figure 29: A map illustatrating the QDS on the study area indicating the historical distribution of threatend and near threatend mammal taxa (sensu Mammal Map)

6.3.2 Avi-Fauna

Important avifaunal habitat types

The composition and distribution of the vegetation communities on the study area are a consequence of a combination of factors simulated by soil texture (sandy vs. clay), topography (plains vs. undulating grassland), grazing disturbances (presence of livestock), vertical heterogeneity (tall open bushveld vs. low shrubland) and the presence of drainage and wetland features (refer to figure 30):

- Mixed Bushveld: This habitat unit (or vegetation association) is widespread on the northern section of the study area and is represented by Zeerust Bushveld, Moot Plains Bushveld and the Dwarsberg-Swartruggens Mountain Bushveld. Some sections have been converted to short dense microphyllous bushveld owing to inappropriate grazing by livestock. However, untransformed mixed Bushveld persist over most of the study area which provide habitat for a high richness of bird species, including many large birds of prey taxa.

- *Medium to tall open microphyllous woodland:* This unit is dominant on the western part of the study area, which was also prominent at the proposed Mahikeng Main transmission substation. It occurs primarily on sandy soils dominated by a well-defined graminoid layer of *Aristida canescens, Eragrostis rigidior, Cymbopogon pospischilii* and *Heteropogon contortus*. The canopy is dominated by *Vachellia erioloba* and other noteworthy plant species include *Vachellia tortilis, Senegalia mellifera, Peltophorum africanum* and *Searsia lancea*. It is represented by Mafikeng Bushveld and Klerksdorp Thornveld. It provides potential suitable foraging and breeding habitat (especially the taller specimens of *Vachellia erioloba*) for large endangered and critically endangered scavenging birds of prey (e.g. Vultures and Tawny Eagle *Aquila rapax*), while the open structure of the graminoid layer provides foraging habitat for the vulnerable Secretarybird (*Sagittarius serpentarius*).

- *Open grassland:* The majority of the proposed corridors correspond to open grassland, either species-rich undulating dolomite grassland or flat *Themeda triandra - Eragrostis* dominated grassland on sandy soils. It provides important habitat for the endemic Melodious Lark *Mirafra cheniana*, including a range of other terrestrial species such as the vulnerable White-bellied Korhaan (*Eupodotis senegalensis*), Secretarybird (*S. serpentarius*) and the near threatened Blue Crane (*Anthropoides paradiseus*).

- *Hills and ridges:* This habitat type was scattered on the study area, especially in the north of the study area. It is confined to the various ridges, hills and outcrops which provides important fire refugia for many woody plant and fauna species, which were responsible for a high floristic diversity. In addition, it provides breeding and foraging habitat for certain bird of prey, namely the vulnerable Verreaux's Eagle (*Aquila verreauxii*) and the vulnerable Lanner Falcon (*Falco biarmicus)*.

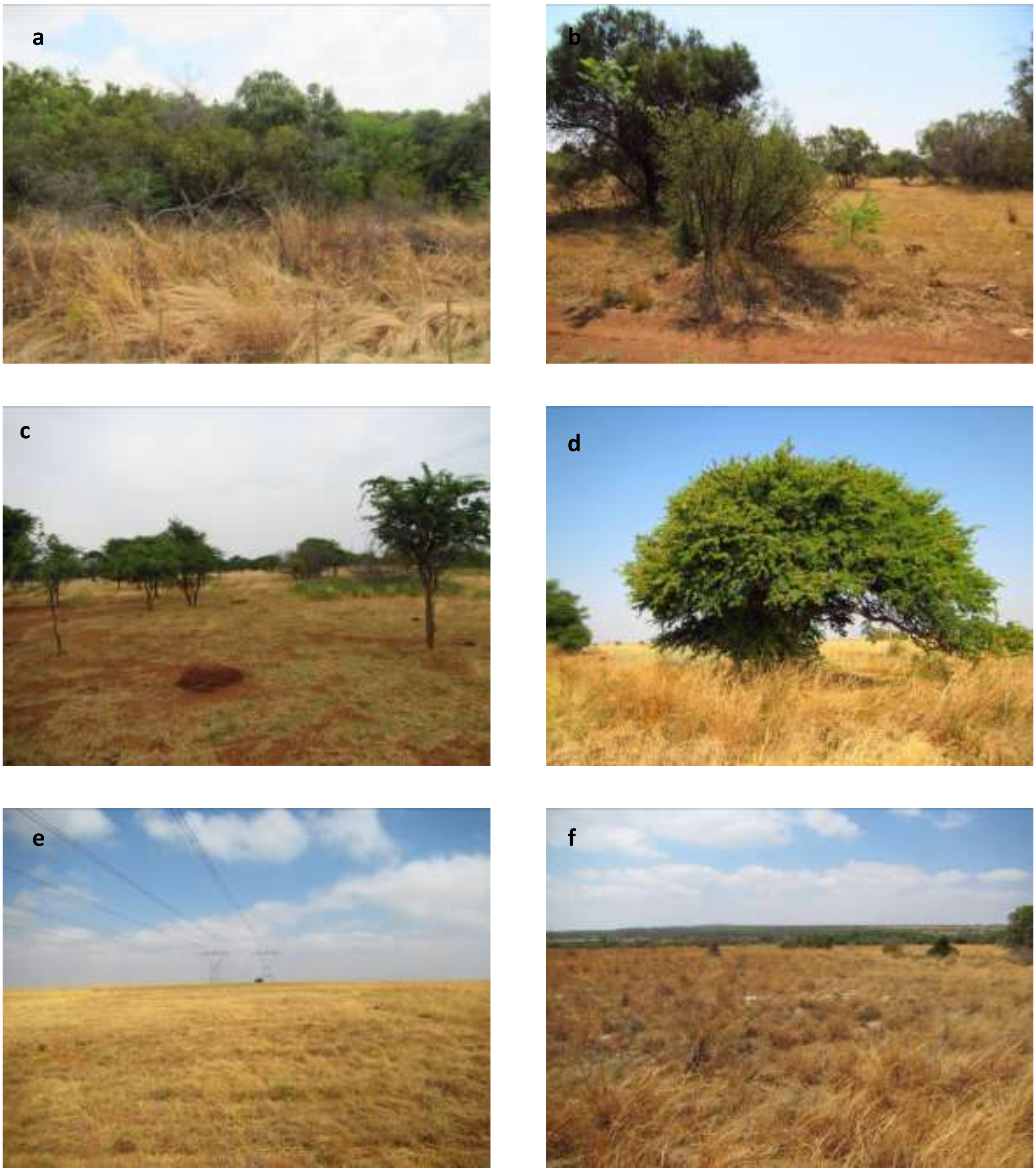
- *Perennial rivers and streams*: This habitat type are important daily flyways for many waterbird species in the region while the prominent woody layer increases the local vertical heterogeneity and niche space which is directly proportional to avifaunal richness, especially "bushveld" birds. It is located along major drainage lines, especially perennial rivers such as the Klein-Marico River, Mooi River, Harts River, Taaibosspruit and the Skoonspruit. The riparian vegetation is typified by a prominent woody component dominated by a dense layer of *Vachellia karroo* and *Asparagus laricinus*. The perennial rivers and streams are important foraging habitat for piscivorous bird taxa such as the Reed Cormorant *Microcarbo africanus* and African Darter *Anhinga rufa*, but also provides refugia for the near threatened Half-collared Kingfisher (*Alcedo semitorquata*) and vulnerable African Finfoot (*Podica senegalensis*), especially along the Klein-Marico River.

- *Channelled and un-channelled valley bottom seeps*: These wetland features are scattered on the study area. They consist of linear landscape features which are often part of the upper catchment of the previous habitat type. They are mostly covered in open grassland. The large and extensive systems provide ephemeral foraging habitat for Blue Cranes (*Anthropoides paradiseus).*

A number of azonal habitat units were also identified in the study area, and it was necessary to elaborate on their importance, primarily from an avifaunal perspective:

- *Man-made impoundments* (dams) – these represent water bodies of variable size which were mainly created to act as irrigation for cultivation. They have undoubtedly benefit the colonisation and range expansion of many waterbird species that favours open water habitat (e.g. Red-knobbed Coot *Fulica cristata,* Egyptian Goose *Alopochen aegyptiaca,* South African Shelduck *Tadorna cana*, various members of *Anas* ducks and heron members of the genus *Ardea* and *Egretta*). These water bodies provide a safe refuge and nesting habitat for waterbird species;
- *Arable land, pastures and secondary bushveld* – These are cultivated land or areas that were historically cleared of vegetation. They provide ephemeral foraging habitat for large terrestrial taxa such as the White Stork (*Ciconia ciconia*), Secretarybird (*Sagittarius serpentarius*) and Abdim's Stork (*Ciconia abdimii*);

- *Pans* – These consist of small to medium basins which temporarily contain surface water. Most of the larger pans provide critical ephemeral foraging habitat for the near threatened Greater Flamingo (*Phoenicopterus roseus*), Lesser Flamingo (*Phoeniconaias minor*) and Maccoa Duck (*Oxyura maccoa*); and
- *Reservoirs and cattle drinking troughs* - These provide drinking water for large terrestrial bird species although they often act as congregation areas for vultures and birds of prey.



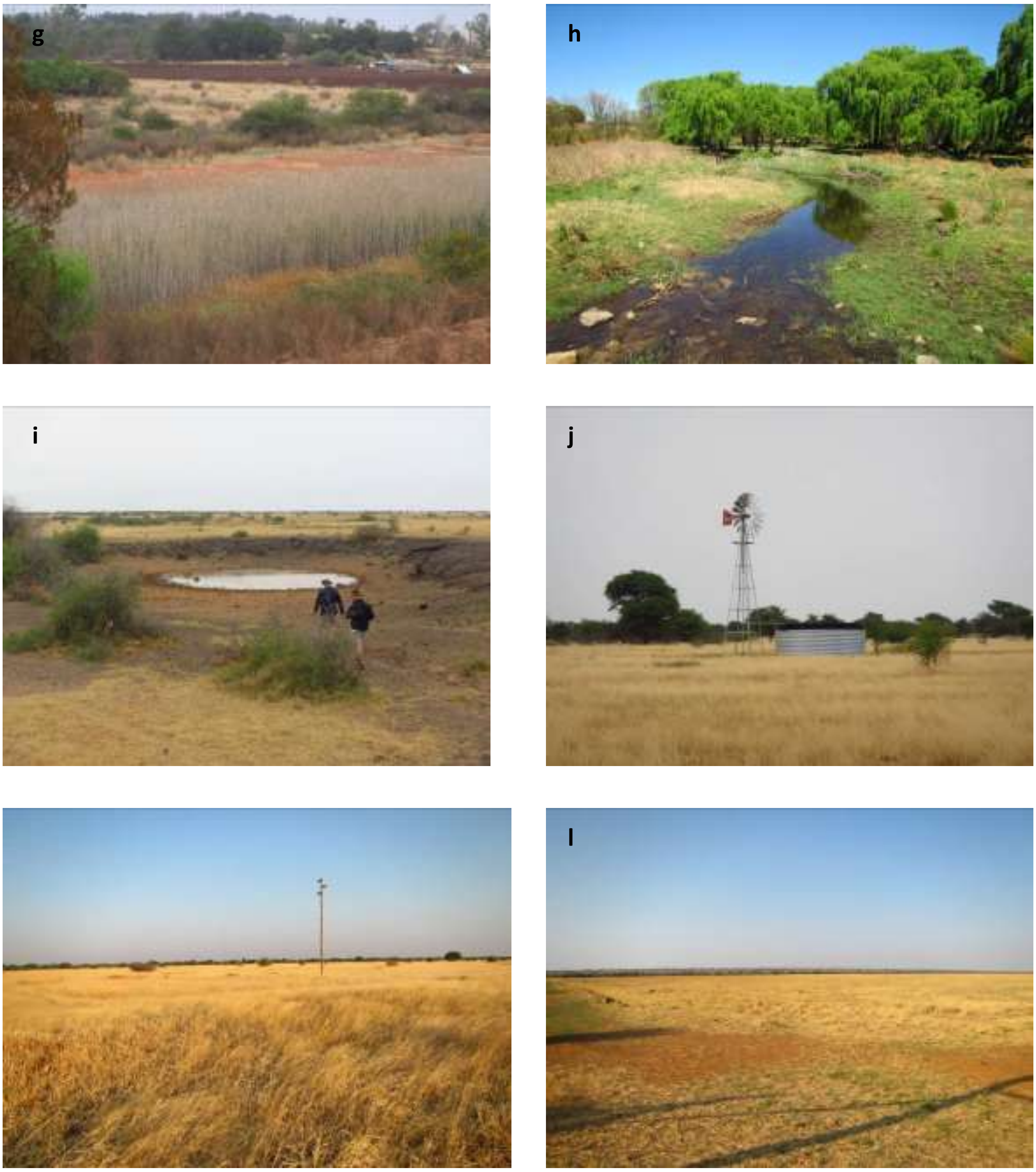


Figure 30: A collage of examples of the habiat tyoes in the study area: a-b mixed bushveld, c-d medium to tall open microphyllous bushveld, e-f open grassland, g-h channelled valley bottom seeps and perennial streams,i- small ephemeral,j-reservior,k- woody veg

Bird species likely to be impacted

In general, the study area supports a high richness of birds species (mean of 222.5 spp, n=20 QDSs). It is evident that increased richness values correspond to the open dolomite and highveld grasslands on the eastern parts of the study area as well as in the Lichtenburg and Marico area – both areas earmarked by a high spatial habitat heterogeneity consisting of outcrops, rocky grassland and open bushveld (Figure 30). Poor richness values occur on the western section along Alternative corridor 1 – an area with low spatial heterogeneity (Figure 30). The number of bird species recorded for each quarter degree square range from 165 species at Gerdau (2626AC) to as many as 291 species at Carletonville (2627AD).

Threatened and Near-threatened Species

Approximately 33 regional and globally threatened and near-threatened bird species are present on the study area.

Table 54 summarizes the Red listed species that have been recorded on the study area based on the SABAP1 database. It is evident that the highest number of Red listed species was recorded from the eastern and central parts of the study area (according to Harrison *et al*., 1997. According to Figure below it is evident that Alternative corridor 1 consists of eight QDSs of which 8-20 Red listed bird species were observed during SABAP1 (Table53). Only seven QDSs with 8-20 Red listed bird species corresponded to Alternative corridor 2.

It is also evident that the highest reporting rates for Red listed bird species (according to Harrison *et al*., 1997) were recorded on the northern parts of the study site (Figure 33). The highest mean reporting rates occurred along Alternative corridor 1 followed by Alternative corridor 2 (see reporting rate class 8.4-13 %, below. In addition, the QDSs with the highest reporting rates include Lead Mine (2526CD), Zeerust (2526CA), Ramathlabama (2525DA) and Groot-Marico (2526CB).

The most widespread and dominant Red listed species is the vulnerable Secretarybird (*S. serpentarius*), endangered Cape Vulture (*Gyps coprotheres*), near threatened Blue Crane (*Anthropoides paradiseus*) and endangered Yellow-billed Stork (*Mycteria ibis*). Other noteworthy species on the study area include the near threatened Short-clawed Lark (*Certhilauda chuana*), near threatened Greater Flamingo (*Phoenicopterus roseus*), near threatened Abdim's Stork (*Ciconia abdimii*), critically endangered White-backed Vulture (*Gyps africanus*), near threatened Curlew Sandpiper (*Calidris ferruginea*), Maccoa Duck (*Oxyura maccoa*) and the near threatened Black-winged Pratincole (*Glareola nordmanni*).

Non-threatened species

A number of other bird species are also likely to be affected by the proposed transmission line and include species such as the White Stork (*Ciconia ciconia*) and a number of waterbird species pertaining to the

Anatidae (ducks and geese), Phalacrocoracidae (cormorants), Anhingidae (darters), Ardeidae (herons and egrets) as well as Threskiornithidae (ibises).

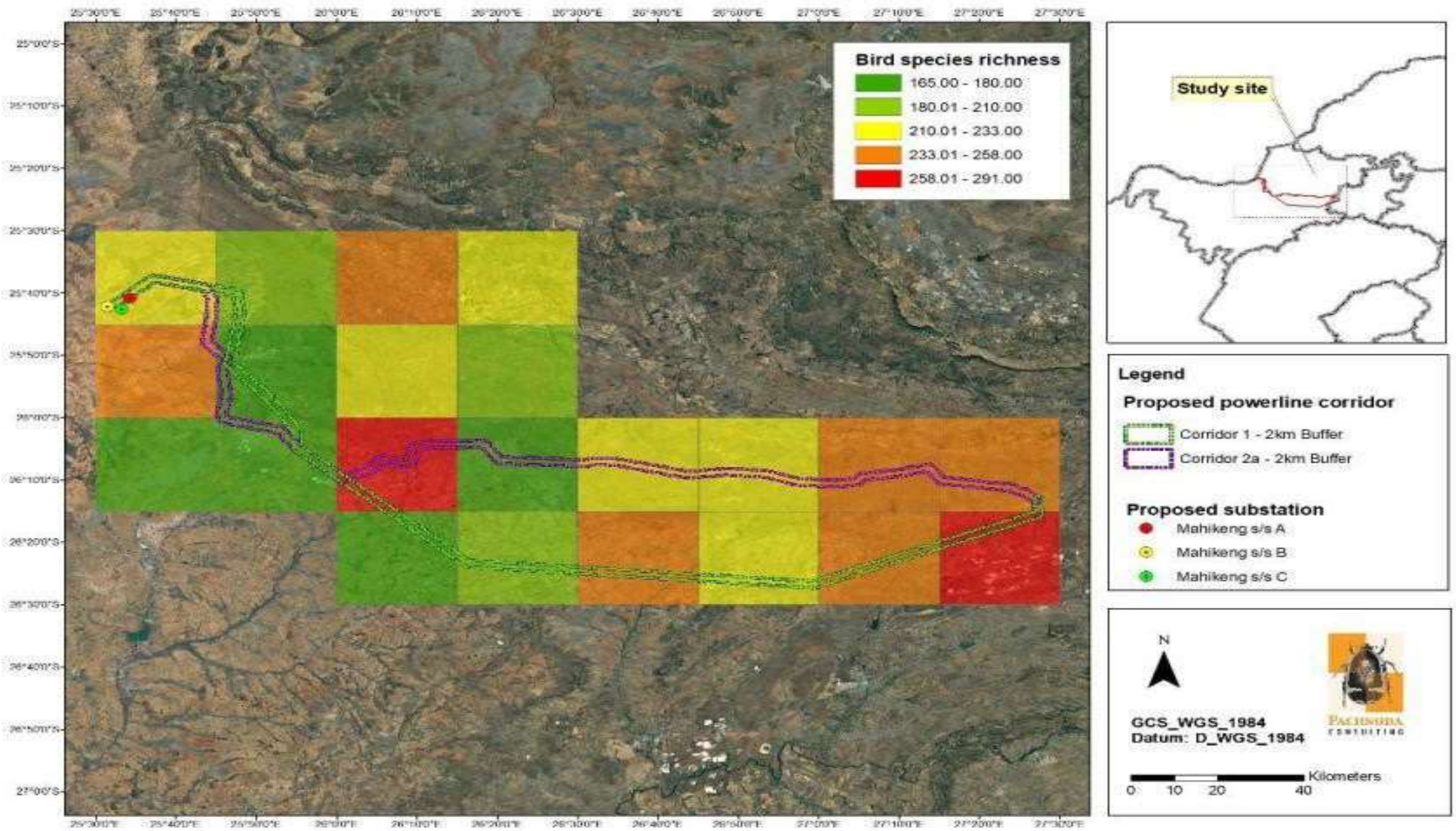


Figure 31: A spatial presentation of the bird richness recorded from the quarter degree squares on the study area.

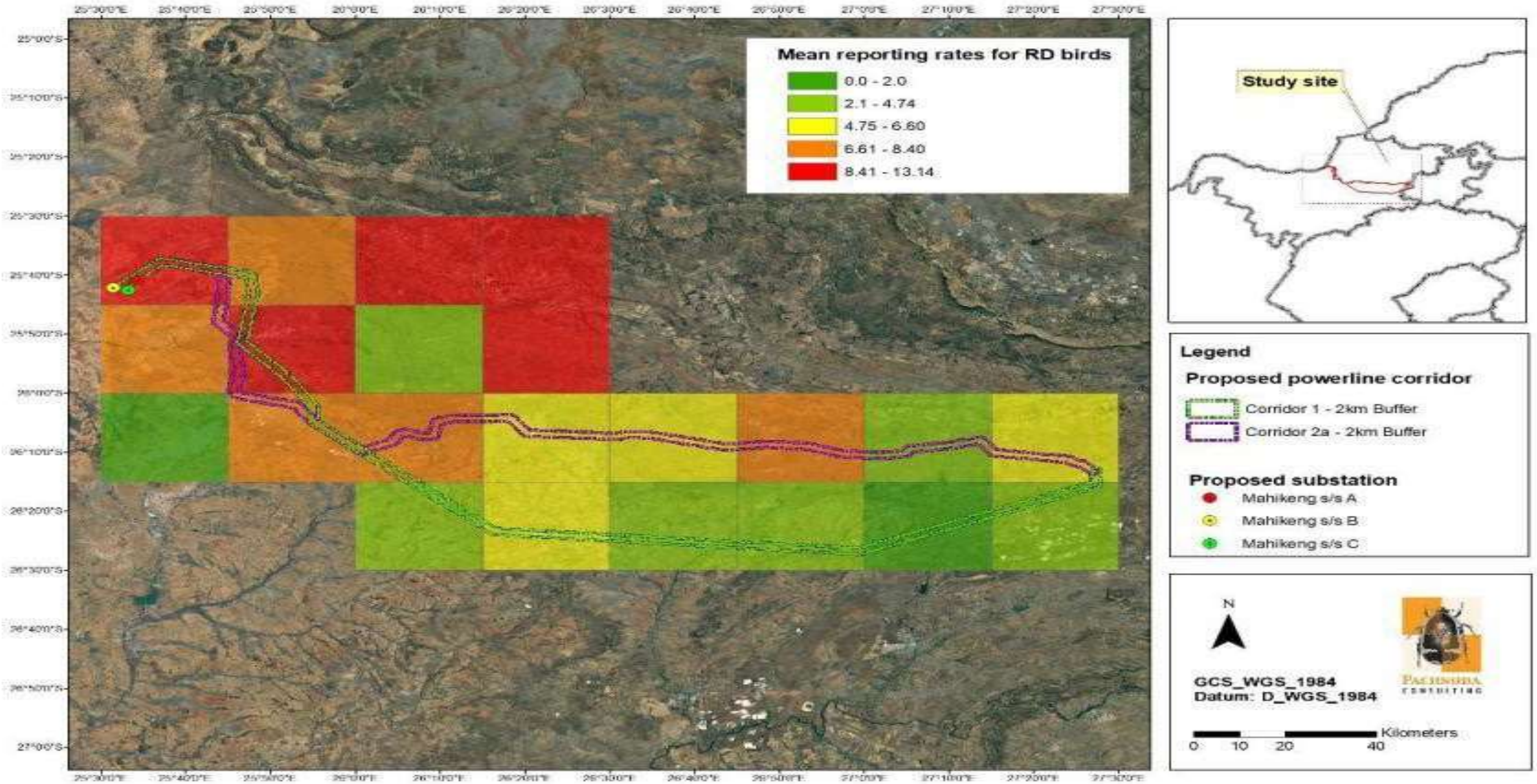


Figure 32: A spatial presentation of the number of conservation important (Red listed) bird richness recorded from the quarter degree squares on the study area.

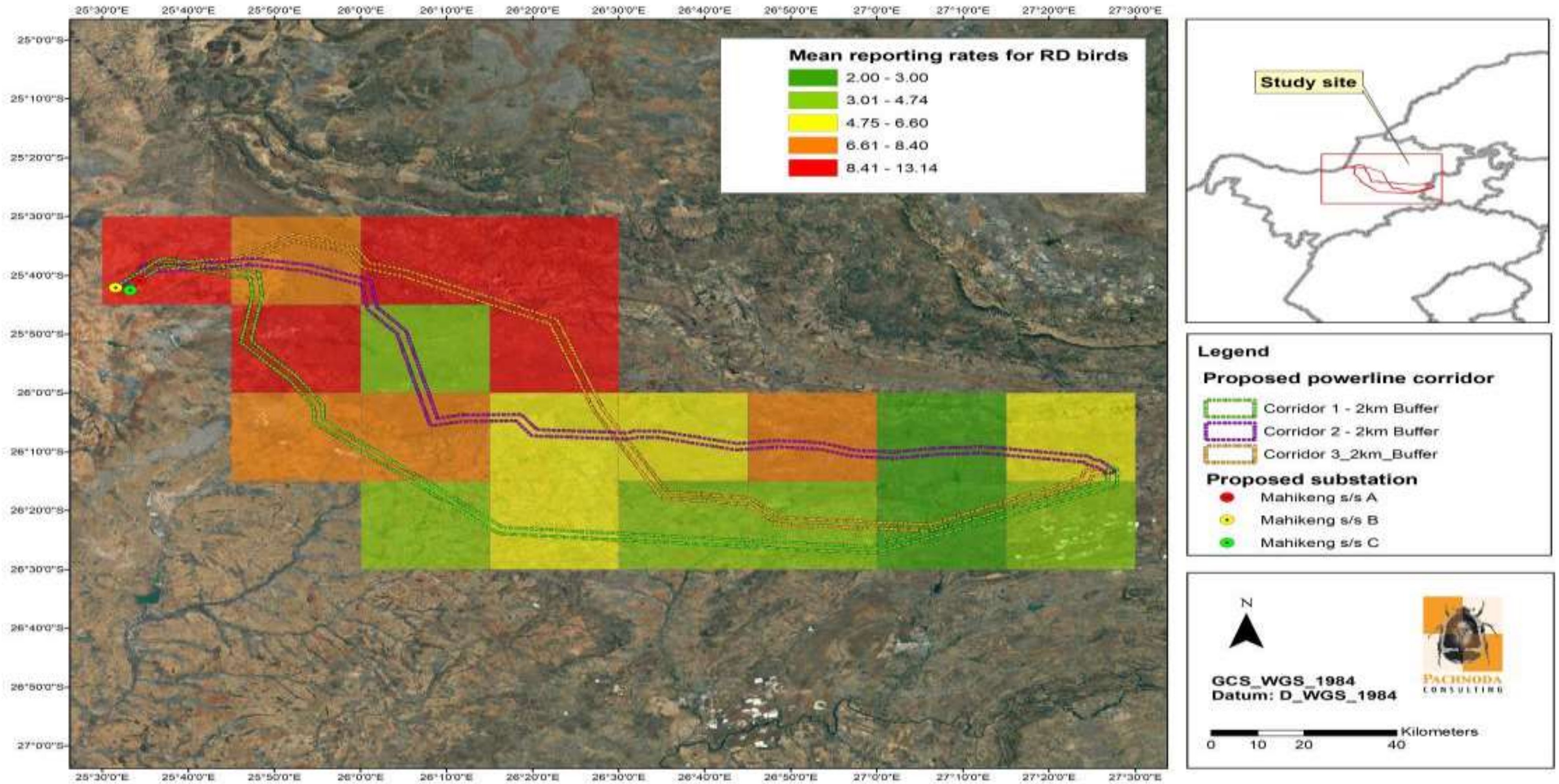


Figure 33: A spatial presentation of the mean reporting rates (%) for Red listed bird taxa recorded from the quarter degree squares on the study area.

Table 45: A summary illustrating the number of quarter degree squares for each proposed corridor in terms of bird richness, number of red listed bird species, mean reproting rates (%) for red listed bird specie and foraging hotspots for flamingos

	Number of QDS			
	Bird Richness (between 210-300 ssp)	Number of RL species (between 8-20 spp)	Mean Reporting Rates (for RL species between 8.4-13%)	Foraging hotspots for flamingos (number of records)
Corridor 1	7	8	2	7
Corridor 2	8	7	1	5

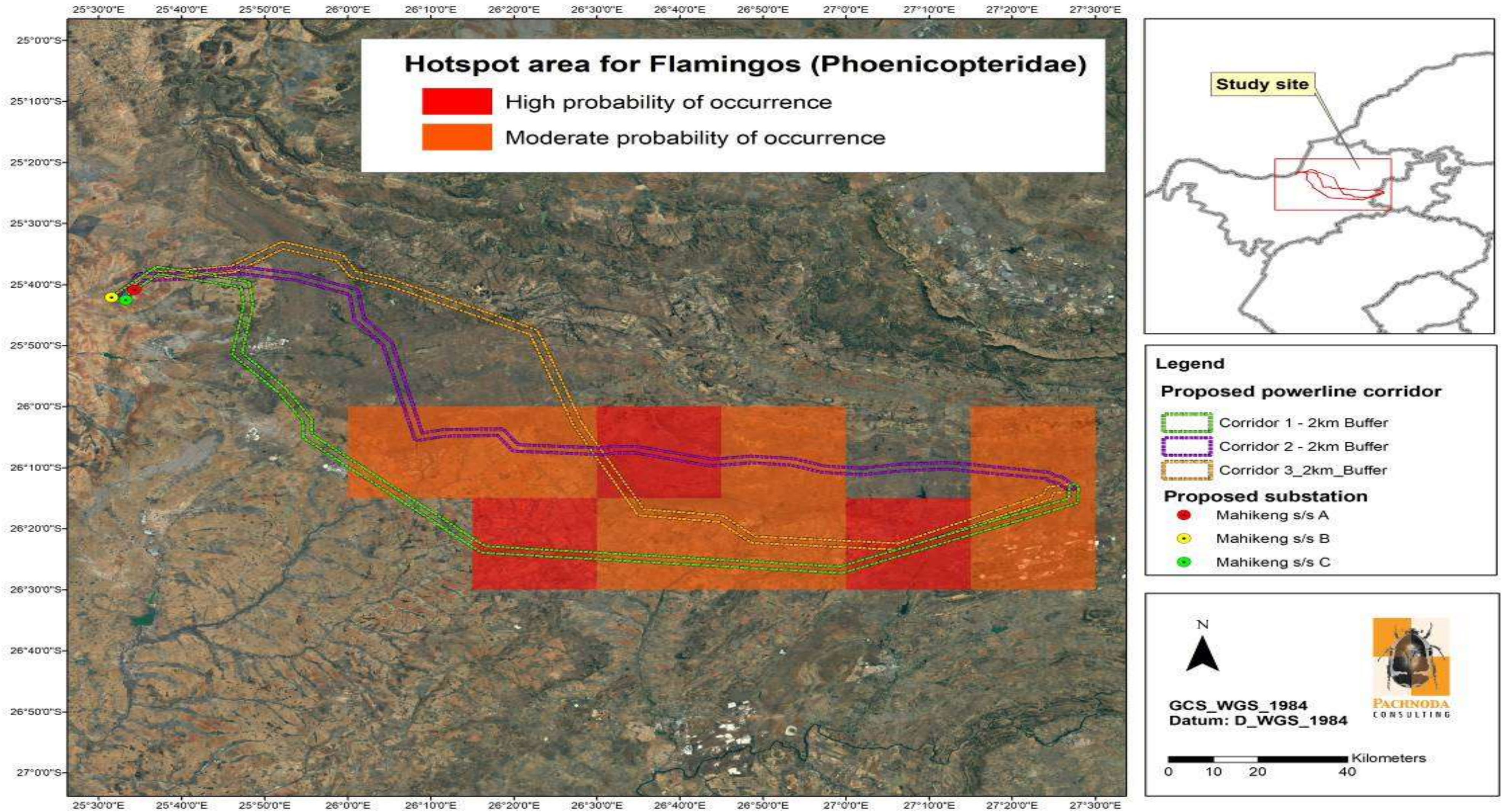


Figure 34: A spatial presentation of hotspot areas with high to moderate probablity for the occurrence of greater and lesser flamingo species

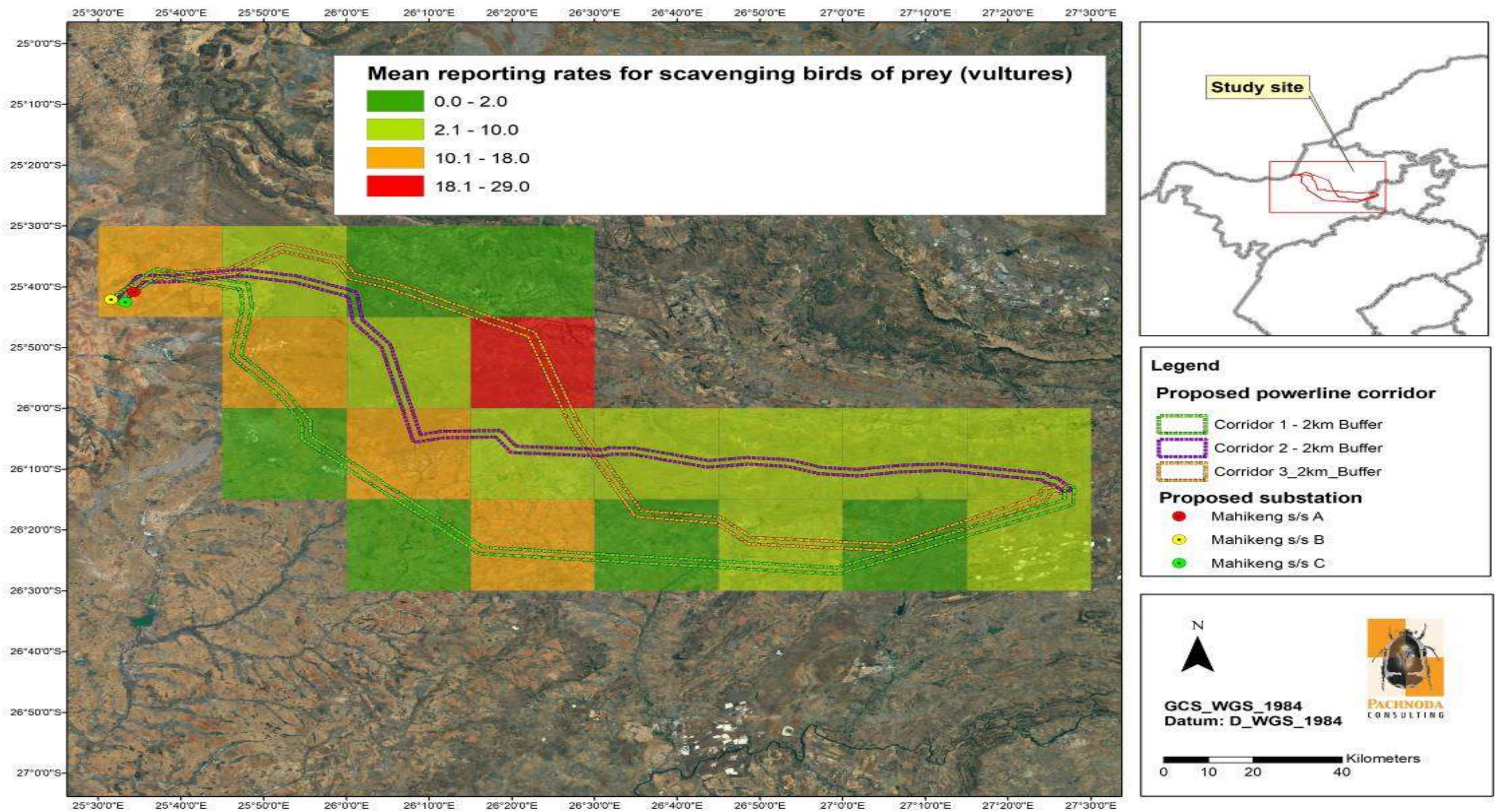


Figure 35: A spatial presentation of the mean reporting rates (%) for scavenging birds of prey

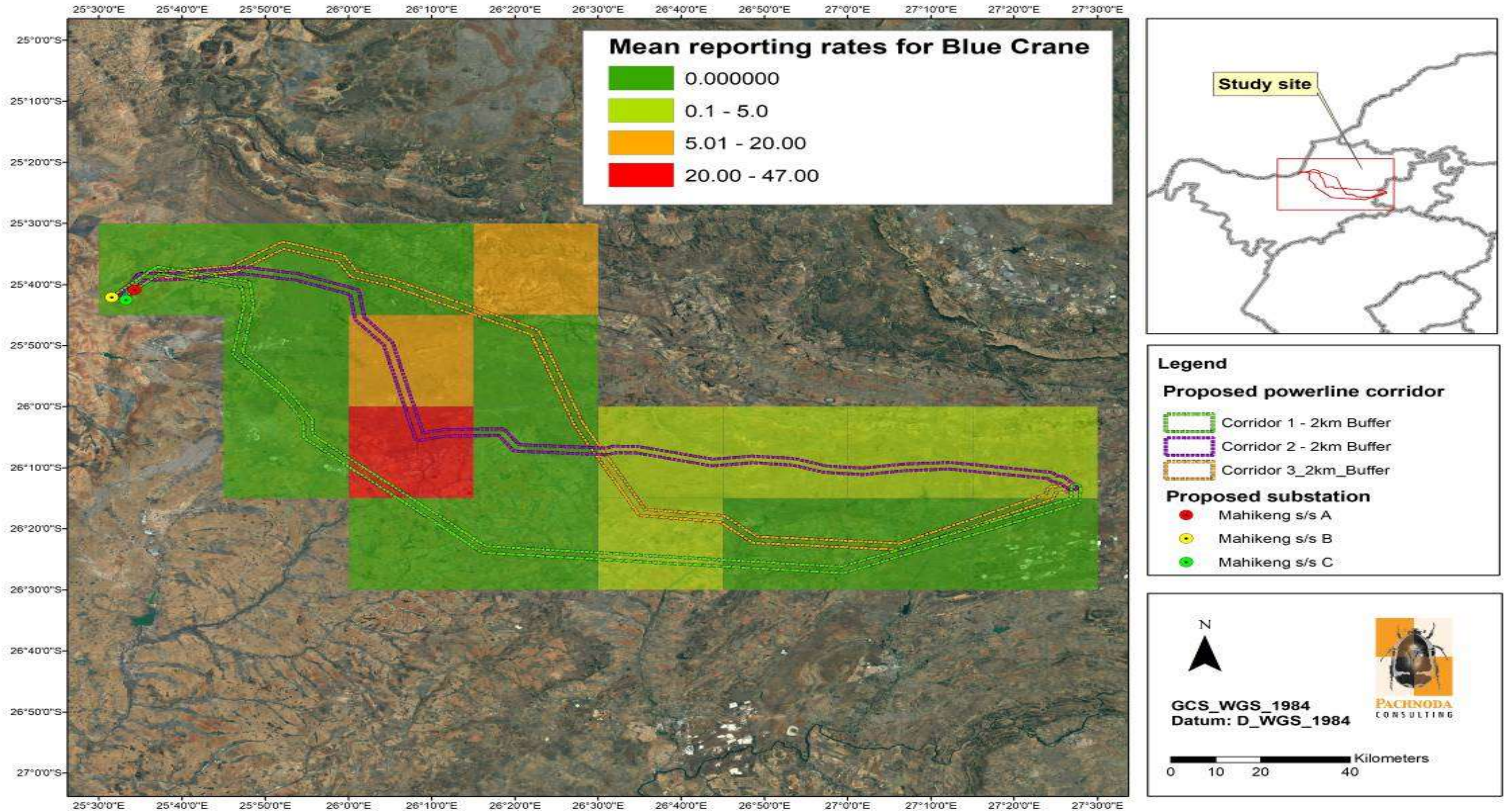


Figure 36: A spatial presentation of the mean reporting rates (%) for Blue cranes recorded from the quarter degree squares on the study area

Table 46: The reporting rates (%) for each Red listed species likely to occur on 20 quarter degree grids

Species	Global Status	Regional Status	2525DA Ramathlabama	2525DB Ottoshoop	2526CA Zeerust	2526CB Groot-Marico	2525DD Rooigrond	2626CC Bakerville	2526CD Lead Mine	2625BB Itsoseng	2626AA Lichtenburg	2626AB Twee Buffels
Abdim's Stork *Ciconia abdimii*		NT			6	23				11	8	10
African Finfoot Podica senegalensis	-	VU				9						
African Grass-Owl *Tyto capensis*	-	VU									2	3
African Marsh Harrier *Circus ranivorus*	-	EN	3					2				3
Black Harrier *Circus maurus*	VU	EN										3
Black Stork *Ciconia nigra*	-	VU	9			2					1	
Black-winged Pratincole *Glareola nordmanni*	NT	NT									1	7
Blue Crane *Anthropoides paradiseus*	VU	NT				20			14		47	
Chestnut-banded Plover *Charadrius pallidus*	NT	NT										
Caspian Tern *Sterna caspia*	-	VU										
Cape Vulture *Gyps coprotheres*	VU	EN	24	13		2	15	5	29		23	7
Curlew Sandpiper *Calidris feruginnea*	NT	-							7		11	10
Greater Flamingo *Phoenicopterus roceus*	-	NT									16	7
Great White Pelican *Pelecanus onocrotalus*	-	VU									1	
Greater Painted Snipe *Rostratula benghalensis*	-	VU						2			1	
Half-collared Kingfisher *Alcedo semitorquata*	-	NT				3						
Lapped-faced Vulture Torgos tracheliotos	EN	EN	9	6							6	
Lanner Falcon *Falco biarmicus*	-	VU		6						6	3	
Lesser Flamingo *Phoeniconaias minor*	NT	NT									12	3
Marabou Stork *Leptoptilos crumeniferos*											1	
Maccoa Duck *Oxyura maccoa*	NT	NT	3							6		10
Martial Eagle *Polemaetus bellicosus*	VU	EN	3		3							
Melodious Lark *Mirafra cheniana*	NT	-							7	6		

Species	Global Status	Regional Status	2525DA Ramathlabama	2525DB Ottoshoop	2526CA Zeerust	2526CB Groot-Marico	2525DD Rooigrond	2626CC Bakerville	2526CD Lead Mine	2625BB Itsoseng	2626AA Lichtenburg	2626AB Twee Buffels
Pallid Harrier *Circus macrourus*	NT	NT										
Red-footed Falcon *Falco vespertinus*	NT	NT	3								2	3
Pink-backed Pelican *Pelecanus rufescens*	**-**	**VU**										
Secretarybird *Sagittarius serpentarius*	**VU**	**VU**	**36**		**9**	**38**		**2**	**14**		**3**	**13**
Short-clawed Lark *Certhilauda chauna*	-	NT	18									
Tawny Eagle *Aquila rapax*	-	EN									3	
Verreaux's Eagle *Aquila verreauxii*	-	VU			34				7		1	
White-backed Vulture *Gyps africanus*	**CR**	**CR**	21	6			8	10			19	5
White-bellied Korhaan *Eupodotis senegalensis*						2			14			
Yellow-billed Stork *Mycteria ibis*	**-**	**EN**									**7**	
Number of species			**10**	**4**	**4**	**8**	**2**	**5**	**7**	**4**	**20**	**13**
Average Totals			**12.90**	**7.75**	**13.00**	**12.38**	**11.50**	**4.20**	**13.14**	**7.25**	**8.40**	**6.46**

Species	Global Status	Regional Status	2626BA Zwartrand	2626BB Swartplaas	2627AA Mathopestad	2627AB Syferbult	2626AC Gerdau	2626AD Coligny	2626BC Makokskraal	2626BD Ventersdrop	2627AC Rysmierbult	2627AD Carletonville
Abdim's Stork *Ciconia abdimii*		**NT**			**2**		**6**	**9**	**5**	**7**	**11**	**3**
African Finfoot Podica senegalensis	-	**VU**										
African Grass-Owl *Tyto capensis*	-	VU				6						1
African Marsh Harrier *Circus ranivorus*	-	EN		4	3	8					1	4
Black Harrier *Circus maurus*	VU	EN			2							
Black Stork *Ciconia nigra*	**-**	**VU**	**3**					**2**			**1**	**1**
Black-winged Pratincole *Glareola nordmanni*	NT	NT	3	5	2	6			3	5	1	1
Blue Crane *Anthropoides paradiseus*	**VU**	**NT**	**3**	**5**	**3**	**2**	**2**		**3**			
Chestnut-banded Plover *Charadrius pallidus*	NT	NT		2								
Caspian Tern *Sterna caspia*	-	VU								1		
Cape Vulture *Gyps coprotheres*	VU	EN	13	9	7	11			1		1	5
Curlew Sandpiper *Calidris feruginnea*	NT	-	5	12	2	13	6	5	11	9	2	5
Greater Flamingo *Phoenicopterus roceus*	**-**	**NT**	**8**	**4**		**16**		**2**	**4**	**6**	**1**	**23**
Great White Pelican *Pelecanus onocrotalus*	**-**	**VU**										**1**
Greater Painted Snipe *Rostratula benghalensis*	-	VU				2						
Half-collared Kingfisher *Alcedo semitorquata*	-	NT			2						1	
Lapped-faced Vulture Torgos tracheliotos	**EN**	**EN**	**3**									
Lanner Falcon *Falco biarmicus*	-	VU		2	2			2	1		1	0.1
Lesser Flamingo *Phoeniconaias minor*	**NT**	**NT**		**5**		**3**			**1**	**1**		**7**
Marabou Stork *Leptoptilos crumeniferos*												
Maccoa Duck *Oxyura maccoa*	NT	NT		25	2	5	4	5	12	2		3
Martial Eagle *Polemaetus bellicosus*	VU	EN									1	0.1
Melodious Lark *Mirafra cheniana*	NT	-	18	30	3	5			5		1	0.1
Pallid Harrier *Circus macrourus*	NT	NT				2						
Red-footed Falcon *Falco vespertinus*	NT	NT		2								
Pink-backed Pelican *Pelecanus rufescens*	**-**	**VU**						**9**				

Species	Global Status	Regional Status	2626BA Zwartrand	2626BB Swartplaas	2627AA Mathopestad	2627AB Syferbult	2626AC Gerdau	2626AD Coligny	2626BC Makokskraal	2626BD Ventersdrop	2627AC Rysmierbult	2627AD Carletonville
Secretarybird *Sagittarius serpentarius*	**VU**	**VU**		**4**	**8**	**3**	**2**	**2**	**3**	**2**	**2**	**5**
Short-clawed Lark *Certhilauda chauna*	-	NT										
Tawny Eagle *Aquila rapax*	-	EN		4								
Verreaux's Eagle *Aquila verreauxii*	-	VU				2						1
White-backed Vulture *Gyps africanus*	**CR**	**CR**	5	9	2				1			1
White-bellied Korhaan *Eupodotis senegalensis*					2	5		2				
Yellow-billed Stork *Mycteria ibis*	**-**	**EN**	**5**	**5**		**5**		**16**	**3**	**8**		**24**
Number of species			**10**	**16**	**14**	**16**	**5**	**10**	**13**	**9**	**12**	**18**
Average Totals			**6.60**	**7.94**	**3.00**	**5.88**	**4.00**	**5.40**	**4.08**	**4.56**	**2.00**	**4.74**

Species highlighted in **red** are critically endangered or endangered, and very susceptible to habitat transformation and disturbance.
Species highlighted in **black bold** are vulnerable to power line collision.
Total values in red refer to QDSs with a high relative abundance of Red Listed species

6.3.3 Flora

Flora is defined as the plants of a particular region, habitat, or geological period.

6.3.3.1 Broad-vegetation units

6.3.3.1.1 Alternative corridor 1

The proposed alternative corridor runs through six vegetation unit types. These are Soweto Highveld Grassland, Carletonville Dolomite Grassland, Vaal-Vet Sandy Grassland (Dominating), Western-Highveld Sandy Grassland, Klerksdorp Thornveld which are part of the Grassland Biome and the Mafikeng Bushveld which is part of the Savanna Biome:-

- The Soweto Highveld Grassland (GM 8) which is part of the Grassland biome as described in the 2006 vegetation map by Mucina and Rutherford (2006). This vegetation is found in Mpumalanga, Gauteng and to a very small extent also in the neighbouring Free State and North-West Provinces. It occurs in a broad band roughly deliminated by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast and the Vaal River in the South. This grassland that is characterized by the dominance of the species, *Themeda triandra*, accompanied by a variety of other grasses, such as *Elionurus muticus, Eragrostis racemosa, Heteropogon contortus and Tristachya leucothrix.* This vegetation type is considered to be vulnerable.
- The Vaal-Vet Sandy (Gh 10) is distributed in the North-west and Free State Provinces. It is found south of Lichtenburg and Ventersdorp, stretching southwards to Klerksdorp, Leeudoringstad, and Bothaville and to the Brandfort area north of Bloemfontein. Important taxa include *Anthephora pubescens, Aristida congesta, Chloris virgate, Cymbogon caesius, Cynodon dactylon, Digitaria argygrapta, Elionurus muticus, Eragrostis chloromeals, E. lehmannianana, E. plana, E. trichophora, Setaria sphacelata, Themenda trianda, Tragus berteronianus, Brachiaria serrata, Digitaria eriantha, Eragrostis curvula, E obtuse, E superba, Panicum coloratum,* and *Pogonarthria squarrosa.* Some of the herbs include *Stachys spathulata, Barleria macrostegia, Berkheya onopordiafolia, Monsonia burkeana, Rhynchosia adenodes, Selago densiflora, Vernonia oligocephala, Bulbine narcissifolia, Ledebouria marginata.* With shrubs such as *ziziphus zeyheriana, Helichrysum dregenum,* and *Tripteris aghillana var integrifolia.* This vegetation is considered Endangered.
- The Western Highveld Sandy Bushveld (Gh 14) is distributed in the North West province, from the Mafikeng to the Schweizer-Reneke in the south and from Broedersput and kamel in the west to Lichtenburg and Ottosdal in the east. The most important taxa on this vegetation unit include *Anthepora pubscens, Aristida congesta, A. diffusa, Cymbopogon pospischilii, Cynodon dactylon, Eragrostis lehamanniana, Themenda triandra.* The herb layer is dominated by species such as *Gazania krebsiana, Stachys spathulata, Barleria macrostegia,* and *Dicoma anomala.* Mucina and Rutherford have categorised this vegetation as Endangered. Only a small section of the corridor crosses this vegetation unit.

- The Klerksdorp Thornveld (Gh 13) occurs in two patches, one in the Wolmaransstad, Ottosdal and Haarteesfontein and the other from Botsolano Game Park to the Madibogo. The dominating plant species include *Acacia karroo, A. caffra, Celtis Africana, Acacia hebeclada, Gymnosporia senegalensis* with low shrubs such as *Asparagus laricinus, A suaveolens, Felicia muricata.* The grass layer is dominated by *Aristida congesta, Cynodon, dactylon, Eragrostis lehmanniana, Themenda triandra, Panicum coloratum, Sporobolus fimbriatus and Microchloa caffra.* This vegetation is regarded as Vulnerable and only about 2.5% is conserved in the Mafikeng Game Reserve, Botsolano Game Park and Faan Meintjes Nature Reserve.
- The Carletonville Dolomite Grassland (Gh 15) occurs mainly in the North West and Gauteng Provinces and marginally in the Free State Province. It occurs in the region of Potchefstroom, Ventersdorp and Carltonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng. Important taxa are graminoids (grasses) such as *Aristida congesta, Brachiaria serrata, Digitaria tricholaenoids, Themeda trianda, Aristida canescens, Melinis repens, M. nerviglumis* and *Cymbopogon caesius*. Also herbs and geophytic herbs such as *Acalypha angusta, Barleria macrostegia, Chamaecrista mimosies, Diathus mooiensis, Boophane Disticha, Senecio coronatus, Vernonia oligocephala and habenaria mossii* are some of the species that inhabit this vegetation (Mucina and Rutherford, 2006). The conservation status of Carletonville Dolomite Grassland is Vulnerable with 24% target for conservation. Almost a quarter of this vegetation type is already transformed for cultivation, by urban sprawl or by mining activity as well as by the building of the Boskop and Klerkskraal Dams.
- The Mafikeng Bushveld (SVk 1) vegetation is distributed west of the Mafikeng and south of the Botswana border. This vegetation unit has a well-developed tree layer as well as the shrub layer. Along the line this vegetation unit is towards the end and on the area proposed for the new substation. Species such as *Acacia erioloba, Terminalia sericea, A. karroo, A. hebeclada, Ziziphus mucronata, Grewia flava, and Rhus tenuinervis* were noticed. According to Mucina and Rutherford, this vegetation unit is regarded as Vulnerable.

6.3.3.1.2 Alternative corridor 2a

Alternative corridor 2a crosses 4 vegetation units, which are Soweto Highveld Grassland, Carltonville Dolomite Grassland (dominating as the longest section of the corridor runs through this vegetation unit), Vaal-Vet Sandy Grassland (Dominating) and Klerksdorp Thornveld which are part of the Grassland Biome and the Mafikeng Bushveld which is part of the Savanna Biome:-

- The Soweto Highveld Grassland (GM 8) which is part of the Grassland biome as described in the 2006 vegetation map by Mucina and Rutherford (2006). This vegetation is found in Mpumalanga, Gauteng and to a very small extent also in the neighbouring Free State and North-West Provinces.

It occurs in a broad band roughly deliminated by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast and the Vaal River in the South. This grassland that is characterized by the dominance of the species, *Themeda triandra*, accompanied by a variety of other grasses, such as *Elionurus muticus, Eragrostis racemosa, Heteropogon contortus and Tristachya leucothrix.* This vegetation type is considered to be vulnerable. This unit occupies less than 3% of the corridor and it is the section where the powerline begins.

- The Vaal-Vet Sandy Grassland (Gh 10) is distributed in the North-west and Free State Provinces. It is found south of Lichtenburg and Ventersdorp, stretching southwards to Klerksdorp, Leeudoringstad, and Bothaville and to the Brandfortarea north of Bloemfontein. Important taxa include *Anthephora pubescens, Aristida congesta, Chloris virgate, Cymbogon caesius, Cynodon dactylon, Digitaria argygrapta, Elionurus muticus, Eragrostis chloromeals, E. lehmannianana, E. plana, E. trichophora, Setaria sphacelata, Themenda trianda, Tragus berteronianus, Brachiaria serrata, Digitaria eriantha, Eragrostis curvula, E obtuse, E superba, Panicum coloratum,* and *Pogonarthria squarrosa.* Some of the herbs include *Stachys spathulata, Barleria macrostegia, Berkheya onopordiafolia, Monsonia burkeana, Rhynchosia adenodes, Selago densiflora, Vernonia oligocephala, Bulbine narcissifolia, Ledebouria marginata.* With shrubs such as *ziziphus zeyheriana, Helichrysum dregenum,* and *Tripteris aghillana var integrifolia.* This vegetation is considered Endangered.
- The Carletonville Dolomite Grassland (Gh 15) occurs mainly in the North West and Gauteng Provinces and marginally in the Free State Province. It occurs in the region of Potchefstroom, Ventersdorp and Carltonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng. Important taxa are graminoids (grasses) such as *Aristida congesta, Brachiaria serrata, Digitaria tricholaenoids, Themeda trianda, Aristida canescens, Melinis repens, M. nerviglumis* and *Cymbopogon caesius*. Also herbs and geophytic herbs such as *Acalypha angusta, Barleria macrostegia, Chamaecrista mimosies, Diathus mooiensis, Boophane Disticha, Senecio coronatus, Vernonia oligocephala and habenaria mossii* are some of the species that inhabit this vegetation (Mucina and Rutherford, 2006). The conservation status of Carletonville Dolomite Grassland is Vulnerable with 24% target for conservation. Almost a quarter of this vegetation type is already transformed for cultivation, by urban sprawl or by mining activity as well as by the building of the Boskop and Klerkskraal Dams. This unit occupies about 85% of the corridor
- The Mafikeng Bushveld (SVk 1) vegetation is distributed west of the Mafikeng and south of the Botswana border. This vegetation unit has a well-developed tree layer as well as the shrub layer. Along the line this vegetation unit is towards the end and on the area proposed for the new substation. Species such as *Acacia erioloba, Terminalia sericea, A. karroo, A. hebeclada, Ziziphus*

mucronata, Grewia flava, and Rhus tenuinervis were noticed. According to Mucina and Rutherford, this vegetation unit is regarded as Vulnerable.

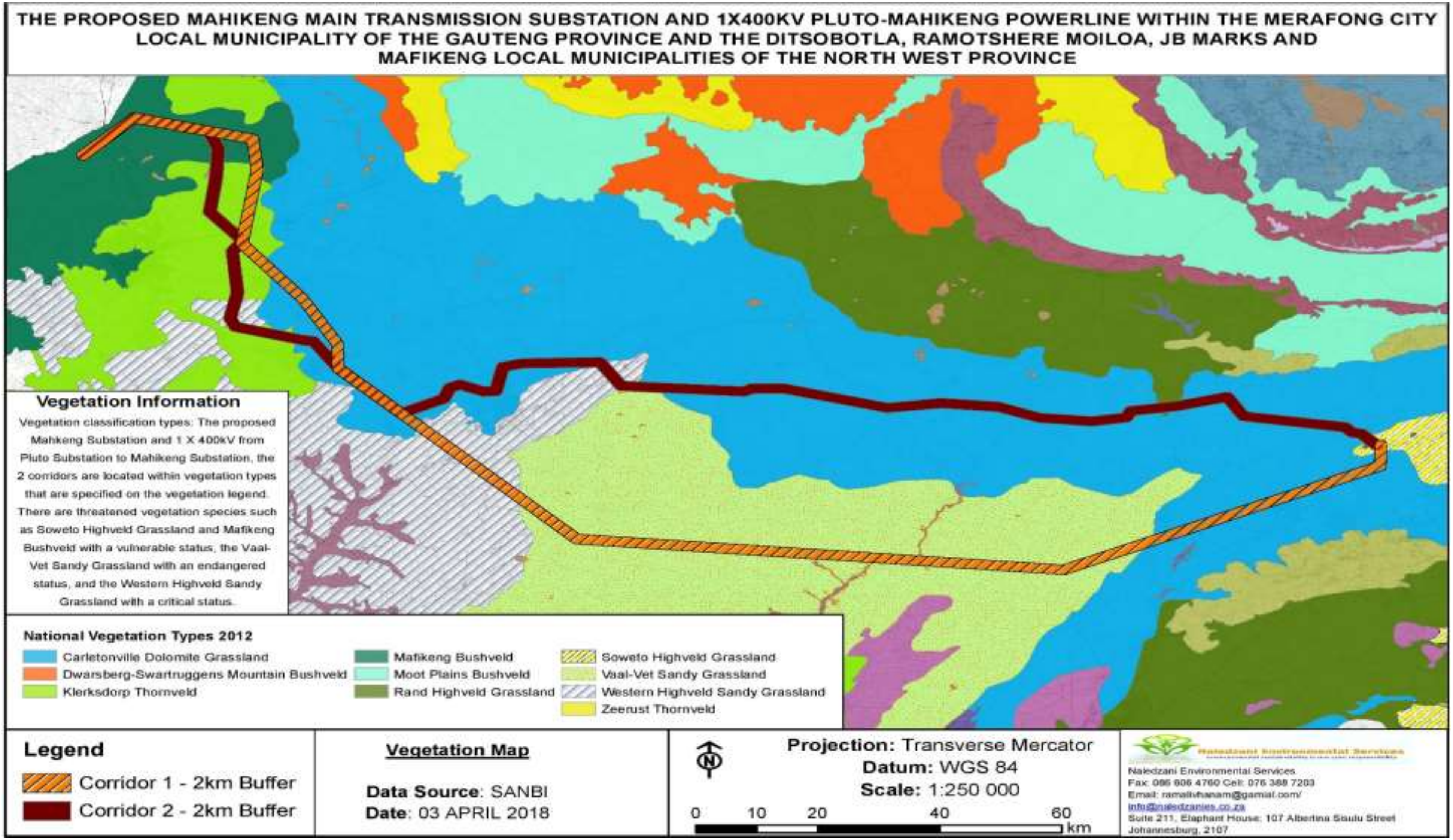


Figure 37: Vegetation Map

6.3.3.2 Description of the Sensitive areas

6.3.3.2.1 Alternative corridor 1

Alternative corridor 1 cuts through small patches of Critical Biodiversity Area 1. A small section of the corridor is within an Ecological Support Area 1 and this is due to the protected plants and Avi-fauna habitat that is likely to be found there. Most of these sensitive patches are associated with water resources, as well the remaining natural vegetation.

Potentially sensitive areas were delineated for the scoping study from visual inspection of Google imagery and available data. It must be noted that the BGIS maps are largely based on the analysis of remotely sensed data, not actual ground verification. According to legislation, the remaining portions of natural vegetation of threatened ecosystems must be investigated on the ground by a specialist to determine their ecological state, from which a final classification about their sensitivity can be made.

6.3.3.2.2 Alternative corridor 2a

Alternative corridor 2a is said to run along an existing powerline, but the desktop assessment indicates that it cuts through many solid patches of an Ecological Support Area1 and a protected area identified as Molemane Nature Reserve that is entirely surrounded by a Critical Biodiversity Area 2. All the identified areas as sensitive will then be verified through the ground-thruthing that is anticipated to take place during the November to January after the first few rains have fallen in the area.

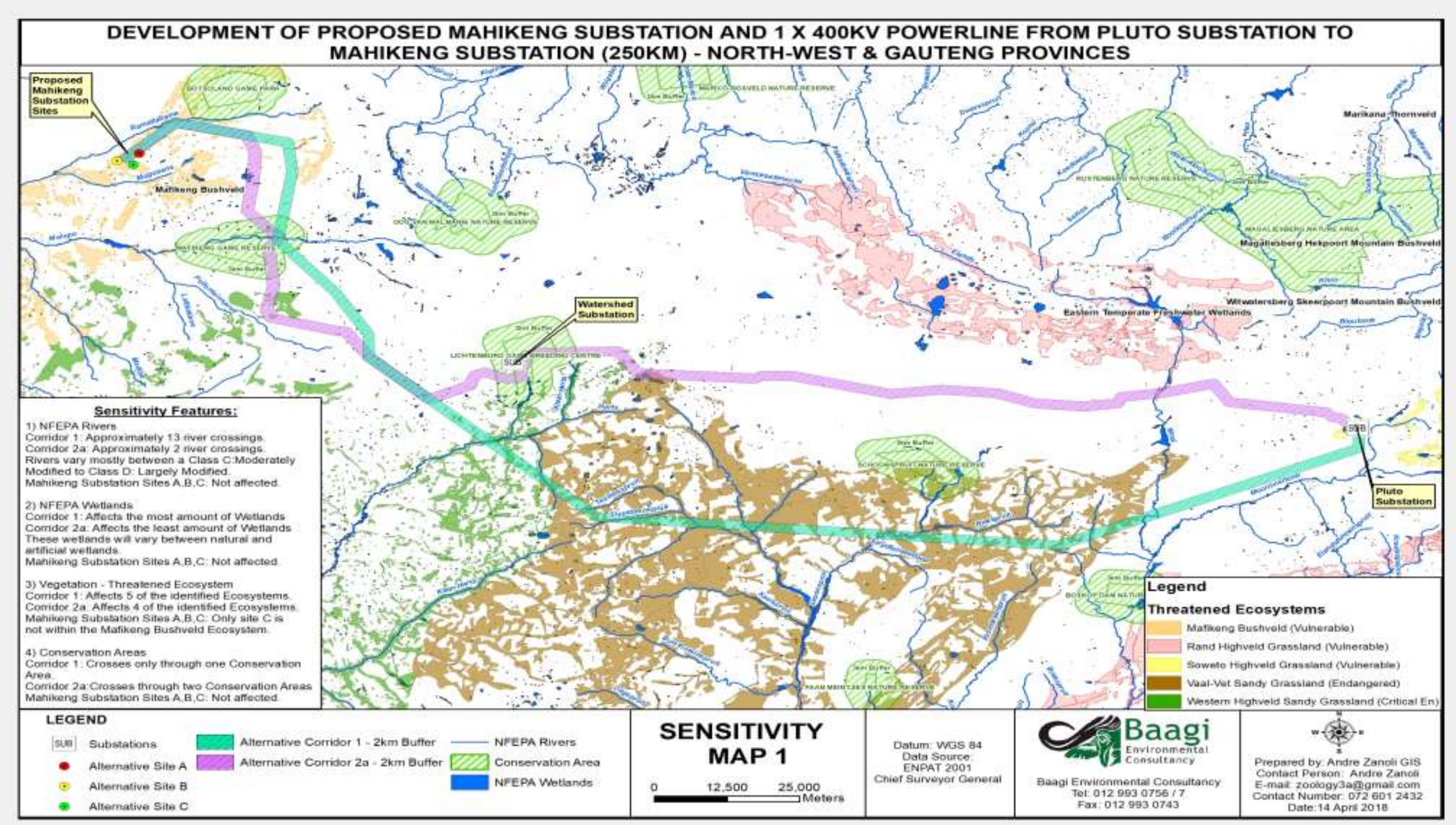


Figure 38: Sensitivity Map

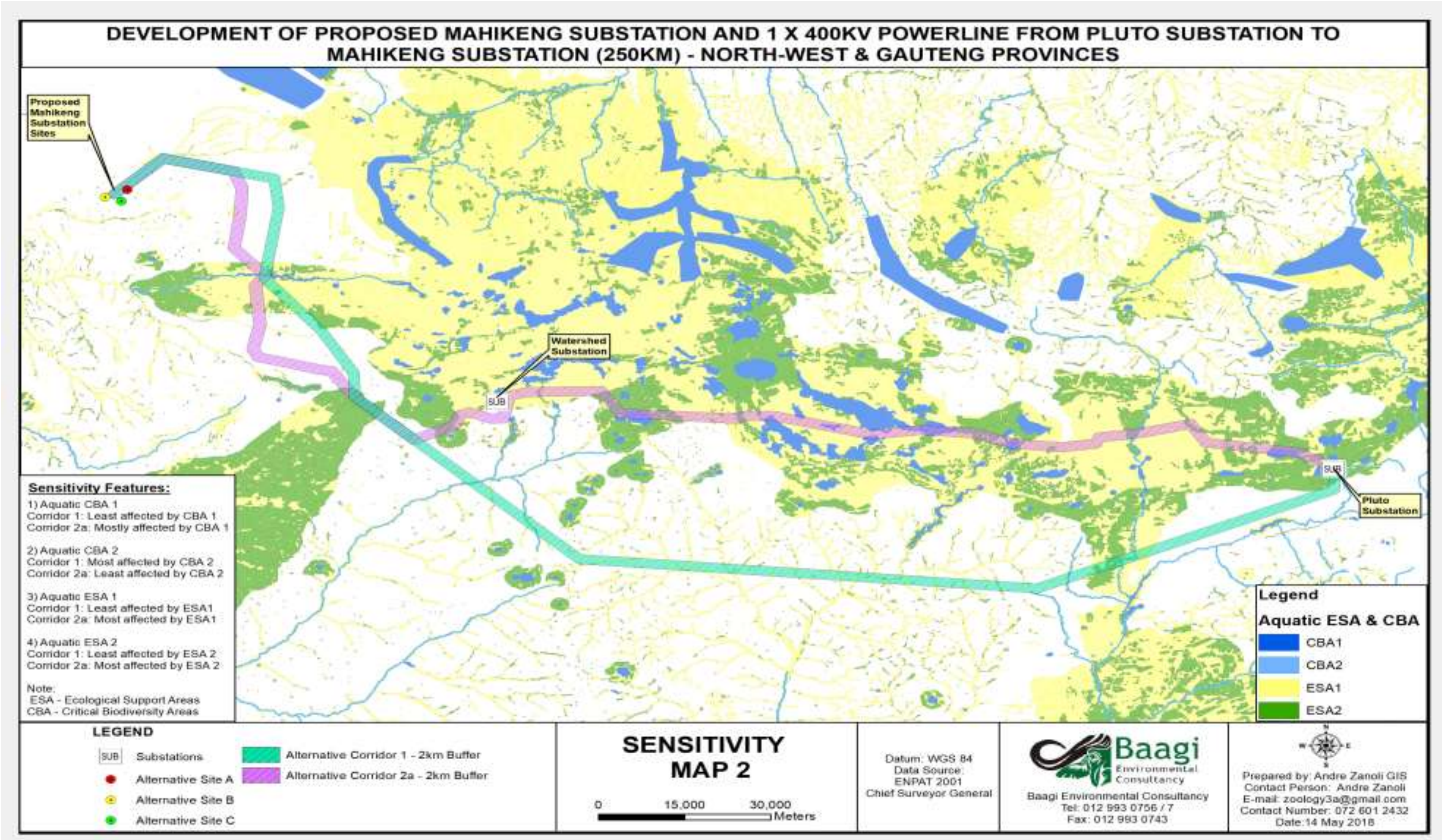


Figure 39: Sensitivity Map 2

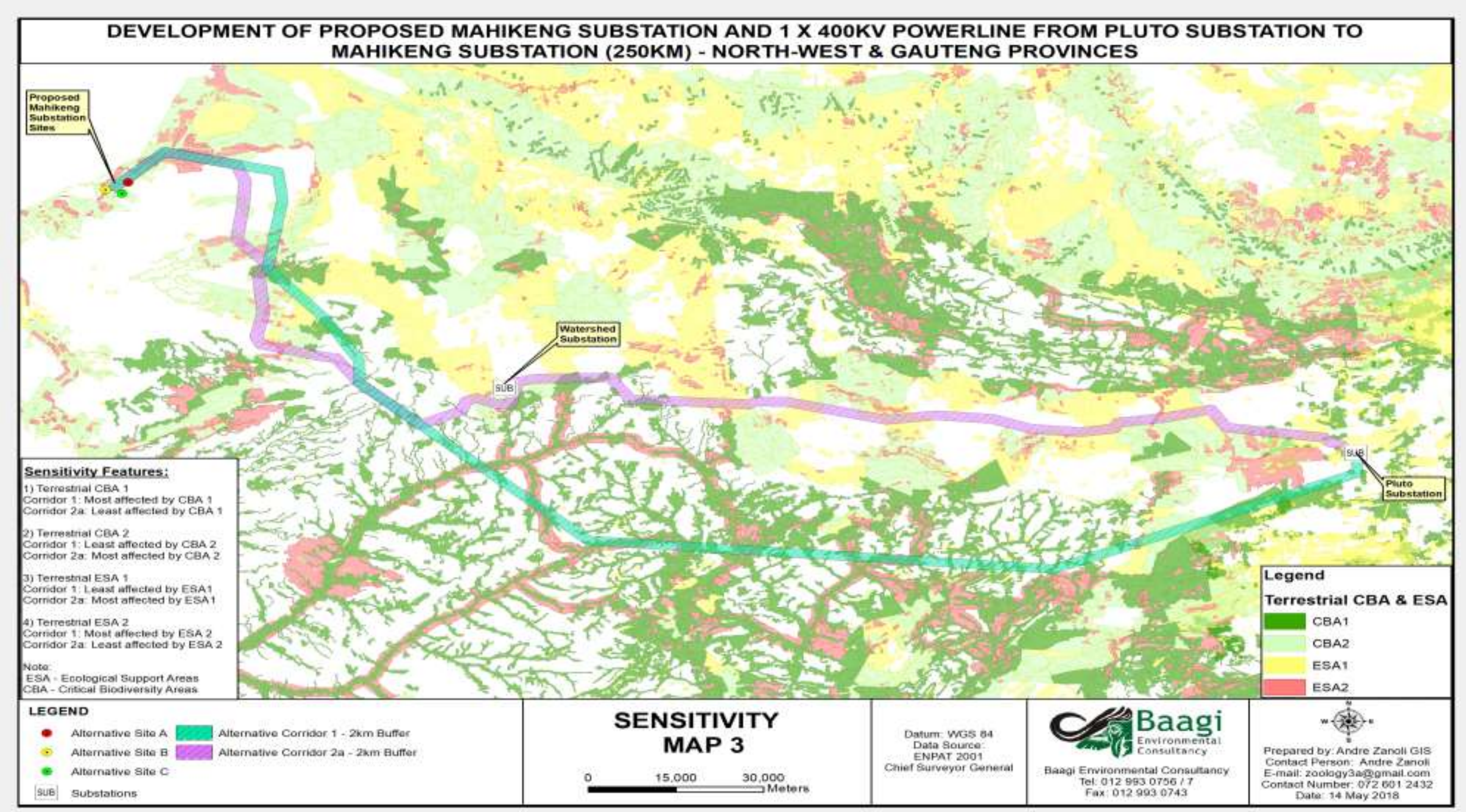


Figure 40: Sensitivity Map 3

6.4 Heritage Resources

Archaeological resources in the general area proposed for the present development stretches in to deep time. The World Heritage Taung Fossil Site with australopithecines (eg *Australopithecus africanus* dating to about 2.4 million years occur further to the south of development footprint. These australopithecines were gradually displaced by early hominid (*Homo habilis*) that was later replaced by the early crude stone tool using hominid (*Homo erectus* around 1.8 million years ago). This marked the beginning of the Stone Age (ESA), which is not very wide spread in the study area. Nonetheless the area has isolated occurrences of the Middle Stone Age (MSA) industries associated with anatomically modern humans, *Homo sapiens* that replaced the ESA around 250000 years ago. The subsequent replacement of the MSA by Later Stone Age (LSA) occurred from about 20000 years ago and the new technology is also represented in isolated occurrences. The LSA is triggered a series of technological innovations and social transformations within these early hunter-gatherer societies that included the advent of rock art (paintings and engravings), associated with the Khoisan communities. The study area generally is not known for rock paintings but the largest collections of rock engravings in the country is located to the south of the development footprint in Provincial Heritage site of Bosworth and Thaba Sione. From this period onwards, there has not been significant reports of Early Iron Age (AD200 to 1000) sites in the study area until the post 15th century Ntsuanatsatsi-Uitkomsts (Nguni-speakers) and Olifantsfontein and Buispoort (Sotho-Tswana speakers) period of Late Iron Age that is characterized by stone walling. Key historical events relate to the 19th century encroachment of Boer Trekkers and *Mfecane* fleeing Mzilikazi's Ndebele people, as well as the aftermaths of Boer-Anglo and European-African military encounters that resulted in the establishment of several towns such as Mahikeng, and the national boundaries of South Africa and Botswana.

These armed encounters left trails of historical battle grounds, cemeteries and unmarked graves (Alterative 2a) that are protected by the South African heritage legislation and must not be disturbed without consultation and approval from national and provincial heritage agencies. Graves in general, and historical (over 60 years) graves in particular, are of high social significance and any development should preferably avoid them. Other historical mining activities relates to the diamond rush triggered by the discovery during the digging for a cattle dip at Bakerville in 1924 (Alternative 2a). This place is now a Provincial heritage site and there are also other provincial sites and structures in the study area, especially near Mahikeng. Small-scale diamond and manganese mining activities still continue to date and the associated pre-development studies have indicated low heritage sensitivity on some parts of the study area. However, only a detailed study of the development footprint can determine the likelihood of encountering significant heritage resources during construction. All the same, archaeological resources are known to occur in buried contexts that may only be identifiable during construction, such that failure to detect them during field surveys is not absolute evidence of their absence and a clear procedure for reporting chance finds must be followed during construction. In addition, the 2km wide corridors will allow the developer to plan around any sensitive heritage resources encountered.

6.5 Geology

The general geology of the survey area from east to west comprises of dolomite and chert landscapes north of Carletonville that stretch towards the north-west in an arc form north-east past Mahikeng. The area to the south of the dolomite/chert arc is comprised of varying underlying geology but in general with the extensive occurrence of windblown Kalahari sand deposits of variable thickness overlying this geology.

6.5.1 Alternative corridor 1

Corridor 1 runs almost entirely along the area characterised by the Kalahari sand surface deposits.

6.5.2 Alternative corridor 2a

Corridor 2a runs almost exclusively across the dolomite/chert geology zone save for a small section (that overlaps with the other corridors) north of Mahikeng that traverses Kalahari sand cover areas.

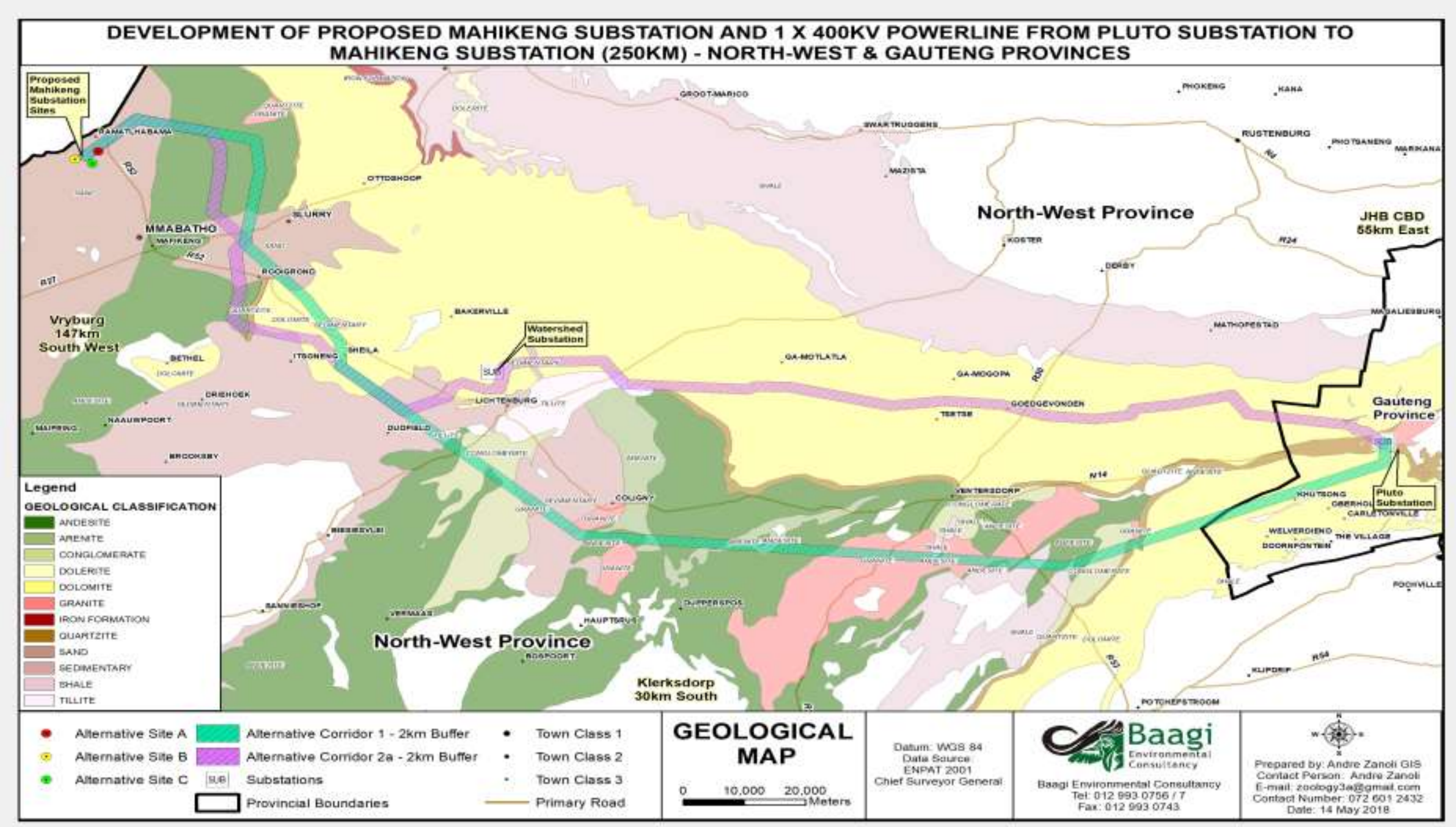


Figure 41: Geological Map

6.6 Soil & Agricultural Potential

6.6.1 Alternative corridor 1

Due to the presence of Kalahari sands along this corridor there is extensive dryland agriculture practiced in most of the landscape. As such the soils constitute large areas of high potential agricultural land. Irrigation practices are limited and very few centre pivot systems were observed. The impact on the agriculture is expected to be low due to the localised footprints of the pylons and areas of irrigation activities should be avoided.

6.6.2 Alternative corridor 2a

Due to the dominance of the dolomite/chert geology this corridor traverses predominantly well-drained but shalow and rocky soils. The agricultural activities include localised dryland crop production but predominantly grazing land. Soil impacts are considered to be low but this area may exhibit sinkholes that can compromise pylon bases.

6.7 Economic

6.7.1 Alternative corridor 1

When investigating alternative corridor 1, it was generally referred to as the agricultural corridor. From the desktop studies and site visit it was verified that there are many farming activities within the study area. Agricultural activities such as irrigation of maize, wheat and cattle farming, pigs, sheep as well as chicken farms (broilers) were observed.

Cement quarries such as those in Dudfield, 21km from Lichtenburg (between Itsoneng and Lichtenburg) may be affected. The Lafarge quarry, also extracting cement, outside of the corridor in Bodibe was observed between Mahikeng and Lichtenburg. The village of Itsoneng also needs to be considered for possible effects due to the proposed power line development. At Rooigrond, South-West from Mahikeng many broilers were spotted in the buffer zone.

6.7.2 Alternative corridor 2a

When assessing Alternative corridor 2a from the Pluto MTS near Carletonville, farms where mitigation measures will need to be implemented includeGoedgevonden, farm and village, part of the Ventersdorp Local Municipality (north of Ventersdorp), Zwartplaat farm and Roodepoortje farm that have large centre pivots.

Within the buffer zone of Line 2 eco-tourism the Malani Oog (South West from Ottoshoop on R505), Molemane Natures Reserve, Lichtenburg Breeding Centre (North of Lichtenburg) and the Abe Nature Reserve between Khutsong and Ventersdorp, might be affected to a certain level.

6.7.3 Proposed Substations

As the proposed site alternative substations are very close to one another, they were assessed as a combined group. Present in the area are villages, particularly informal settlements with subsistence farming cultivating vegetables, and livestock. Also, irrigation agriculture (maize) was observed with cattle grazing around the proposed site of the power stations.

6.8 Social

6.8.1 Alternative corridor 1

The most dominant form of economy for the people of this corridor is that of agriculture, which would mean that unless mitigated, the effect on the social environment and livelihood of the people in the vacant would be in this domain. It is also the corridor where if the boundaries of the corridor remain the same, would have the greatest impact on the people in terms of the infrastructure of homestead that would potentially be affected by the project. This alternative is the corridor with the most considerations to investigate from an SIA viewpoint. The main tourism attributes of this corridor are the Abe Bailey Nature Reserve (Gauteng Province) and the outskirts of Botsalano Game Reserve (North West Province).

The anticipated impacts on this corridor would therefore be on agriculture, on communities in the corridor and on tourism with the mentioned reserves above. These impacts would be heightened in the construction phase where the impacts would be experienced in their most severity, and during the operational phase, impacts on tourism may still be apparent in the phase however the extent would be clarified.

6.8.2 Alternative corridor 2a

Tourism is prevalent on this corridor and the following reserves and ventures that are connected to this corridor are as follows: Ventersdorp Game Reserve (North West Province), Molemani Eye Nature Reserve (Provincial Reserve declared by North West Parks Board, North West Province).

The dominant consideration for this corridor would be the impacts that would be on the tourism industry in the area and the people a part of the communities associated with it, especially as the intended corridor would go directly through the Molemani Eye Nature Reserve which is defined as a level 2 conservation area. This alternative is the corridor with the least sites of consideration from an isolated SIA perspective, however the reserve that it is intended to transverse a protected area on a provincial level by the North West Parks Board. This is a definite red flag that would be explored during fieldwork to examine whether it would manifest as a fatal flaw. It has not been deemed an immediate fatal flaw because there is already an existing power-line going through the reserve so the cumulative impact of another one would need to be examined.

7. PUBLIC PARTICIPATION PROCESS: SCOPING PHASE

Public participation forms an integral part of the full EIA process and the EAP is reliant, over and above networking from the Public Participation (PP) team, on the I&AP's participation to ensure adherence to the legal requirements as set out in the NEMA.

Baagi applied for extension in line with Regulation 3(7) of the EIA Regulations as amended on the 7th of April 2017 for the submission period of the Scoping Report due to unforeseen circumstances that were picked up during the Public Participation period which took place on the 22nd of November 2017 to the 23rd of January 2018. The Public Participation period was then extended from the 23rd of January 2018 to the 31st of January 2018 because there were incidents that impacted the attendance of community members at the public meetings i.e. Khutsong Community Hall was not available, and the next best suitable venue had to be secured. Villages / townships were located distances away from the centrally located venues and due to the lack of attendance at the series of eight (8) public meetings, the project team assessed the situation and made the decision to hold a second round of public meetings by focussing on the villages / townships within the study area, although the minimum requirements as prescribed in the EIA Regulations were followed.

Through the consultation process and desk-top studies done by the environmental specialist, it was found that deviations were required to avoid the Molemane Nature Reserve and a cluster of small holdings in Buhrmannsdrif. The Environmental Assessment Practitioner (EAP) applied to the Department of Environmental Affairs (DEA) for an extension of the Scoping Phase to address the deviation of Corridor 2a and during this extension period. The 50 day exension was granted on the 07th of March 2018, Public Meetings were held in February to March 2018 at the villages closest to the Deviated Alternative corridor 2a.The Public Participation period for the Amended Draft Scoping Report commenced on the 12th of February 2018 to the 13th of March 2018.

Sections 39 to 44 of GN Regulation 326 of the EIA Regulations (December 2014), as amended on the 7th of April 2017 and promulgated under the National Environmental Management Act (Act No 107 of 1998) are applicable. The important elements relating to the public participation process that are required by the Regulations are the following:

- The manner in which potential Interested and Affected Parties (I&APs) were notified of the application for authorisation, and that a public participation process is mandatory.
- Opening and maintaining a register of the names and addresses of I&APs. These include all persons who have attended meetings, submitted comments, and organs of State who have some form of jurisdiction in

the assessment process, and all those who have requested that they be placed on the register as registered I&APs.

- Registered I&APs are entitled to comment, in writing, on all written submissions made to the competent authority by the applicant or the EAP managing the application, and to bring to the attention of the competent authority any issues which that party believes may be of significance when the application is considered for authorisation. The comments of registered I&APs must be recorded and included in the reports submitted to the competent authority.

During the Scoping Phase of the process the PP team commenced with a notification process to ensure that as many I&APs as possible are well informed about the proposed project for them to form part of the EIA process, from inception to completion.

The PP process during the Scoping Phase is outlined as below:

7.1 Developing the I&AP Database

The PP Process in the Scoping Phase kicked off with an identification exercise to ensure that the team sourced contact details of pre-identified I&APs, including key stakeholders and possibly affected landowners. The initial stages of the process were conducted between September and October 2017. Every endeavour was made to create and update the project database of stakeholders as mentioned above.

Database information was also sourced through other EIA processes in the study area and where possible, the contact details of I&APs have been included in this proposed project's database. The updating of the project database is an ongoing process until the culmination of the project.

7.2 Site Notices

In terms of Regulation 41[2](a) site notices were erected within the proposed three (3) corridors mainly on fences along these corridors but also at a location frequented by landowners / community members. The information captured on the site notices included the information as required by Regulation 41[3](a&b), including the locality map showing the three (3) proposed new Alternative corridors, Eskom's existing Pluto Transmission Substation and the newly proposed Mahikeng Main Transmission Substation. The site notices were erected during Wednesday, 27 September and Friday, 29 September 2017. Site notices for the second round of Public Participation were erected on the 12th of February 2018.

7.3 Notifying I&APs and potentially affected landowners of the Project

Potentially affected landowners were identified during the site visit, during the first round of public meetings and by obtaining contact information through Windeed search. Outdated contacted details are still in the process of being updated. It is important to note that as stipulated in Regulation 39[1] **written consent** of landowners or person(s) in control of the land on which the proposed development is taking place does not apply to this proposed project in terms of Regulation 39[2](a) and (c). It can be noted that all possible means available to the PP team will be utilised to ensure that as many possibly affected landowners as possible are identified and notified during the scoping phase.

In reference to paragraph 7.1 above, a Background Information Document (BID) was drafted for the first round of Public Participation in English, Tswana and Afrikaans and the English copy of the BID, together with a cover letter inviting them to register and participate in the EIA process and a registration and comment sheet, was e-mailed to all those with e-mail addresses. A letter notifying the I&AP's of the changes was drafted and sent.

7.4 Newspaper Advertisements (DSR availability & invitation to Public Meetings)

The Scoping Phase advertisements were placed in Afrikaans, Sotho and English notifying I&AP's of the opportunity to review the DSR and public meeting dates and venues. This advertisement asked all those who were affected or feel that they are interested to register as I&APs. During the second round of Public Participation no advertisements will be placed however, site notices will be put up and loud hailing will be done. Advertisements were placed in the various newspapers as identified to date (refer to Table 53 below) to inform the public of the availability of the Draft Scoping Report for review and comment and inviting them to the series of public meetings. No newspaper adverts will be placed for the second Public Participation Process.

Table 47: Newspaper Advertisements Placed

Newspaper	Publication Date	Language
Mafikeng Mail	**English, Tswana & Afrikaans**	**Thursday, 16 November**
Rustenburg Herald	**English, Tswana & Afrikaans**	**Thursday, 16 November**
Carletonville Herald	**English, Tswana & Afrikaans**	**Thursday, 16 November**
Noordwester	**Afrikaans**	**Friday,17 November 2017**
Star	**English**	**Monday,20 November 2017**

- Registered I&APs on the project database were notified of the availability of the DSR and invited them to attend any one (or more) of the Public Meetings by a personal invitation. This notification and invitation letter was accompanied by a DSR comment sheet and a registration sheet for the series of public meetings. Tearsheets of the advertisements placed are attached to the FSR.

7.5 Draft Scoping Report: Public Review and Comment Period

The Draft Scoping Report (DSR) was made available to I&AP's for review and comment from **Wednesday 22nd of November 2017 to Tuesday, 23rd of January 2018**. As mentioned in 7.4 above this review period was communicated in both the advertisements and the personalised letters.

Table 48: Hard Copies of the Draft Scoping will be at the following Venues:

Venue
Carletonville Public Library, c/o Celestine & Emerald Street
Khutsong Public Library, Khutsong South
Ventersdorp Public Library, 1 Van Tonder Road
Coligny Public Library, 67 Voortrekker Street
Lichtenburg Public Library, 40 Melville Street
Boikhutso Public Library, 410 Kudu Street
Itsoseng Public Library, No. 3775 Zone 2
Ottoshoop Public Library, 56 Commission Street
Mahikeng Public Library, 30 Robinson Street
Miga Public Library, Miga Community Hall

The Amended Draft Scoping Report (ADSR) was made available to I&AP's for review and comment from **Monday 12th of February 2018 to Tuesday, 13th of March 2018** at the following venues:

Table 49: Amended Draft Scoping Venues

Venue
Carletonville Public Library, c/o Celestine & Emerald Street
Khutsong Public Library, Khutsong South
Ventersdorp Public Library, 1 Van Tonder Road
Coligny Public Library, 67 Voortrekker Street
Lichtenburg Public Library, 40 Melville Street
Boikhutso Public Library, 410 Kudu Street
Itsoseng Public Library, No. 3775 Zone 2
Ottoshoop Public Library, 56 Commission Street
Mahikeng Public Library, 30 Robinson Street
Miga Public Library, Miga Community Hall
Zeerust Public Library ,Voortrekker Street
Welverdiend Library,khutsong

7.6 Meetings

Two (2) Key Stakeholder Workshops (KSWs) and six (6) Focus Group Meetings (FGMs) were held during the first DSR review period where the following was presented:

- overview of the proposed project;

- need for the proposed project;
- present summary of the key environmental findings as documented in the DSR; and
- Providing them the opportunity to raise question for clarification, concerns and/or comments regarding the proposed project.

Table 50: Key Stakeholder and Focus Group Meeting Schedule

MEETING TYPE	DATE	TIME	STAKEHOLDERS & VENUE
Key Stakeholder Workshop	**Wednesday, 22 November 2017**	**10h00 - 12h00**	**Government Officials, Organs of State, Representatives from NGOs/CBOs, etc Lido Country Lodge, Carletonville**
Focus Group Meeting		**13h30 – 15h30**	**District & Local Authorities (incl Tribal Authorities) Municipal Offices, Carletonville (venue to be confirmed)**
Focus Group Meeting		**17h00**	**Possibly affected landowners**
Focus Group Meeting	**Thursday, 23 November 2017**	**09h00 – 11h00**	**District & Local Authorities (incl Tribal Authorities) Municipal Offices, Ventersdorp**
Focus Group Meeting		**13h30 – 15h30**	**District & Local Authorities (incl Tribal Authorities) Municipal Offices, Lichtenburg**
Focus Group Meeting		**17h30 – 19h30**	**Possibly affected landowners**
Key Stakeholder Workshop#2	**Friday, 24 November 2017**	**09h00 – 11h00**	**Government Officials, Organs of State, Representatives from NGOs/CBOs, etc District / Local Municipality's Offices Mahikeng**
Focus Group Meeting		**13h30 – 15h30**	**District & Local Authorities (incl Tribal Authorities) Municipal Offices, Mahikeng**

Six (6) Public Meetings (PMs) were held during the week of Monday, 4th to Friday, 8th of December 2017 with the help of a Facilitator. The same information as outlined above was presented at the Public Meetings although it is envisaged that the material would be more visual than technical text. These Public Meetings took take place at the following venues:

Table 51: Public Participation Meeting Schedule

DATE	TIME	VENUE
Monday, 04 December 2017	**10h00 (Registration from 09h30)**	**Lido Country Lodge. Carletonville**

	17h00 (Registration from 16h30)	
Tuesday, 05 December 2017	10h00 (Registration from 09h30)	Goedgevonden Community Hall, Goedgevonden
	17h00 (Registration from 16h30)	Doc Villa Guest House, Ventersdorp
Wednesday, 06 December 2017	10h00 (Registration from 09h30)	Coligny Hotel, Coligny
	17h00 (Registration from 16h30)	Boikhutso Community Hall, Lichtenburg
Thursday, 07 December 2017	10h00 (Registration from 09h30)	Otthoshoop Community Hall, Ottoshoop
	17h00 (Registration from 16h30)	Miga Community Hall

Table 52: Public Participation Meeting Schedule

	Type	Time	Stakeholders	Venue
Thursday, 11 January 2017	FGM	10h00 - 11h30	JB Marks Local Municipality Municipal Manager & Officials / Ward Councillors / Traditional Council	Municipal Offices - Potchefstroom
Tuesday, 16 January 2018	FGM	09h00 - 10h30	Ramotshere Moiloa Local Municipality Municipal Manager & Officials / Ward Councillors / Traditional Council	Municipal Offices
	FGM	12h00 - 13h30	Mahikeng Local Municipality Municipal Manager & Officials / Ward Councillors / Traditional Council	Mahikeng Local Municipality Council Chambers
	PM	15h00 - 16h30	Khunotswana CPA / Chief / Villagers	Khunotswana Tribal Office

	FGM	**18h00 - 19h30**	**Land Owners - Corridor 3 (northern section)**	**Marikwa Game Farm**
Wednesday, 17 January 2018	**FGM**	**09h00 - 10h30**	**Klippan Farmers' Union & Buhrmansdrift**	**Ottoshoop Community Hall / Farmers' Union Hall**
	PM	**11h30 - 13h00**	**Residents / Businesses - Rooigrond / Sheila & Verdwaal (Itsoneng excl)**	**Sheila / Verdwaal Community Hall?**
	FGM	**14h00 - 15h30**	**Ditsobotla Local Municipality Municipal Manager & Officials / Ward Councillors / Traditional Council**	**Lichtenburg Library Auditorium**
	PM	**16h00 - 17h00**	**Residents / Businesses - Bakerville**	**Church Hall / Mining Company Community Hall**
	FGM	**18h00 - 19h30**	**Soetdoring Farmers' Association & TLU SA Farmers' Union**	**Coligny Hotel / Farmers' Union Hall**
			Makokskraal Farmers' Union	**Farmers' Union Hall**
Thursday, 18 January 2017	**PM**	**09h00 - 10h30**	**CPA / Chief / Traditional Council - Ga-Motlatla**	**Community Hall**
	PM	**11h30 - 13h00**	**Ga-Mogopa Village (CPA / Traditional Council)**	**Ga-Mogopa Community Hall**
	PM	**13h30 - 15h00**	**Goedgevonden Village (CPA / Traditional Council)**	**Goedgevonden Community Hall**
	PM	**16h00 - 17h30**	**Tsetse Village (CPA / Traditional Council)**	**Tsetse Community Hall**
Friday, 19 January 2018	**FGM**	**09h00 - 10h30**	**Merafong Local Municipality Municipal Manager & Officials / Ward Councillors / Traditional Council**	**Speakers Parlour Merafong**

	PM	12h00 - 13h30	Khutsong / Carletonville Residents	Khutsong Community Hall

Minutes were drafted and recorded for all meetings held and copies will be included in the FSR. All comments / concerns / issues raised during these meetings were captured in the Issues and Responses Report (IRR) and included in the FSR.

Public Meetings for the second Public Participation took place at the following venues:

Table 53: Schedule for Public Participation Meetings

DATE	TIME	VENUE	MEETING FORMAT
Wednesday, 28 February 2018	14h30 – 17h30	Matshephe Community Hall, Matshephe Village	Public Meeting
Thursday, 01 March 2018	13h00 – 16h00	EH Mogase Primary School, Bodibe Village	Public Meeting
	16h30 – 18h30	Makgwe Primary School, Bodibe Village	Public Meeting
Friday, 02 March 2018	09h00 – 11h30	Lichtenburg Town Hall	Public Meeting
Wednesday, 14 March 2018	10h00 – 11h00	Mosaic B&B, Lichtenburg	One-on-One Discussion with landowners
	15h00 - 17h30	Regolotswe High School's Grounds, Itsoseng	Public Meeting
	18h00 – 20h00	Laerskool Buhrmannsdrif	Focus Group Meeting
Thursday, 15 March 2018	10h00 – 12h00	Farm Rysmierbult, Ventersdorp	One-on-One Discussion with landowners
Tuesday, 27 March 2018	09h30 – 11h00	Castello Boerdery Offices, Potchefstroom	One-on-One Discussion with landowners
Wednesday, 28 March 2018	07h00 – 08h30	Brandvlei	One-on-One Discussion with landowner

7.6 Summary of Concerns Raised During the Scoping Phase

- Environmental Impact Assessment and Project Related Comments/Issues
  - ❖ Clear timelines for the proposed project were requested.
  - ❖ It was stated that the the reason for the proposed substation, proposed expansion of the Mahikeng Airport, seems not to hold water if the substation location is north of Mahikeng and closer to Miga. Looking at the site locations, could it not be confirmed that the electricity is to be exported to Botswana.
- Agricultural Related Comments/Issues

- The contact details of the Agricultural Specialist was requested as information regarding the possible effect of EMF would have on the pecan nuts which are being farmed on the property should the power lines traverses over it.
- It was asked whether the proposed Corridors will affect farming operations.

- Biodiversity Related Comments/Issues
  - It was said , based on the Gauteng C-Plan Version 3.3, the proposed route is characterised as CBA, Ecological Support Area, Threatened Ecosystem and Primary Vegetation (Gauteng Grassland).
- Wetland and Groundwater Related Comments/Issues
  - It was said, the area north of Lichtenburg, as depicted in Figure 1, is very important as the catchment areas and dolomitic recharge area for both the Limpopo Primary Catchment and the Vaal Primary Catchment. This area (primarily sub-catchments C23F, C24C, the northern section of C24F and C31A) forms the watershed between the Limpopo Primary Catchment and the Vaal Primary Catchment. Although not formally documented, evidence suggests that withdrawal of water in the area affects the water levels in the streams of the Marico River system, which provides water not only to many communities living next to the river but also to Botswana through the TSWASA agreement. Furthermore, if Figure 1 is considered, it is clear that this area is the biggest aquatic Critical Biodiversity Area (CBA) in the North West Province, thus making it an important area in terms of water provision for the province.
- Avi-fauna Related Comments/Issues
  - It was commented that as per the presentation the bird species in the area are not comprehensive especially in the area close to the Molomane Eye Nature Reserve, as this area is rich in bird-life.
  - Reference was made to the abundant bird life in the ABNR and raised the concern that an additional PL could have a negative impact on the Avi-fauna.
- Heritage Impact Related Comments/Isssues
  - The project team was informed of various heritage sites within north-western section of Corridor 3 on the farms Stinkhoutboom, Zendelingspost and Weltevreden. Some of the heritage sites mentioned were: graves on the farm Grasland, old houses, Mosega Hospital, etc. The project team was informed that the PHRA is not against the proposed development but with experience gained while conducting Heritage Impact Assessments (HIA), was that the HIA are mainly conducted by Archaeologist and focus on the environment. However, the human

aspect of an HIA i.e. the rich oral history of communities is generally neglecting/exclude or underplay as the specialist does not interact with the communities. Sites related to sacred ancestral ceremonies and graves, which are mostly not marked, and these sites can only be identified by speaking to the local community members. He pointed out to the project team that their Department has a database of all the heritage sites and are willing to share it with the Heritage Specialist.

- Social Impact Related Comments/Issues
  - ❖ In terms of safety and security, the concern was raised regarding access to the property for servitude and power line maintenance.
  - ❖ It was asked, what benefits there would be for the communities, also in terms of job opportunities.
- Specialist Studies and Related Comments/Isssues
  - ❖ It was enquired whether there will be collaboration between the specialists and landowners.
- Technical Related Comments/Issues
  - ❖ The concern regarding the sagging of the existing power lines was raised, especially in terms of lighting. It could cause a fire and endanger the lives of the community.
  - ❖ It was asked why the existing power lines are not being upgraded.
- Agriculture Related Comments/Issues
  - ❖ It was enquired regarding the size of the substation site as he is concern that it would affect the grazing that is currently available in that area
  - ❖ The project team was informed that there were discussions regarding the establishment of an agricultural hub in or close to ABNR. As the attendees are not sure how far the extent of the hub would be, it is recommended that the project team enquire information from the Department of Rural Development.
- Economic Related Comments/Issues
  - ❖ It was asked that in light of Eskom's current financial crisis whether there will be funds available to complete this project.
  - ❖ It was asked, what the estimated cost for constructing a substation was.
- Visual Related Comments/Issues
  - ❖ It was stated that Impact on game farms from direct view surroundings.
- Substation Related Comments/Issues

- It was asked where the newly proposed Mahikeng Substation would be built.

- Corridor Related Comments/Issues
  - It was asked why there was three (3) alternative power line corridors proposed to be as wide as 2km.
- Spatial Developments Related Comments/Issues
  - It was requested that maps be provided to the Tribal Council to determine whether there are any challenges in terms of projects being planned in the area. Currently it seems where business developments are being planned, that these developments would not be closely located to any of the corridors.
- Construction Related Comments/Issues
  - It was asked what type of digging / trenching would be expected.
- Servitude Negotiation & Compensation Related Comments/Issues
  - It was stated that community members need to know how much is being paid out for the land.
- Electromagnetic Field (EMF) Related Comments/Issues
  - It was asked that in terms of safety, would the EMF cause veld fires which may be negative to the community.
- Final Scoping Report and Plan of Study for EIA Related Comments/Issues
  - It was stated that all comments from IAPs would be included and responded to in the FSR and PoS for EIA. The issues raised by the IAPs would be addressed and integrated into the impact and mitigation measures in the EMPr. The following would be attached as part of the public participation process: Comments from the Merafong City LM, Comments and Responses Report.
- Communication Related Comments/Issues
  - The project team was informed that the DSR has not yet been reviewed, but once done, formal written comments on the DSR will be submitted.
- General Related Comments/Issues
  - The project team was thanked for the presentation and informing them of the proposed development. He informed the project team that the area's electricity capacity is overloaded, and it is believed that the communities will benefit from the project.

8. OVERVIEW OF THE EXPECTED EFFECTS ON THE RECEIVING ENVIRONMENT

Any development has an impact on the surrounding area and region in which the development occurs. The proposed construction of a 400kV line Pluto and proposed Mahikeng Substation will have an impact on environment. The goal of an EIA process is to determine the impacts, the extent of the impacts and the mitigating measures that will limit the impacts to acceptable levels for the social and biophysical environment, the local community, I&APs, and all spheres of government. During the public participation process, the comments received from I&APs will indicate specific issues of concern and the concerns received will be taken forward to the Impact Assessment Phase in the attempt to address these concerns.

The following section provides an overview of the issues to be investigated by specialist study area.

8.1 Overview of the Potential Impacts on the Socio Environment

Maintaining good relationships with Botswana is of the utmost importance. In addition, despite the fact that South Africa supplies electricity to Botswana at present, this will change once Botswana's pumped storage schemes become operational.

The proposed project will also provide additional capacity to the Carletonville Customer Load Network and, in so doing, will make provision for future expansion.

On the other hand, the proposed power lines will transect many farms and will have an impact on the landowners and other land users, especially due to the aesthetic impact of the power lines. The Substation will also be located on a farm and affect the land users. The aim of the Social Impact Assessment will be to ensure that a responsible alternative corridor and Substation site alternative is selected and that potential impacts are mitigated as far as possible.

8.1.1 Economic Impacts

The proposed alternative corridors and substation site alternatives will have an impact on agricultural activities within the study area. The proposed 400kV line will require a 55m wide servitude, which will have economic implications for agricultural land.

The tourism and eco-tourism facilities and activities include nature-based and heritage resource facilities. A 400kV transmission line and Substation could therefore, potentially affect these activities in that the transmission lines could change the aesthetic appeal and/or sense of place of an area and cause damage to heritage resources, thereby making it less appealing or attractive to patrons. The potential impacts of the proposed project on the tourism sector in the area traversed by the various corridors will be considered as part of an Economic Overview and a Socio-Economic Assessment.

8.1.2 Infrastructure Impacts

No residential or regularly inhabited structures are allowed within transmission line servitudes. Although final alignments of the transmission lines within a preferred corridor will be done giving high priority to avoidance of homesteads and settlements, this may not always be possible. It will be easier to avoid homesteads within country estates and private nature reserves than in higher density housing developments.

From an infrastructure perspective, all the corridors cross over various district, provincial and national roads. Future development within the study will be identified based on the SDF and IDP from the affected municipalities. Some information will be received from the stakeholders indicating the priority areas that were earmarked for development ranging from residential to commercial and industrial development.

8.1.3 Aesthetic Impacts

Visibility is determined by a line of sight where nothing obscures the view of an object. Exposure is defined by the degree of visibility, in other words “how much” of it can be seen. This is influenced by topography and the incidence of objects such as trees and buildings that obscure the view partially or in total. Visibility will be modelled by making use of a digital terrain model (DTM), and applying a viewshed analysis using GIS software in the EIA phase report.

Visual exposure is expected to decrease with distance from the development site. For all the areas considered in the Visual Impact Assessment from alternative 1 to 2a;

- the highest impact is expected within the 2km radius from the development where the power line will be 95% visible overall,
- in the 5km radius the impact decreases to a 75% overall visibility,
- between 5km to 15km an overall decrease in impact to 50%, and
- within the zone of 15km+ from the site, visual exposure is expected to be low to very low, beyond which any exposure of the proposed power line will be insignificant in relation to the dominant landscape at such distances.

The modelling of visibility is merely conceptual. Being based on DTM data, it does not take into account the effect of buildings, trees etc. that could shield the facility from being visible.

The viewshed analysis therefore signifies a worst-case scenario. The immediate landscape surrounding the observer has a determining influence on long distance views. It is expected that vegetation may offer some degree of visual screening, especially where tall trees occur in the landscape between the viewer and proposed power line route, which is not the case in this study.

Table 54: Visual Analysis of the Alternative corridors

Alternative corridor:	Analysis:
Alternative corridor 1	▪ Due to the very little topographical features and predominately conservation areas, grasslands and agriculture land use, the proposed power line is highly likely to be visible within the 2km zone. ▪ Changes to the visual character of available views resulting from the development that include: – obstruction of existing views; – removal of screening elements thereby exposing viewers to unsightly views; – the introduction of new elements into the viewshed experienced by visual receptors and intrusion of foreign elements into the viewshed of landscape features thereby detracting from the visual amenity of the area ▪ The cumulative visual intrusion of the proposed power line over a 250km route will be high as the footprint of the

	proposed power line route is extensive. The visual impact and impact on sense of place of the proposed project will contribute to the cumulative negative effect on the aesthetics of the study area, especially within the conservation areas. ▪ The topography of the region is such that some pylons will be exposed against the skyline where hills and ridges are traversed, but this is unavoidable and alternative routes will face similar issues. ▪ The power line will pass through a landscape of low, open hills covered in agricultural lands, grasslands and woodlands. There are officially recognised protected areas that will be majorly affected with most of the land used for agricultural and hunting purpose. ▪ Tourists to the area who attach a greater sense of place to the landscape will probably be affected within the 15km radius of the development footprint. Mitigation measures are unlikely to reduce the visual impact of the power lines on these visual receptors. Alternative routes are likely to encounter similar situations since houses are spread out throughout the region. The ideal route in terms of visual impact will maintain a 1 km exclusion zone around residential buildings (farmsteads, dwelling or huts).

Alternative corridor 2	▪ Due to the very little topographical features and predominately grassland and/or agriculture land use, the proposed power line is highly likely to be visible within the 2km zone. ▪ Changes to the visual character of available views resulting from the development that include: − obstruction of existing views; − removal of screening elements thereby exposing viewers to unsightly views; − the introduction of new elements into the viewshed experienced by visual receptors and intrusion of foreign elements into the viewshed of landscape features thereby detracting from the visual amenity of the area ▪ The cumulative visual intrusion of the proposed power line over a 250km route will be high as the footprint of the proposed power line route is extensive. The visual impact and impact on sense of place of the proposed project will contribute to the cumulative negative effect on the aesthetics of the study area. ▪ The topography of the region is such that some pylons will be exposed against the skyline where hills and ridges are

	traversed, but this is unavoidable and alternative routes will face similar issues.

In relation to aesthetic and visual concerns, property values may decline as a consequence of the construction of transmission lines and presence of a Substation in the middle of the farm. Similarly, transmission lines, leading to loss of income for landowners, may negatively affect land-based commercial activities. There is little that can be done to completely avoid the visual intrusiveness of transmission lines and a Substation. However, mitigation measures to lessen impacts are available and should be applied. The aim should be to determine the least visually sensitive route. A Visual Impact Assessment study will be conducted during the Impact Assessment phase to investigate these concerns.

8.1.4 Health-Related Impacts

Electromagnetic fields are generated by electric currents and voltages in conductors. There is considerable concern about the health effects of long-term exposure to these fields. While the risks remain difficult to quantify, it is clear that the highest exposures occur when people live or spend significant amounts of time near a power conductor.

Considerable concern regarding injuries of staff members on site during the construction and maintenance phase of the proposed project occur with an unfortunate frequency, if precautionary and mitigatory measures are not implemented.

There is expected to be an inflow of workers from outside the project area to take up positions for the project and the majority of these workers (if not all) are expected to be male. A construction camp is also expected to be set up to accommodate the workers for the duration of the project, which can have various implications for the sustainability of the surrounding community.

It can affect the sustainability of the community in a negative light if there are many short term relationships that form for the duration of the project with workers that are temporarily in the area and can also result in the increase in the amount of women offering sexual services to increase in the respective area. This can result in the growth of HIV/AIDS and sexually transmitted diseases in the project area.

8.2 Overview of the Potential Impacts on Biophysical Environment

8.2.1 Ecological Impacts

The proposed corridors traverse the Savanna and Grassland Biomes. However, vegetation is mostly affected during the relatively short construction period where the construction of access roads, clearing of vegetation for the servitude and site establishment for construction has significant impact on vegetation. Thereafter, impacts are minimal.

Fauna species are generally dependent on vegetation, which means that where there is habitat destruction in the form of vegetation clearing, the faunal species will be impacted upon. The protection of faunal species' habitat automatically protects the vegetation that occurs within that habitat and vice versa. The construction activities once again pose many threats to the faunal communities since construction activities are associated with habitat destruction, fragmentation, soil erosion, and accidental injury to wildlife or livestock and poaching. All proposed corridors would have impacts on the avi-faunal species within the study area. Most habitats for bird species are associated with wetland systems. Birds are impacted in three ways by transmission lines. It is however a common rule that large and heavy-bodied terrestrial bird species are more at risk of being affected in a negative way when interacting with transmission lines. These include the following: electrocution, collision and physical disturbances and habitat destruction caused during construction and maintenance.

8.2.2 Hydrological and Wetland Impacts

The study area comprises various quaternary catchments that pose various wetland types within the study area. It is important to note that wetland in most cases is easily avoided especially with overhead power lines. The positioning of the towers is critical because it has the potential to impact on wetlands if it is positioned directly on wetland systems. Once again, construction activities that include creating access roads, construction camp and movement of vehicles have the potential to impact on the wetland system; pose the greatest risk of impact.

8.3 Specific Impacts and Proposed Mitigation

The purpose of this section is to identify potential impacts and to recommend mitigation measures to minimise detrimental environmental impacts. A number of biodiversity, socio- economic and cultural issues associated with the proposed transmission line have been identified through the public participation process, as well as by the EAP Team. The following are identified impacts as well as proposed mitigation measures.

8.2.1 Potential Impacts on Flora

The power lines usually have no to very low impact on the vegetation. The major concern is in terms of the edge effects of the construction phase:

- Unauthorised off-road driving.
- Removal of medicinal or aesthetic plants.
- The harvesting of wood from drainage lines, outcrops or bush clumps for warming and cooking.

The following impacts in relation to proposed development were identified as potentially influencing ecological processes and functioning of the study area itself as well as on regional and provincial scale:

- Removal of vegetation at construction camps**.**
- Harvesting of medicinal plants and wood.
- Construction of access roads.
- Alien vegetation control at construction camps, within servitudes and along access roads.

<u>Proposed Mitigation</u>

The following recommendations are applicable to the project area:

- Placing construction camps in all ready transformed areas such as cultivated fields or revamping derelict homesteads or other abandoned infrastructure can mitigate this impact. New borrow pits should be kept to the minimum; existing one should rather be used than new ones created. If successfully mitigated, the impact on the vegetation could be considered low on a local scale in the long term.
- Contractors should make sure that the necessary medical facilities are available for their staff on site.
- Where possible existing routes should be used and enhanced. If the access roads are required to cross green fields (untransformed) areas, it is strongly recommended that the, medicinal plants rescued instead of being destroyed and rare or threatened species moved to nurseries for re-establishment after construction or used for rehabilitation in areas where construction activities had result in the significant loss of natural vegetation. If successfully mitigated, the impact on the vegetation could be considered moderate on a local scale in the long term.
- Alien vegetation should be controlled and the spread managed. Declared alien vegetation should be controlled and removed in compliance with the Conservation of Agricultural Resource Act and the National Environmental Management Biodiversity Act.

8.2.2 Potential Impacts on Fauna

The following impacts were identified as potentially influencing ecological processes and functioning of the study area itself as well as on regional and provincial scale:

- Loss of conservation important faunal species.
- Disturbances caused during the construction phase.
- Disruption of functional ecological habitat types (rocky grassland and wetlands).
- Disturbances associated with maintenance procedures.
- Maintenance of the vegetation on the power line servitude.
- Increased hunting, poaching and removal of firewood.

Proposed Mitigation

The following recommendations are applicable to the project area:

- When a threatened or near-threatened faunal species is identified, a route/pylon/site deviation is advised to minimise the interference of the servitude/pylon footprint on the respective faunal species/population.
- Mandatory measures to be implemented during the construction and operational phases:
  - The construction of "new" access roads should be limited, and existing roads should be used during the construction phase. It is suggested that the construction of roads be avoided.
  - The unnecessary removal of natural vegetation should be avoided.
  - The extent of the construction sites and access roads should be demarcated on site layout plans and should be restricted to disturbed areas or those identified with low conservation importance. Therefore, no construction personnel or vehicle may leave the demarcated area except those authorised to do so. Those areas surrounding the construction site that are not part of the demarcated development area should be considered as "no-go" areas for employees, machinery, and visitors.
  - Open fires must be strictly prohibited and only allowed at designated areas.
  - Hunting must be strictly prohibited. Any person found hunting or in the possession of any indigenous animal) should face disciplinary measures, following the possible dismissal from the site.
  - Intentional killing of any faunal species should be avoided by means of awareness programmes.

- If any species is recovered during the construction phase, this species must be relocated to the nearest area or natural open space with suitable habitat.
- All construction activities must be limited to daylight hours.

8.2.3 Potential Impacts on Avi-Fauna

The potential impacts regarding transmission lines on birds are follows:

- Electrocution.
- Collision.
- Loss of habitat and disturbances.
- Poaching and trade of birds.

Proposed Mitigation

There are numerous ways to mitigate bird impacts imposed by power line interactions. Probably the best way is to proactively avoid areas where the potential for bird interaction is evident by means of route deviation. However, route deviations are not always feasible unless significant bird mortalities or habitat destruction is inevitable.

The following recommendations are applicable to the project area:

- A walk down of the selected route must be conducted prior to the construction phase.
  - Marking devices to be used should include large Double Loop Bird Flight Diverters.
  - All devices should be applied in a staggered fashion to the phase while alternating between black and white diverters. The maximum distance between the diverters should not exceed 5m.
- Mandatory measures to be implemented during the construction phase:
  - The construction sites must be confined to disturbed areas or those identified with low conservation importance. All construction sites must be demarcated on site layout plans (preferably), and no construction personnel or vehicles may leave the demarcated area except those authorised to do so. Those areas surrounding the construction sites that are not part of the demarcated development area should be considered as “no-go” areas for employees, machinery, and visitors.
  - A natural buffer zone (to be announced by the wetland specialist) should be allowed between the line servitude and any wetland or other sensitive habitat type.

- All road networks must be planned with care to minimize dissection or fragmentation of important avifaunal habitat type. Where possible, the use of existing roads is encouraged. Access must be determined during the "walk-through" process.
- The breeding status of threatened species should be evaluated prior to construction / decommissioning. If breeding is confirmed, the nest site must be barricaded and appropriately buffered (by at least 500m). Construction / decommissioning activities shall only commence once the fledglings are successfully reared and has left the nesting site;
- Open fires is strictly prohibited and only allowed at designated areas.
- Killing or poaching of any bird species should be avoided by means of awareness programmes presented to the labour force. The labour force should be made aware of the conservation issues pertaining to the bird taxa occurring in the study area. Any person found deliberately harassing any bird species in any way should face disciplinary measures, following the possible dismissal from the site.

8.2.4 Potential Impacts on Wetlands

The potential impacts regarding transmission lines on birds are follows:

- Compaction of watercourse soils.
- Changes to the hydrological regime caused by infrastructure construction in watercourses.
- Decrease in water quality.
- Loss of wetland, riparian, and drainage line vegetation and habitat as a result of pylon construction, new quarries and created construction camps.
- Increased sedimentation and erosion.
- Encroachment of invasive alien vegetation into watercourses.

<u>Proposed Mitigation</u>

The following mitigations measures are proposed recommendations are applicable to the project area:

- Avoid driving on watercourses during construction of the transmission line to prevent vehicle track incisions and the potential for channel initiation. Where this is unavoidable, crossing structures should be in place across affected wetlands and other watercourses. These crossing structures can include the following:

  - A wearing course (wear surface) should be added as a surface layer on top of geotextile fabrics, which forms base for surface capping.
  - A wearing course (surface cap) of good quality clastic or gravel material also has the potential to reduce surface scour by creating a mix that will easily bind together and minimise detachment of particles.
  - Geotextiles provide four important functions in temporary road and trail surface construction that includes separation, drainage, reinforcement, and stabilisation.
  - Geotextiles work as separation fabrics when they are placed between gravel caps and underlying soils to prevent the materials from mixing.
- Additional benefits of such as crossing structure include:
  - Defines a single route alignment for vehicle travel.
  - Provides a 'wear and carry' surface over unsuitable and easily compactable wetland soils.
  - This results in a stable, durable crossing surface for vehicle access, including heavy motor vehicle traffic.
  - Halts the widening and the development of braided crossing sections, while formerly used track alignments are allowed to naturally stabilise and revegetate.
  - Restrict the construction of infrastructure in watercourses as far as possible.
- Pylon construction in wetland, riparian and wash buffer zones should only be allowed in exceptional circumstances where these areas cannot be spanned.
- All unavoidable overlap between individual pylons and along road crossings in demarcated watercourses will require a Water Use License (WUL) in order to be allowable. Efforts should therefore be undertaken during the planning phase and proposed walk through phase to avoid infrastructure overlap as far as possible.
- Construction and maintenance tracks and roads should also be located outside of watercourses.
- No pylons, construction camps or quarries should be constructed within watercourses (i.e. wetlands, riparian habitat, and headwater drainage lines).
- The smallest possible footprint should be utilized and positioned as close to the boundary of the affected watercourse in cases where pylon construction in a watercourse is unavoidable.
- Pylon construction activities in these areas should be completed in the shortest possible time and preferably during the dry season.

- Excavated watercourses should be re-sloped to a stable gradient (e.g. at least a slope of 1:3), revegetated with naturally occurring indigenous species or annual grass species such as *Eragrotis tef*, and covered with bio-jute to help facilitate revegetation soon after construction.
- Pylons in wetlands or other watercourses should not be located on steep slopes, channels or other surfaces with visible erosion features.
- Road crossings should make provision for dispersed flow and energy dissipation.
- Management of roadside drainage is the most effective way of controlling sediment runoff from unsealed roads.
- To minimise sediment load, an unsealed road network should have an emphasis on slowing drainage flows and dispersing them more frequently.
- Storm water should be diverted away from the road early and often, so as to reduce the catchment area of the road.
- The use of drains, such as table drains and cut-off drains should not be used in any of the watercourse crossings. These types of drains typically have concentrated high-velocity flows and can frequently form channels within the watercourse. These channels provide an easy pathway for sediment to reach streams and adversely impact on water quality.
- Alternative options for storm water control should therefore be considered. These include the use of:
  - Grass swales.
  - Entrenched rock (riprap) aprons.
  - Sediment traps, such as hay bales or silt traps. These structures do, however, require maintenance.
  - Vegetated buffer / filter strips. The use of vegetation in the watercourse, especially downstream of unsealed road surfaces, will help to provide soil stability and reduce sediment input. It is important to use local and indigenous plant species.
  - Permanent crossing structures across channelled watercourses can include unvented fords that are constructed of riprap, gabions, or concrete to provide a stream crossing without the use of pipes. Water will periodically flow over the crossing.
  - If the construction of a crossing is unavoidable make sure that substrate continuity in the watercourse is maintained within upstream and downstream portions of the channel bed.
  - Unvented fords are best suited for ephemeral or intermittent streams (streams that are dry most of the year). Unvented fords may also be used across some shallow, low velocity perennial streams.

- Other important best management practices associated with ford design, construction, operation and maintenance that should be adhered to as far as possible, include (Anon, 2006):
  - Where possible locate crossings on straight channel segments (avoid meanders).
  - To the extent possible align crossings perpendicular to the stream channel.
  - Minimize the extent and duration of the hydrological disruption.
  - Use appropriate energy dissipaters and erosion control at the outlet drop.
  - Minimize impact to riparian vegetation during construction.
  - Prevent excavated material from running into water bodies and other sensitive areas.
  - Use appropriate sediment barriers (silt fence and hay bales).
  - Dewater prior to excavation.
  - Check construction surveys to ensure slopes and elevations meet design specifications.
  - Use appropriately graded material (according to design specifications) that has been properly mixed before placement inside the structure.
  - Compact bed material.
  - Tie constructed banks into upstream and downstream banks.
  - Evaluate structure stability.
  - Transmission line infrastructure (e.g. pylons) should be located outside of demarcated watercourses with a buffer of 50 m to avoid edge effects and opportunity for the encroachment of invasive alien plant species.
  - Restrict the clearing of watercourse vegetation as far as possible. Areas that have been cleared should be revegetated with indigenous species after construction.
  - Compile and implement an alien plant control program during the operational phase of the project.

Note that these pylon construction recommendations are the last mitigation option and all other attempts should first be attempted to prevent pylons in watercourses. Infrastructure construction in watercourses would also require a WULA.

8.2.5 Potential Impacts on Agriculture

The potential impacts on agricultural activities include:

- Impact on stock farming activities.
- Impact on timber farms and plantations.

- Impact on agricultural and irrigation activities.

Proposed Mitigation

The following mitigation measures are proposed:

- Eskom should discuss the construction schedule and activities with the affected farmers to enable them to plan their farming activities and animal movement accordingly.
- Conditions and/or specific requests relating to construction activities raised by property owners should be included in the EMPr.
- Placement of the line and towers should preferably not impact on income generating activities.
- Sensitivities with regards to farming practices should be considered when finalising a line alignment.
- The location of the construction camp where workers would be housed should be carefully considered to limit any possible negative social impacts.
- The construction camp should be located near support services, and ideally not in the vicinity of residential dwellings.
- Construction camp management should adhere to the EMPr specifications.

8.2.6 Potential Impacts on Residential Areas

Proposed Mitigation

- Should relocation be required, residents should be resettled nearer to their places of work and amenities.
- Avoid placing the transmission line in close view of restaurants and accommodation facilities where the visual beauty of the area is the main attraction.
- Careful consideration should be given to the tower designs in order to minimise impacts on existing structures and activities on affected properties.
- Careful consideration should be given to the final route alignment and tower placements to ensure minimal disruption of resources and infrastructure, especially on the smaller properties.
- Where possible, towers should be placed on the border of properties. The negotiation process would have to determine whether this is acceptable for the property owners involved and whether feasible.
- Avoid placing the transmission line across properties used for eco-tourism and leisure activities, such as horse riding and horse-based tourism. Should avoidance not be possible, the alignment should avoid the main activity areas and preferably be placed on the border of the properties.

8.2.7 Potential Impacts on Land Value

Proposed Mitigation

- During the construction process the EMPr should be strictly adhered to.
- The negotiation process between Eskom and the property owners should be concluded as rapidly as possible and compensation should be undertaken immediately thereafter.
- Placement of the power line along the farm boundaries where possible would limit the possible negative economic impacts.

8.2.8 Potential Impacts Resulting from the Inflow of Workers

Proposed Mitigation

- Eskom and the contractors should maximise the use of local labour where possible by developing a strategy to involve local labour in the contractor teams and construction process.
- Before construction commences, representatives from the local municipality and community-based organisations, as well as neighbouring and/or affected residents should be informed of the details of the construction company (contractor), size of the workforce and construction schedules.
- Conditions stipulated by property owners in terms of the construction activities should be implemented and monitored.
- Contractors and temporary employees should behave fittingly at all times.
- Workers should receive fines if they do not adhere to the conditions, rules and regulations.
- Workers should be made aware of property owners' concerns regarding construction work on their properties so that they are familiar with the sensitive issues.
- A specific contact person should be identified to allow community members and property owners to easily direct their queries and concerns and obtain general information regarding the construction process.
- Eskom personnel should preferably not access private properties without prior notification of the property owners.
- Eskom maintenance personnel should be in possession of the required identification documents and clothing when undertaking maintenance work.
- Vehicles used should be clearly marked.
- Eskom personnel should behave properly at all times.

8.2.9 Potential Local Economic Contribution

Proposed Measures

- Local procurement should be aimed at local businesses as far as possible.
- Local sourcing of materials would assist in providing more economic and employment opportunities for the local people.
- Maximise the use of local labour, even if the number of locals that would be employed would be limited. Accommodate, but regulate the activities of vendors in the vicinity of the construction areas and at the construction camps.
- Eskom should aim to turn the indirect local economic benefits into direct local and regional benefits through the provision of stable and sufficient electricity supply to the region thereby stimulating the local economy and by ensuring investor confidence in the region.

8.2.10 Potential Employment Opportunities

Proposed Mitigation

- Ward councillors could assist in determining available local labourers that could be considered for possible employment.
- Eskom should ensure an equitable process whereby minorities and previously disadvantaged individuals (especially women) are also taken into account.
- It is recommended that Eskom implements a skills audit and develops a skills database. Capacity building and skills transfer should immediately commence to ensure that locals are employable.
- It should be ensured that contractors use local skills, or train semi-skilled people or re-skill appropriate candidates for employment purposes where possible.
- On-site training should focus on the development of transferable skills (technical, marketing and entrepreneurial skills) to ensure long-term benefits to the individuals involved.
- Should opportunities arise for employment during the operational phase, Eskom should consider locals for any intermittent or permanent opportunities.

8.2.11 Potential Health Risks

Proposed Mitigation

- The safety exclusion zone should be strictly adhered to.
- Homesteads and dwellings should be avoided when finalising a route alignment.

- Careful consideration should be given to the location of the construction site where workers would be accommodated.
- Littering should be prevented by ensuring adequate facilities at the construction sites to dispose of refuse.
- Sufficient water and sanitation facilities should be provided for the workers on site during the construction period.
- Informal vending stations (if it occurs) should be closely monitored to ensure that no environmental pollution occurs.
- Local labour should be employed as far as possible.
- An HIV/Aids awareness campaigns should be focused on the contract workers.
- Adequate water supply and sanitation related facilities should be provided to the workers at the construction sites.
- Local labour should be employed as far as possible to avoid additional pressure of outsiders on the existing services.

8.2.12 Potential Impacts on Community Infrastructure

Proposed Mitigation

- Eskom should contact the relevant government departments and other possible stakeholders regarding the possible impact on infrastructure prior to construction. Written agreement should be sought from these affected parties to allow the project proponent to cross the various types of infrastructure.
- Construction schedules should again be discussed and finalised with the affected government departments and other affected stakeholders prior to the construction commencement date.
- Rehabilitation of new access roads for construction vehicles should be undertaken as soon as the construction process allows.
- There should be strict adherence to speed limits when using local roads and when travelling through residential areas.
- Access routes and access points for heavy construction vehicles should be indicated to warn motorists of the movement of these vehicles.
- Limit the movement of construction vehicles to off-peak periods (where possible).
- Conditions to access farms should be discussed during the negotiation phase.

- An Environmental Control Officers and Farm Liaison Officer could be appointed to ease communication between the property owners and Eskom / the contractor.
- Maintenance personnel should travel in a marked vehicle and should wear uniforms to ensure that the personnel are easily identifiable as Eskom personnel.
- Maintenance personnel should keep to the service roads.
- Maintenance vehicles should be operated according to all road regulations.
- Maintenance vehicles should be in good working order.
- Ideally permission should be sought before entering properties.

8.2.13 Potential Impacts on the Visual Environment
The potential impacts on the visual environment include:

- Impact on sense of place.
- Visual Intrusion and reduction of open space.
- Deposition of litter.
- Night light.

Proposed Mitigation

The following mitigation measures are proposed:

- Avoid placing the proposed transmission line within nature reserves and conservation areas.
- Careful consideration should be given to the type of towers to be used to ensure the least intrusive technology possible.
- Avoid tourism nodes where possible.
- Mitigation measures as proposed by the Visual Impact Assessment should be strictly adhered to.
- No litter, refuse, waste, rubble and builder's waste generated on the premises are to be placed, dumped or deposited on adjacent/surrounding properties including road verges, roads or public places and open spaces during or after the construction period of the proposed development. Refuse must be disposed of at a dumping site approved by the Council. Site cleaning and screening of storm water outlets is essential to prevent large debris from impacting on stream banks downstream of the site. Dustbins must be provided at strategic places within the construction area, and cleared at regular intervals as required to avoid overflow.
- The construction site must be kept in a clean and orderly state at all times. All signs and advertisements erected for the development and within its confines must be in line with the guidelines of the South African Manual for Outdoor Advertising Control.
- Security lights in the construction camp are to be angled downwards and into the centre of the site to avoid disturbance to adjoining residents. No tall lighting masts are to be erected or operated during the construction or operational phases. Only standard height lighting poles (shorter than 3m) may be used.

8.2.14 Potential Impacts of the Construction Camps

The potential impacts of the construction camps include:

- Health risk.

- Safety and security risks.
- Deposition of contaminants.
- Stockpiling of Construction Materials.
- Oil Spillages.

Proposed Mitigation

The following mitigation measures are proposed:

- Staff or personnel should be properly trained in handling of their equipment in order to avoid oil spillage that will increase deposition of contaminants. Construction camps should not be positioned in areas that has natural vegetation, preferably highly transformed area or already paved areas that do not have conservation value should be used.
- Construction vehicles should take into cognizance of peak hour traffic and they should avoid movement during those period. The speed of construction vehicles within the built up area should be limited to 40km/h.
- Careful consideration should be given to storm water control that will result in compaction or paving of surfaces within construction camps.
- Clearance of vegetation should only be done on areas that are deemed absolutely necessary.
- The areas to be cleared for roads and services should be restricted only to those that are essential for the operation and should be clearly demarcated. Construction vehicles and workers should not stray from these areas.
- All building rubble from the demolition of current structures is to be removed immediately in appropriate manner.
- The period between vegetation clearing and construction of the infrastructure must be kept to a minimum.
- Stockpiles are to be covered during windy conditions and material stockpiled for longer periods should be retained in a bermed area.
- Excavated and stockpiled soil material are to be stored and bermed on the higher lying areas of the site and not in any storm water run-off channels or any other areas where it is likely to be eroded or where water would naturally accumulate.
- Refuse collection should take place on a regular basis. A litter patrol around the construction area is to take place twice a week to collect any litter that may have been strewn around.

- Adequate provision must be made for sanitation of the construction workers. Chemical toilets on site are to be emptied regularly so as to prevent overflow.
- Construction materials that are left over after completion of the development are to be removed from the site and disposed of in an appropriate manner.
- Storage of potentially hazardous materials should be above the 100-year flood line, or as agreed with the ECO. These materials include fuel, oil, cement, etc.
- Surface water draining off contaminated areas containing oil and petrol must be channelled towards a sump, which will separate these chemicals and oils. Oil residue shall be treated with oil absorbent products such as Drizit or similar and this material removed to an approved waste site.

8.2.15 Potential Impacts on Safety and Security

Safety of personnel and equipment;

- Increase activity and vigilance.
- Decrease in uncontrolled criminal areas.
- Increased crime and reduction in personal safety.

Proposed Mitigation

The following mitigation measures are proposed:

- The associated risk of increased crime due to work staff being located on site would be reduced if the number of staff and people on site were limited. The site and crew are to be managed in strict accordance with the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and the National Building Regulations.
- Ensure that the handling of equipment and materials is supervised and adequately instructed. The entrance will have to be supervised to monitor entry and exit.
- Adequately barricade any exposed excavations or erect warning signs to notify the public of the inherent dangers. The contractor must have 24-hour security during the construction phase.
- Ensure that construction vehicles are under the control of competent personnel.
- Adequate facilities should be provided on site to treat emergencies to staff.
- No fires should be allowed on site.
- The maintenance of firebreaks by landowners is of critical importance.
- The servitude should be monitored on an ongoing basis.

- Eskom should take a strong stance with regard to the illegal entering of the servitude areas and people erecting building in the servitude. Such dwellings should be removed immediately.
- Eskom should, in conjunction with the local municipalities, develop an emergency management plan to specifically deal with the increased risk of fires from possible flashovers.

9. POTENTIAL CUMULATIVE IMPACTS

Cumulative impacts imply the sum total or combined impacts (positive and negative) associated with the proposed development whether on local or regional scale. In terms of the EIA regulations, a cumulative impact in relation to an activity means "the impact of an activity that itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar of diverse activities or undertakings in the area". Assessment of the cumulative impacts will be conducted in depth with the specialists during the Impact Assessment phase.

This section provides cumulative impacts ratings associated with the proposed project which include infrastructure development, Agricutural activities, Game Farming activities and Ecological Resources. It outlines the significance of the impact with and without mitigation measures. However, at this stage possible cumulative impacts associated with this project include, but are not limited to, the following:

9.1 Impacts on the Infrastructure Development

Any housing and other infrastructure development projects planned by municipalities, communities or landowners within the study area will potentially be affected by the proposed transmission line project. All the proposed infrastructure developments within the study area will be taken into consideration during the Impact Assessment to determine the most viable route for the proposed new power line. Without mitigation measures in place the significance of the impact is high, however the transmission line can deviate areas that have development.

Table 55: Table of Impact for Infrastructure Development

Aspect	Mitigation Status	Probability	Duration	Extent	Magnitude / Severity	Significance
Infrastructure Development	Without Mitigation	5	5	1	8	70
	With Mitigation	1	5	1	2	8

9.2 Impacts on Agricultural Activities

There are various agricultural activities occurring within the study area. The cumulative impact of construction the proposed 400kV power line parallel to existing power lines within agricultural activities and proposed Substation will further reduce crop yields and infrastructure development.

Table 56: Table of Impacts for Agricultural Activities

Aspect	Mitigation Status	Probability	Duration	Extent	Magnitude / Severity	Significance
Agricultural Activities	Without Mitigation	5	3	1	8	60
	With Mitigation	4	3	1	6	40

9.3 Impacts on Ecological Resources

The cumulative impact of construction the proposed 400kV power line parallel to existing power lines within significant ecological resources, such as wetlands, drainage areas and ecological corridors, would cause further habitat fragmentation and habitat degradation in sensitive ecosystems. The cumulative impact of the proposed Mahikeng substation is likely to be high and a critical consideration. It is inevitable that additional powerlines will be planned to connect with the proposed substation. Thereby, the risk of bird collisions (when concerning transmission lines) and bird electrocutions (when concerning distribution lines) will increase as well as the general displacement of large-bodied bird species in the area.

Secondly, construction activities associated with the substation and future planned powerlines will attract "job-seeking" people to the area, which could result in the expansion of informal settlements, clearing of land for subsistence agricultural practices and also increased collection of firewood. In addition, subsequent "urban sprawl" based on “job-seeking” opportunities near the substation could also result in the localised depletion of natural resources and direct persecution of bird/animal taxa.

Table 57: Table of Impact for Ecological Resources

Aspect	Mitigation Status	Probability	Duration	Extent	Magnitude / Severity	Significance
Ecological Resources	Without Mitigation	5	4	1	8	65
	With Mitigation	4	4	1	2	28

9.4 Game Farming Activities

There are various game farming activities occurring within the study area. The cumulative impacts of the proposed projecton game farming activities will negatively impact the farm by depreciating its value.

To optimise hunting shelters, workers' houses, sheds and similar buildings should remain unseen, away from major internal roads. Good quality access roads that can accommodate standard passenger vehicles, internal roads, including firebreak roads, game-viewing roads and walkways for game retrieval, that are in good condition is needed for Game farming activities, however the proposed project might interfere with this if necessary precautions and mitigation measures are not followed.

Table 58: Table of Impact for Game Farming Activities

Aspect	Mitigation Status	Probability	Duration	Extent	Magnitude / Severity	Significance
Game Farming Activities	Without Mitigation	5	4	1	6	55
	With Mitigation	1	4	1	2	7

9.5 Construction Activities

Various construction activities such as construction camps of the Mahikeng Substation and Powerlines structures will contribute to an increase in heavy vehicles on the roads in the region, with the proposed construction activities noticeable.

10. EXPECTED STUDIES FOR IMPACT ASSESSMENT

The expected impacts of the proposed two corridors for establishing a 400kV line between the Pluto and the proposed Mahikeng substations triggered the need for specialist studies. The following studies were identified during the Scoping Process and will require specialist assessment during the Impact Assessment Phase:

1. Flora Assessment
2. AviFauna and Fauna Assessment
3. Wetland and Hydrological Impact Assessment
4. Heritage Impact Assessment
5. Visual Impact Assessment
6. Social Impact Assessment
7. Soil & Agricultural Potential Impact Assessment
8. Economic Impact Assessment
9. Paelontological Assessment

10.1 Specialist Assessment Terms of Reference

10.1.1 Flora Impact Assessment

The flora assessment will cover the following key aspects:

- A description of the current state of the flora in the areas traversed by the corridors, outlining important characteristics and components thereof, which may be influenced by the proposed project or which may influence the proposed project during construction and operation. Use will be made of annotated maps where appropriate.
- The identification of existing and future planned conservation areas.
- The identification and categorisation of Red Data species potentially affected by the proposed project.
- The identification of potential impacts (positive and negative, including cumulative impacts) of the proposed project on vegetation, and vice versa, during construction, operation and decommissioning.
- Map all sensitive features (including wetlands, drainage lines, habitats for threatened specifies and other areas of conservation significance) and superimpose these on the proposed corridors.
- The identification of mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks (to be implemented during design, construction and operation of the proposed project).

- The provision of clear guidelines to reduce the damage and loss of vegetation and to assist with rehabilitation where damage and loss are unavoidable and to reduce the risk of the spread of alien vegetation.
- The formulation of a clear and simple system to monitor impacts, including their management, based on key indicators.
- The specialist will be required to adhere and comply with the NEMA regulations as well as provincial and national authorities' policies, such as Conservation Plans.
- To aid in the integration of findings, this study must involve close collaboration with the Faunal and Avi-faunal Impact Assessments.
- The specialist will be required to attend integration meetings and where necessary the specialists will be requested to attend public participation meetings.
- The specialist should highlight assumptions, exclusions and key uncertainties.

10.1.2 Fauna Impact Assessment

The fauna assessment will cover the following key aspects:

- A description of the current state of fauna in the areas traversed by the corridors, outlining important characteristics and components thereof, including species-specific habitats, which may be influenced by the proposed project or which may influence the proposed project during construction and operation. Use will be made of annotated maps where appropriate.
- The identification of Red Data species potentially affected by the proposed project.
- The identification of potential impacts (positive and negative, including cumulative impacts) of the proposed project on fauna during construction, operation and decommissioning
- The identification of mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks (to be implemented during design, construction and operation of the proposed project).
- The specialist will be required to adhere and comply with the NEMA regulations as well as provincial and national authorities' policies, such as Conservation Plans.
- The formulation of a clear and simple system to monitor impacts, and their management, based on key indicators.
- To aid in the integration of findings, this study must involve close collaboration with the Avi-Faunal and Floral Impact Assessments.

- The specialist will be required to attend two integration meetings and where necessary the specialists will be requested to attend public participation meetings.
- The specialist should highlight assumptions, exclusions and key uncertainties.

10.1.3 Wetland and Surface Water Resources Assessment

This assessment will cover the following key subjects:

- Description of current state of wetland and surface water resources and key ground water resources (including geo-hydrological aspects) within the study area. This must outline important characteristics and components thereof, which may be influenced by the proposed transmission line, or which may influence the proposed transmission line during construction and operation.
- Description of the functionality of the wetlands within the study area.
- The identification of the potential impacts (positive or negative, including cumulative impacts, if relevant) of the proposed transmission line on wetlands during construction, operation and decommissioning. This aspect of study must identify the sensitive "no-go" areas and should also include an analysis of construction constraints associated with wetlands.
- The identification of mitigation measures for enhancing benefits and avoiding or mitigating negative impact and risks (to be implemented during design, construction and operation of the transmission line).
- The formulation of a simple system to monitor impacts and their management based on key indicators.
- The specialist will be required to attend two integration meetings and where necessary the specialists will be requested to attend public participation meetings.
- The specialist will be required to adhere and comply with the NEMA regulations as well as provincial and national authorities' policies, such as Conservation Plans. The requirements in terms of river crossing should be highlighted.
- Collaboration with the Geotechnical and Soil specialists will be required.
- The specialist should highlight assumptions, exclusions and key uncertainties.

10.1.4 Avi-Fauna Impact Assessment

The avi-fauna assessment will cover the following key aspects:

- A description of the current state of avi-fauna in the areas traversed by the corridors, outlining important characteristics and components thereof, including species-specific habitats and roosting/nesting sites, which may be influenced by the proposed project or which may influence the proposed project during construction and operation. Use will be made of annotated maps where appropriate.

- The identification of Red Data and vulnerable species potentially affected by the proposed project.
- The identification of potential impacts (positive and negative, including cumulative impacts) of the proposed project on avi-fauna construction, operation and decommissioning.
- The identification of mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks (to be implemented during design, construction and operation of the proposed project).
- The formulation of a clear and simple system to monitor impacts, and their management, based on key indicators.
- The specialist will be required to adhere and comply with the NEMA regulations as well as provincial and national authorities' policies, such as Conservation Plans.
- To aid in the integration of findings, this study must involve close collaboration with the Faunal and Floral Impact Assessments.
- The specialist should highlight assumptions, exclusions and key uncertainties.

10.1.5 Soil and Agricultural Potential Assessment

The terms of reference for this project will include but not be limited to the following:

- Description of current state of soil and agricultural potential within the study area. This must outline important characteristics and components thereof, which may be influenced by the proposed transmission line, or which may influence the proposed transmission line during construction and operation. Collaboration with the Geotechnical and Wetland specialists will be required.
- Description of the agricultural potential and soil types within the study area.
- The identification of the potential impacts (positive or negative, including cumulative impacts, if relevant) of the proposed transmission line on soil and agricultural potential during construction, operation and decommissioning. This aspect of study must identify the sensitive "no go" areas and should also include an analysis of construction constraints associated with the areas with high agricultural potential.
- The identification of mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks (to be implemented during design, construction and operation of the transmission line).
- The formulation of a simple system to monitor impacts and their management based on key indicators.

- The specialist will be required to adhere and comply with the NEMA regulations as well as provincial and national authorities' policies, such as Conservation Plans.
- The specialist will be required to attend two integration meetings and where necessary the specialists will be requested to attend public participation meetings.
- The specialist should highlight assumptions, exclusions and key uncertainties.

10.1.6 Visual Impact Assessment

The visual and aesthetics assessment will cover the following key aspects:

- Description of visual landscape of the study area, with specific focus on topographical features that offer impact mitigation opportunities and constraints.
- Description of the area from which the project can be seen (the view shed), as well as the viewing distance.
- An assessment of the visual absorption capacity of the landscape (i.e. the capacity of the landscape to visually absorb structures and form placed upon it).
- The appearance of transmission line from important or critical viewpoints within established and existing planned land uses/activities.
- The identification of potential impact (positive or negative, including cumulative impacts, if relevant) of the proposed development on the visual landscape during construction, operation and decommissioning.
- The identification of mitigation measures for enhancing benefits and avoiding, reducing or mitigating negative impact and risks (to be implemented during design, construction and operation of the transmission line)
- The formulation of a simple system to monitor impacts, and their management, based on key indicators.
- The specialist will be required to attend two integration meetings and where necessary specialist will be requested to attend public participation meetings.
- The specialist will be required to adhere and comply with the NEMA regulations as well as provincial and national authorities' policies, such as the North West Conservation Plan.
- The specialist should highlight assumptions, exclusions and key uncertainties.

10.1.7 Social Impact Assessment

- The social assessment will cover the following key aspects:
- Description of the current social environments within the study area, outlining important characteristics and components thereof, which may be influenced by the proposed infrastructure or which may influence the proposed infrastructure during construction and/or operation.
- The identification of potential impacts (positive or negative, regional and local, including cumulative impacts, if relevant) of the proposed development on the social environment during construction, operation and decommissioning. This aspect of the study must consider potential impacts on the following but not limited to; existing infrastructure, nuisance impacts, possible traffic effects, the transmission of diseases, in particular HIV/AIDS, and health and safety impacts (including poaching and stock theft).
- The identification of mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and the risks (to be implemented during design, construction and operation of the proposed transmission line).
- The formulation of a simple system to monitor impacts and their management based on key indicators.
- The specialist will be required to adhere and comply with the NEMA regulations as well as provincial and national authorities' policies.
- To aid in the integration of findings, this study must involve close collaboration with the Economic Assessment.
- The specialist will be required to attend two integration meetings and where necessary the specialists will be requested to attend public participation meetings.
- The specialist should highlight assumptions, exclusions and key uncertainties.

10.1.8 Heritage Impact Assessment

The heritage impact assessment will cover the following key aspects:

- The consideration of the impacts on Cultural Heritage resources arising from the construction and operation of the proposed transmission line and the infrastructure.
- Information will be provided on the following:
  - Results of the survey of the construction footprint and the identification of cultural heritage resources that may be affected by the proposed infrastructure, or which may affect the proposed infrastructure during construction, operation and decommissioning.

- Recommended mitigation measures for enhancing positive impacts and avoiding or minimizing negative impacts and risks (to be implemented during design, construction and operation).
- Formulation of protocol to be followed by Eskom for the identification, protection and recovery of cultural heritage resources during construction and operation.

- The specialist will be required to handle the process of attaining comments from SAHRA.
- The specialist will be required to adhere and comply with the NEMA regulations as well as provincial and national authorities' policies, such as the Mpumalanga Conservation Plan.
- The identification of heritage resources that will be adversely affected by the proposed development.
- The specialist will be required to attend two integration meetings and where necessary the specialists will be requested to attend public participation meetings.
- The specialist should highlight assumptions, exclusions and key uncertainties.

10.1.9 Economic Assessment

The Economic assessment will cover the following key aspects:

- Provide a broad understanding of the economic profile of the areas traversed by the three corridors, outlining the key components, characteristics and drivers thereof, which may be influenced by the proposed project or which may influence the proposed project during construction and operation. This must be done in close collaboration with the Social and Economic Assessment.
- The identification and mapping of geographic areas of economic importance (such as areas of important tourism, areas of recreational value, areas of important agriculture). Identify those geographic areas where the proposed project would be incompatible with existing and future planned developments.
- Where possible, quantification of impacts on the various sectors for comparison between corridor alternatives will be important.
- The identification of potential impacts (positive and negative, local and regional, including cumulative impacts) of the proposed project on the economic environment during construction and operation.
- To aid in the integration of findings, this study must involve close collaboration with the Social and Economic Assessment, the Tourism Overview, and the Town and Regional Planning Overview.

10.1.10 Paleontological Assessment

The process of assessment for the palaeontological (PIA) specialist components of heritage impact assessments, involves:

- Scoping stage in line with regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. This involves an initial assessment where the specialist evaluates the scope of the project (based, for example, on NID/BIDs) and advises on the form and extent of the assessment process. At this stage the palaeontologist may also decide to compile a Letter of Recommendation for Exemption from further Palaeontological Studies. This letter will state that there is little or no likelihood that any significant fossil resources will be impacted by the development. This letter should present a reasoned case for exemption, supported by consultation of the relevant geological maps and key literature.
- A Palaeontological Desktop Study – the palaeontologist will investigate available resources (geological maps, scientific literature, previous impact assessment reports, institutional fossil collections, satellite images or aerial photos, etc) to inform an assessment of fossil heritage and/or exposure of potentially fossiliferous rocks within the study area. A Desktop studies will conclude whether a further field assessment is warranted or not. Where further studies are required, the desktop study would normally be an integral part of a field assessment of relevant palaeontological resources.
- A Phase 1 Palaeontological Impact Assessment is generally warranted where rock units of high palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large-scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed project area is unknown. In the recommendations of Phase 1, the specialist will inform whether further monitoring and mitigation are necessary. The Phase 1 should identify the rock units and significant fossil heritage resources present, or by inference likely to be present, within the study area, assess the palaeontological significance of these rock units, fossil sites or other fossil heritage, comment on the impact of the development on palaeontological heritage resources and make recommendations for their mitigation or conservation, or for any further specialist studies that are required in order to adequately assess the nature, distribution and conservation value of palaeontological resources within the study area.
- A Phase 2 Palaeontological Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or the recording and sampling of fossil heritage

that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before Phase 2 may be implemented.

- A 'Phase 3' Palaeontological Site Conservation and Management Plan may be required in cases where the site is so important that development will not be allowed, or where development is to coexist with the resource. Developers may be required to enhance the value of the sites retained on their properties with appropriate interpretive material or displays as a way of promoting access of such resources to the public.
- The assessment reports will be assessed by the relevant heritage resources authority, and depending on which piece of legislation triggered the study, a response will be given in the form of a Review Comment or Record of Decision (RoD). In the case of PIAs that are part of EIAs or EMPs, the heritage resources authority will issue a comment or a record of decision that may be forwarded to the consultant or developer, relevant government department or heritage practitioner and where feasible to all three.

10.2 Composition of the Project Team

Table 59: Composition of the Project Team

Company	Specialist	Field of expertise
Naledzani	Mr. Mpho Ramalivhana	Flora Impact Assessment
Integrated Specialist Services	Mr. Trust Mlilo	Heritage Impact Assessment
Integrated Specialist Services	Mr.Jacobus Francois Durand	Palaeontological Assessment
Pachnoda Consulting cc	Mr. Lukas Niemand	Avi-fauna and Fauna Impact Assessment
Ecoelementum	Mr. Vernon Siemelink	Visual Impact Assessment
Imperata Consulting	Mr. Retief Grobler	Wetland & Watercourse Impact Assessment
Terralogix Consulting cc	Dr. Johan de Waals	Soil & Agricultural Potential Impact Assessment
Turnscapes Travel & Tourism	Ms. Chanel Turner	Social Impact Assessment
GIBB	Dr. Patrick Sithole	Lead Legal and Peer Reviewer
Andre Zanoli GIS	Mr. Andre Zanoli	G.I.S
Conningarth Economists	Ms. Riekie Cloete	Economics Impact Assessment

10.3 Baagi Environmental Consultancy Project Team

Table 60: Baagi Environmental Consultancy Project Team

Company	Name	Field of expertise
Baagi Environmental Consultancy cc	Lordwick Makhura	Project Leader
Baagi Environmental Consultancy cc	Tinashe Maramba	Project Manager
Imaginative Africa	Nicolene Venter	Public Participation Manager

11. FINDINGS AND RECOMMENDATIONS OF SPECIALIST REPORTS

This chapter provides a brief outline of the findings and recommendations by the specialists. A total of 9 specialist studies were undertaken by independent Specialists (Table 59), the results of which are summarised in this chapter. Copies of the specialist reports are provided in Appendix G.

11.1 Flora

11.1.1 Vegetation Survey

All the proposed alternative corridors for the proposed construction of the powerline give the feeling of a typical grassland biome characterised by shrubs and the grass layer; whilst the area proposed site alternative for the substation is a typical savannah characterised by short trees, shrubs and grasses. Dominant transformation agents primarily include cultivation, small-scale mining and infrastructure development.

11.1.2. Vegetation communities

Four vegetation communities were identified during the site assessment (Figure 42). These were recognised based on physiognomy, moisture regime, and species composition and disturbance characteristics. The vegetation communities include the following:

- Riverine and wetland vegetation,
- Cultivated land,
- Open grassland,
- Ridge,
- Secondary grassland and
- Mixed bushveld.

The characteristics of each vegetation community are discussed in the sections below.

11.1.2.1 Open grassland

This vegetation unit consist a small section of the site. Occurs between the cultivated land and the open shrubland. Although the assessment was done during what is supposed to be a wetter season, the grass layer was found to be dry and some of the species could not be identified to the species level. Dominant floral species in this community include *Eragrostis lehmanniana, Aristida congesta, A. canescens, Digitaria eriantha, Urochloa mosambicens, Setaria sphacelata, Themenda triandra*, *Melinis repens, Cynodon dactylon and Heteropogon contortus.* Few small species of *Ziziphus zeyheri, Hypoxis hemerocallidea* and *diospyros lycioides* were recorded scattered in the grassland. Only one plant species of *Boophane disticha* was recorded within this vegetation.

Sensitivity aspects of the study area include:

- The open grassland has an ecological functioning of low-medium;
- The suitability of this community for Red Data/protected species is considered medium due to indication as certain grassland have been previously cultivated but now regenerating.
- Two listed species (regarded as declining) have been recorded, *i.e. Hypoxis hemerocallidea* and *Boophane disticha.*

Figure 42: Open grassland vegetation unit

11.1.2.2 Cultivated area/land

Cultivation along the corridors include *Zea mays (*Maize*), Helianthus annuus* (Sunflower) and *Glycine max* (Soybeans). Currently this area has no natural vegetation remaining and is largely planted with Lucerne (*Medicago sativa*) crop. At the boundaries of this vegetation community, areas which have previously been cultivated but are currently left fallow are heavily disturbed and are colonised by a mixture of invasive, exotic plants, as well as pioneer and sub-climax indigenous species. Amongst these, common grasses noted include, *Eragrostis curvula, Hyparrhenia hirta, Melinis repens and Panicum repens*. Forb and herbs species include *Bidens pilosa, Datura stramonium, Tagetes minuta, Argemone mexicana, Conyza bonariensis, Conyza canadensis, and Cosmos bipinnatus*.

Sensitivity aspects of the study area include:

- Due to the complete transformation of currently cultivated fields these areas have negligible or low ecological functioning.
- No endemic, Red Data or protected species were recorded in the cultivated lands and the probability of such species occurring in this vegetation community is considered low.
- Accordingly, the conservation importance of cultivated land is considered low.

Figure 43: Cultivated area with *Zea mays* and dominated by *Urochloa mosambicens* along the edges of a pivot

Figure 44: *Helianthus annuus* cultivation

11.1.2.3 Riverine and wetland vegetation

This unit consist of tall trees such as *Eucalyptus spp., Salix mucronata, Rhus lancea and Melia azedarach.* Other species include *Ziziphus mucronata, Gymnosporia buxifolia, Asparagus laricinus, Phragmites australis Senecio inornatus* as well as grass species including *Andropogon eucomus, Eragrostis plana, Typha capensis Panicum coloratum, Sporobolus africanus,* Cyperus *rupestris, Andropogon appendiculatus* and *Setaria incrassata* were all recorded in seasonal and temporary saturation zones.

No red-listed species were recorded in this vegetation unit but it is an important semi-natural/natural habitat for fauna within the study area renders the conservation importance of this area of the community medium to medium-high.

Sensitivity aspects of the study area include:

- The riverine vegetation unit in the study area has an ecological functioning of medium;
- The suitability of this community for Red Data/protected species is considered medium although;
- The conservation importance of this community is considered medium to medium-high as they provide habitat for avi-fauna.

Figure 45: illustration of the Riverine vegetation unit with dry *Eucalyptus sp, Asparagus laricinus and Ziziphus mucronata*

11.1.2.4 Mixed bushveld

This unit covers occurs more on the Klerksdorp thornveld and the Mafikeng bushveld along the proposed corridors as well as covering the entire area proposed for the Mahikeng substation. The vegetation is characterised by trees, shrubs (being dominating) as well as a well-developed grass layer. It is mainly dominated by shrubs such as *Acacia erioloba, Diospyros lycoides, Grewia occidentalis, Ziziphus mucronata, Rhus lancea, Acacia tortilis, and Acacia hebeclada. Other species include Aloe Zebrina, Prosopis glandulosa, Asparagus densiflorus, and Asparagus laricinus.* The grass species include *Melinis repens, Themenda triandra, Panicum coloratum, Sporobolus africanus, Andropogon eucomus, and Urochloa panicoides*.

Sensitivity aspects of the study area include:

- The overall ecological functioning of this community is considered medium.
- Sections of the area have previously been mined. Many excavations were noticed but the whole vegetation unit has a medium ecological functioning.
- Only one dominating protected species was recorded in the area.
- Accordingly, the conservation importance this vegetation unit is considered medium to high due to the dominating nature of the *Acacia erioloba* (listed as declining).

Figure 46: The mixed bushveld dominated by *Acacia erioloba and Ziziphus mucronata*

11.1.2.5 Secondary grassland

Secondary grasslands develop where the original, primary (undisturbed) grassland vegetation was removed (e.g. by cultivation). After such disturbances cease, pioneer grassland species colonise the disturbed areas leading to a secondary grassland state with a lower species diversity as opposed to the primary (climax) state prior to any disturbances. In the absence of any further disturbances, continuous succession should theoretically lead to the development of the original climax (or primary) state of the grassland. However, primary grasslands are species rich ecosystems, which once disturbed, are difficult, if not impossible to restore.

The assessment found that some of the historically cultivated areas were planted with pasture grasses (e.g. *Digitaria eriantha*), while others were dominated by pioneer grasses such as *Eragrostis plana* (Tough Love Grass), *Hyparrhenia hirta*, *E. lehmanniana* and *Cynodon dactylon* (Couch Grass). Derelict cattle dip areas and kraals between Pulsar substation and the proposed Meteor substation confirmed that the area was historically used for large scale cattle farming. The secondary grasslands, and in particular at the proposed Meteor substation site, comprised a low species diversity and Basel cover.

Due to the severe and long term soil disturbances, it is unlikely that secondary grassland will revert to primary grassland. It is doubtful that geophytes or plants of conservation concern survived the cultivation, except in areas around wetlands where the soil was too wet to plough. Although some herbaceous species were observed in the secondary grasslands (e.g. *Cleome maculata, Comelina africana var krebsiana, Felicia muricata, Indigofera zeyheri and Hermannia depressa)*, the diversity was observed to be low.

- No plants of conservation concern were observed in the secondary grasslands.
- The overall ecological functioning of this community is considered medium.

Figure 47: Secondary grassland along the proposed route

11.1.2.6 The ridge

Ridges are known to provide unique and diverse floristic composition. This vegetation unit was noted on along corridor 1 but could not be surveyed as access was not granted. It is located on a private game farm.

11.1.3 Alien invasive plants

Declared weeds and invaders have the tendency to dominate or replace the herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that all these transformers be eradicated and controlled by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

According to the published Alien and Invasive Species regulations in terms of section 97(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) four categories of problem plants are identified as:

- **Category 1a**, plants are high-priority emerging species requiring compulsory control. All breeding, growing, moving and selling are banned.
- **Category 1b**, plants are widespread invasive species controlled by a management programme.
- **Category 2**, plants are invasive species controlled by area. Can be grown under permit conditions in demarcated areas. All breeding, growing, moving, and selling are banned without a permit.
- **Category 3,** plants are ornamental and other species that are permitted on a property but may no longer be planted or sold.

Numerous alien plant species were recorded in the study area at the time of the survey; most notably the extensive invasions by species such as *Melia azedarach, Opuntia ficus-indica, Campuloclinium macrocephalum* and *Cereus jamacaru* also have the potential to form dense stands. Table 61 lists the alien species as well as the various NEMBA categories for the alien species recorded during the survey.

Table 61: Alien species recorded in the study area

Scientific name	Common name	NEMBA Category
Acacia mearnsii	Black wattle	2
Argemone Mexicana	Mexican prickly poppy	1b
Arundo donax	Giant reed	1b
Campuloclinium macrocephalum	Pom-pom weed	1b
Cereus jamacaru	Queen of the night	1b
Cortaderia selloana	Pampas grass	1b
Datura ferox	Large apple thorn	1b

Datura Stramonium	Downy thorn apple	1b
Eucalyptus spp		
Lantana camara	Bird's brandy; cherry pie; tick-berry	1b
Melia azedarach	Syringa	1b
Opuntia ficus-indica	Prickly pear	1b
Prosopis glandulosa	Honey mesquite	1b in NW and not listed in Gauteng
Ricinus communis	Castor oil plant	2
Solanum mariantanum	Bug weed	1b
Verbena bonariensis	Wild Verbena	1b

11.1.4 Medicinal Plants

The demand for medicinal plants is increasing while the frequently used species and the communal land that it is harvested from are on the decline. With an increase in the country's population and the high rate of infectious diseases, this will put an even higher strain on the already scarce natural medicinal resources (Emery *et al*., 2002). Areas of high biodiversity are thus important for the conservation and sustainable use of these resources and should be protected. Most of the medicinal plant species recorded in the study area was alien species.

Table 62: Medicinal plants recorded in the study areas.

Scientific name	Common name	Conservation Status
Aloe Zebrina	Spotted aloe	Indigenous
Hypoxis hemmerocallidea	African potato	Indigenous

Opuntia ficus-indica	Prickly pear	Exotic
Rhus lancea	Karee	Indigenous
Ziziphus mucronata	Buffalo thorn	Indigenous
Boophane disticha.	century plant	Indigenous

11.1.5 Description of the CBAs

Critical Biodiversity Areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI, 2007). These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making tools.

The primary purpose of CBA's is to inform land-use planning and the land-use guidelines attached to CBA's aim to promote sustainable development by avoiding loss or degradation of important natural habitat and landscapes in these areas and the landscape as a whole. CBA's can also be used to inform protected area expansion and development plans.

The use of CBA's here follows the definition laid out in the guideline for publishing bioregional plans (Anon, 2008):

- "**Critical biodiversity areas** (CBAs) are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses".
- "**Ecological support areas** (ESA's) are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas."

The guideline for bioregional plans defines three basic CBA categories based on three high-level land management objectives which were adapted for the Gauteng Province (Table 68).

Table 63: A framework for linking spatial planning categories (CBAs) to land-use planning and decision-making guidelines based on a set of high-level land biodiversity management objectives.

CBA category	Land Management Objective
PA & CBA 1	**Natural landscapes**: • Ecosystems and species fully intact and undisturbed • These are areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. • These are landscapes that are at or past their limits of acceptable change.
CBA 2	**Near-natural landscapes**: • Ecosystems and species largely intact and undisturbed. • Areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising our ability to achieve targets. • These are landscapes that are approaching but have not passed their limits of acceptable change.
Ecological Support Areas (ESA)	**Functional landscapes**: • Ecosystems moderately to significantly disturbed but still able to maintain basic functionality. • Individual species or other biodiversity indicators may be severely disturbed or reduced.

CBA category	Land Management Objective
	• These are areas with low irreplaceability with respect to biodiversity pattern targets only.
Other Natural Areas (ONA) and Transformed	**Production landscapes**: manage land to optimize sustainable utilization of natural resources.

Alternative corridor 1 cuts through a number of small patches of Critical Biodiversity Area 1, with only a small section of the corridor passing through an Ecological Support Area 1. Most of these sensitive patches are associated with water resources, as well the remaining natural vegetation in the area. The areas identified as protected during the scoping phase have been excluded in the assessment due to the deviations of the corridors.

Alternative corridor 2a run along an existing powerline, and also a number of agricultural holdings which has led to the remove of the natural vegetation. From Pluto to Mahikeng, corridor 2a runs through an Ecological Support Area 1 and 2. Only a small section of the corridor runs through CBA 2.

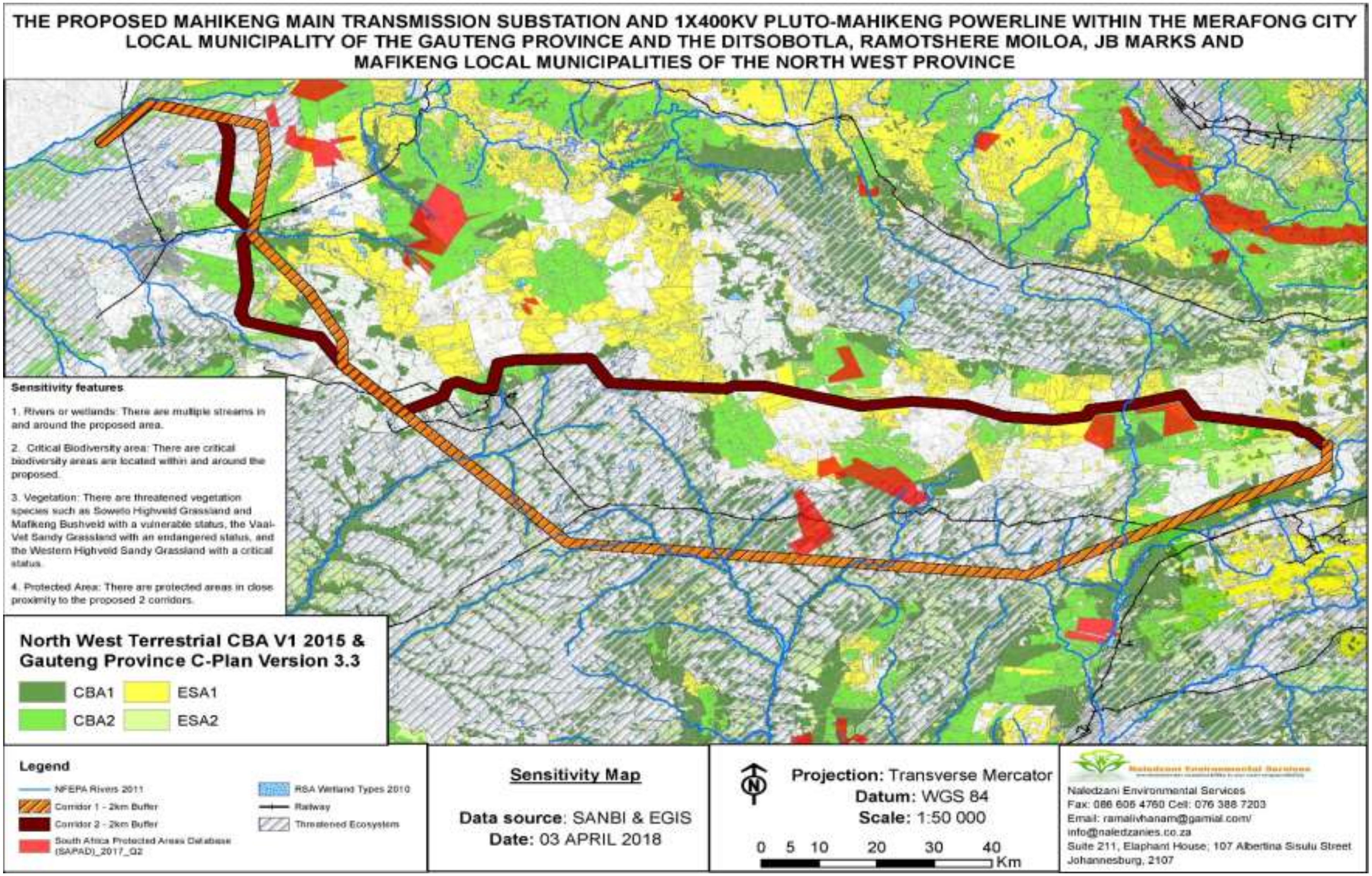


Figure 48: Sensitivity map in relation to the proposed corridors as well as the Mahikeng substation

11.2 Fauna

11.2.1 Red Listed, Endemic and Conservation Important Faunal Taxa

It is evident from Figure 49 and Figure 50 that the highest number of mammal taxa and mammal species of conservation concern are confined to north-western and south-eastern parts of the study area. These areas correspond to the Abe Bailey and Mafikeng Nature Reserves, which explains the high richness of species.

The proposed alternative corridors will traverse through extensive areas of open dolomite and sandy grassland which provide suitable habitat for a variety of mammal species as well as a variety of bushveld types. It is likely to support 13 mammal species of conservation concern. Likewise, the perennial rivers and seeps provide suitable habitat for near-threatened taxa that are wetland-dependant (e.g. shrew taxa of the genus *Crocidura,* the Cape Clawless Otter *Aonyx capensis* and Serval *Leptailurus serval*). However, the area also supports two large carnivores of global and national significance (Brown Hyaena *Parahyaena brunnea* and Leopard *Panthera pardus*) and two globally threatened taxa (Black-footed Cat *Felis nigripes* and White-tailed Rat *Mystromys albicaudatus*). Apart from the aforementioned species, the mesic Highveld grassland types on the eastern parts of the study area also provide habitat for the nationally near threatened Vlei Rat (*Otomys auratus*) and Grey Rhebok (*Pelea capreolus*).

In addition, the Mafikeng Bushveld on the western parts of the study area was one of a few vegetation types on the study area where the vulnerable Temminck's Ground Pangolin (*Smutsia temminckii*) was recorded. The study area also support (based on known historical and extant distribution ranges) habitat for 19 frog species, 56 reptile taxa, 12 Odonata (dragonflies and damselflies) and 132 diurnal butterfly species. Most mammal species are in general highly mobile (except those that live in burrows or dens, or those with small body size) and therefore able to vacate areas should adverse environmental conditions prevail. Therefore, direct impacts associated with construction activities on adult mortality are less likely to occur, although indirect impacts will have consequences on their “fitness” (e.g. the ability of a species to reproduce). However, persistent disturbances across extended temporal scales will eventually affect any population’s ability to sustain itself, and will more than likely result in total abandoning of a particular area. Species most likely to be affected are habitat specialists e.g. Black-footed Cat *F. nigripes,* Temminck's Ground Pangolin *Smutsia temminckii* and White-tailed Rat *M. albicaudatus*. Faunal compositions are believed to remain the same irrespective of the intensity of the construction activities (e.g. road construction) associated with the power lines, but the distribution and abundance of species could effectively change. Many habitat specialists could suffer from local range contraction.

In addition, construction activities go hand in hand with high ambient noise. Although the construction phase is considered to be of short duration, many of the larger terrestrial species will vacate the study area during the construction phase and will become temporarily displaced.

Table 64 and 65 provides a list of threatened, near-threatened and conservation important faunal species with geographic distribution ranges sympatric (overlapping) to the study area. It is evident that most of the taxa are evenly distributed across the study area owing to the extensive and vast occurrence of open grassland. However, many of the habitat specialists are either located on the sandy Bushveld in the west, or the mesic Highveld grassland on the eastern extremity of the study area. Many are also partial towards grassland of untransformed ecological condition and termitaria.

Table 64: A list of threatened, near threatened and conservation important faunal species likely to occur on the study area (excluding introduced game).

Scientific Name	Common Name	Global Conservation Status	National Conservation Status	Probability of Occurrence	Habitat
Mammals					
Leptailurus serval	Serval		Near threatened	Known to be present.	Along moist grassland near rivers and dams.
Felis nigripes	Black-footed Cat	Vulnerable	Vulnerable	Known to be present.	Widespread, although partial to habitat with shelter (aardvark burrows or termitaria) and a high abundance of murid prey and terrestrial passerine Birds.
Parahyaena brunnea	Brown Hyaena	Near threatened	Near threatened	Known to be present.	Widespread.
Poecilogale albinucha	African Weasel		Near threatened	Could occur. Known from 2627AD	Mainly open grassland with an abundance of rodent prey.
Atelerix frontalis	South African Hedgehog		Near threatened	Known to be present	A widespread species that prefer dry habitat types and will often utilise Urban gardens.
Mystromys albicaudatus	White-tailed Rat	Endangered	Endangered	Could occur, status uncertain. It was recorded From 2627AD and 2626AA.	Late-successional Themeda triandra grassland on sandy soils. Most probably restricted to the Vaal-Vet Sandy Grassland type on the western Parts of the study area.
Crocidura mariquensis	Swamp Musk Shrew		Near threatened	High.	Mainly moist or inundated grassland and sedge along the edges of pans, Dams and vleis.
Otomys auratus	Vlei Rat		Near threatened	High, mainly in east of study area corresponding to vegetation types of the Grassland Biome	Moist grassland bordering wetland features.
Panthera pardus	Leopard	Vulnerable	Vulnerable	High, mainly confined to the northern parts of the study area consisting of Bushveld and Thornveld vegetation types	Varied, although partial to broken or mountainous terrain.

Table 65: List of threatened, near threatened and conservation important faunal species likely to occur on the study area (excluding introduced game).

Scientific Name	Common Name	Global Conservation Status	National Conservation Status	Probability of Occurrence	Habitat
Aonyx capensis	Cape Clawless Otter	Near threatened	Near threatened	High	Mainly perennial rivers, streams, dams and pans.
Pelea capreolus	Grey Rhebok		Near threatened	Localised, confirmed from 2525DB, 2626CB, 2526CC, 2627AD.	Open undulating grassland at high altitudes.
Redunca fulvorufula fulvorufula	Mountain Reedbuck		Endangered	High, mainly from northern parts of study area,	Broken or mountainous terrain in both grassland and savanna.
Smutsia temminckii	Temminck's Ground Pangolin	Vulnerable	Vulnerable	Could occur in western part of study area (2525DA, 2525DB, 2626CB & 2525DB)	Open arid sandy savanna with a high abundance of prey (mainly ants).
Frogs					
Pyxicephalus adspersus	Giant Bullfrog		Urban populations in Gauteng are important	Could occur, known from three records on the study area.	Partial to seasonal pans and depressions.
Reptiles					
Homoroselaps dorsalis	Striped Harlequin Snake		Near threatened	Could occur, although not confirmed from the study area.	Partial to outcrops and termitaria.
Invertebrates					
Ceratogyrus darlingi			Specially Protected (in NW Prov.)	Could occur on western parts of study area	Mainly dry sandy bushveld.
Idiothele nigrofulva			Specially Protected (in NW Prov.)	Could occur .	Mainly in bushveld on clayey soils.
Harpactira hamiltoni			Specially Protected (in NW Prov.)	Could occur on eastern parts of study area	Mesic highveld grassland.

Opistophthalmus pugnax			Specially Protected (in NW Prov.)	Could occur on eastern parts of study area	Mesic highveld grassland.

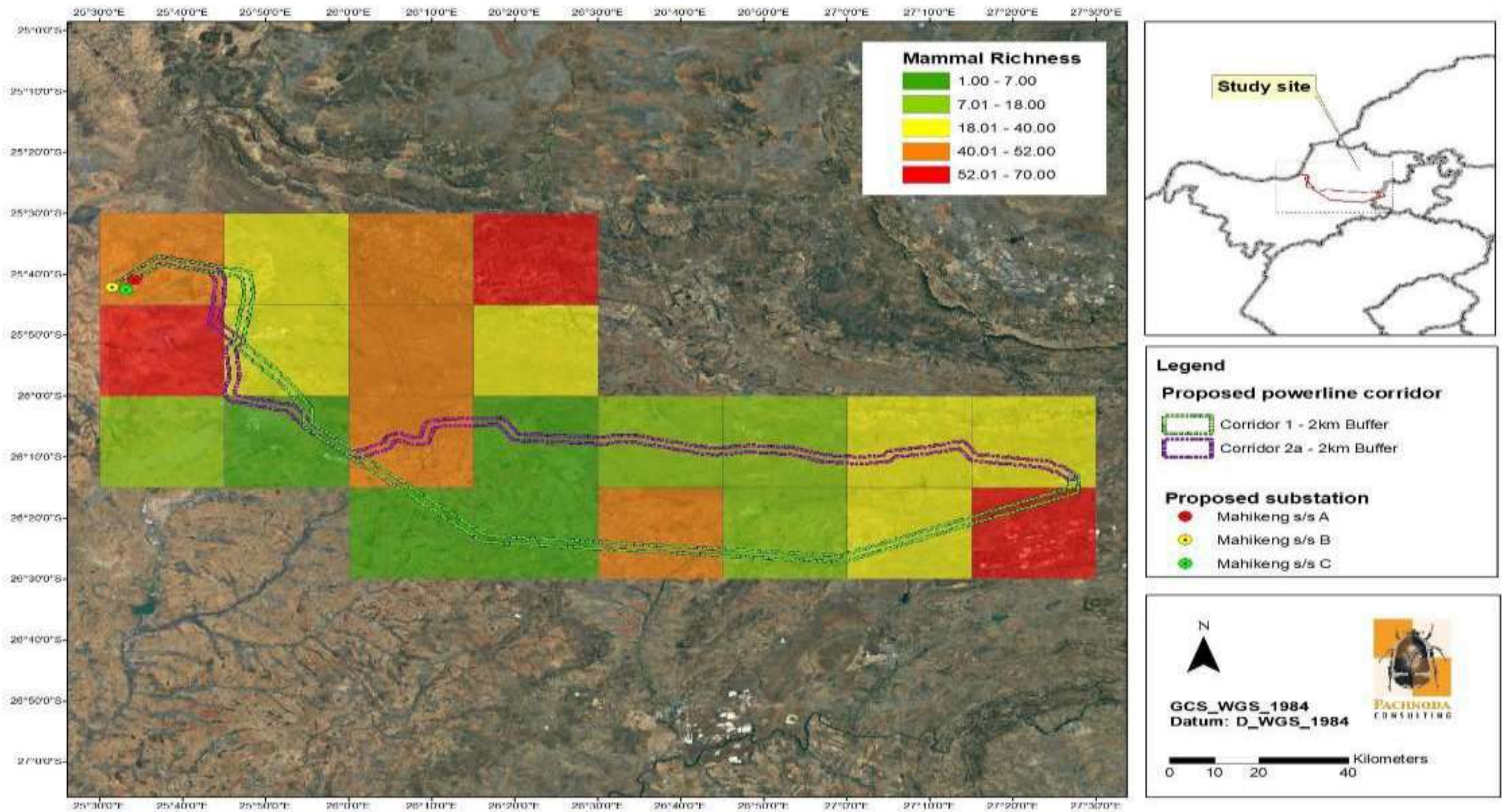


Figure 49: A map illustrating the preliminary (approximated) mammal species richness (number of species) on the study area (sensu Mammal Map).

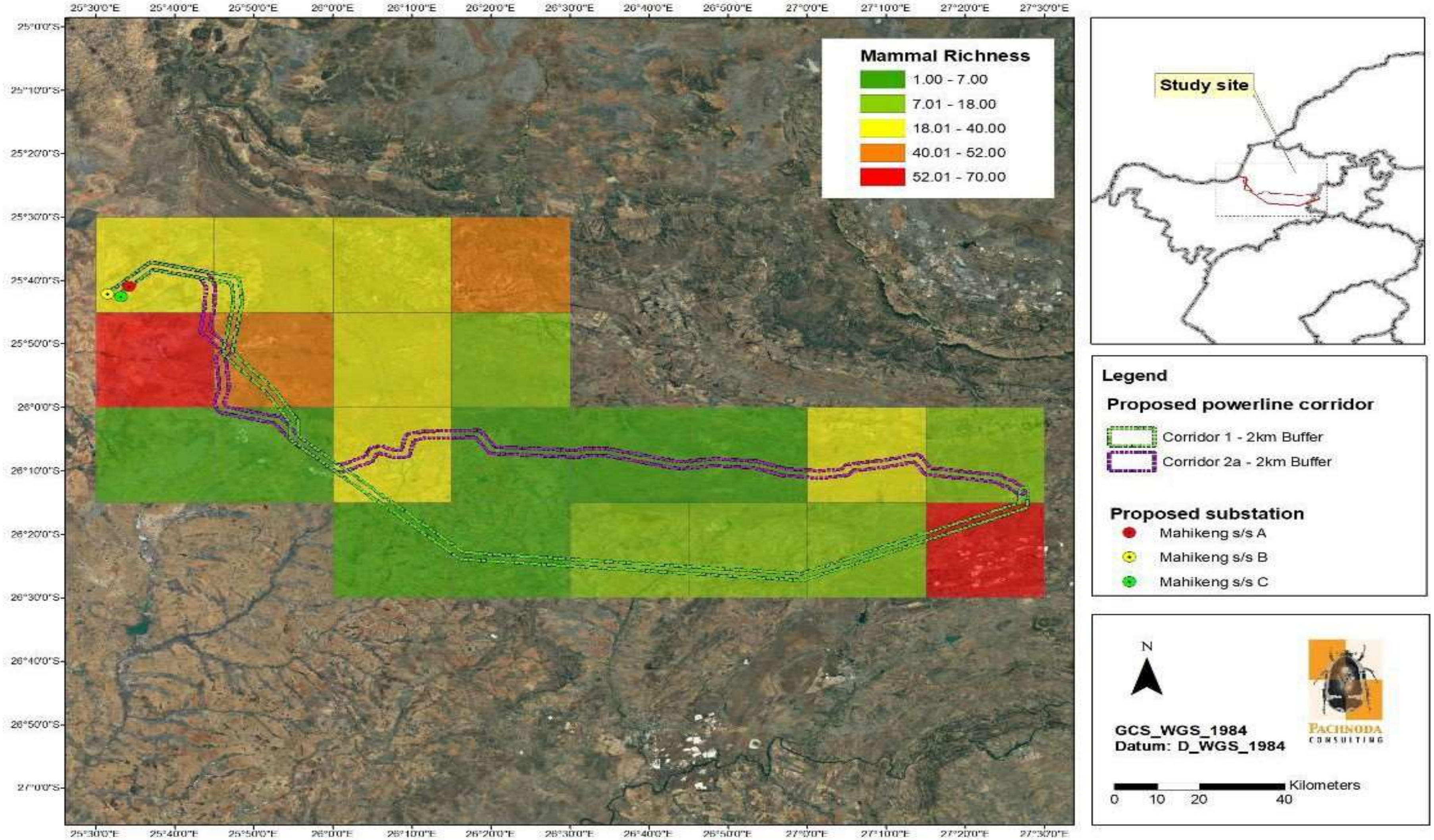


Figure 50: A map illustrating the QDS on the study area indicating the historical distribution of threatened and near threatened mammal taxa (sensu Mammal Map.

11.3 Wetland

11.3.1 Existing Watercourse and Powerline Datasets

11.3.1.1 NFEPA Rivers

The NFEPA River dataset is based on an older 1:500 000 river dataset produced by the Department of Water Affairs and Forestry (currently known as the Department of Water and Sanitation). The dataset is regarded as an accurate demarcation of rivers on a national scale as rivers, as opposed to lower order streams, are easily detectable and therefore contain little ambiguity in terms of their location and extent. A comparison of the number and extent of rivers within the two corridor alternatives indicate a clearly larger number and combined length of rivers in Alternative corridor 1 Table 66. Alternative corridor 1 contains a six times longer length of combined river crossings compared to Alternative corridor 2a (Table 68).

No ecologically intact river reach, with an A or B Present Ecological State is present in either corridor based on the NFEPA River dataset (Table 67). All of the river reach sections in Alternative corridor 2a and the large majority of river reach sections in Alternative corridor 1 (95.62 %) are regarded as Moderately modified, while the remaining 4.38 % are modelled as ecologically not intact.

Not a single river crossing in either of the corridors is classified as a Freshwater Ecosystem Priority Area (FEPA) river reach. River reaches regarded as Fish Support Areas or Fish Corridors are 1.35 times longer in Alternative corridor 1 than in Alternative corridor 2a. A total of 18.73 % of river reaches in Alternative corridor 1 are associated with areas identified as important for upstream management compared with none in Alternative corridor 2a (Table 67). From a river consideration, Alternative corridor 1, is regarded as more sensitive compared to Alternative corridor 2a, as the former has a larger number of river crossings and combined crossing lengths compared to the latter.

The different FEPA categories are also more representative in Alternative corridor 1.

- Discussion on the long length of river associated riparian habitat and wetlands along river reaches that are alignment parallel to the corridor in Alternative corridor 1. Mention difficulty of impact avoidance in these scenarios.

Table 66: Summary of NFEPA River names, the combined length of different river reaches and river types present in Alternative corridor 1 and 2a (Net et al.,2011).

Alternative corridor 1			Alternative corridor 2a		
River name	**Combined river length**	**River type**	**River name**	**Combined river length**	**River type**
Harts	2.95 km	Permanent lower foothills river	-	-	-
Molopo	1.91 km	Not permanent/flashy lower foothills river	Molopo	2.54 km	Not permanent/flashy lower foothills river
Mooi	6.11 km	Permanent lower foothills river	Mooi	3.38 km	Permanent lower foothills river
Ramatlabama	3.15 km	Not permanent/flashy lower foothills river	Ramatlabama	3.15 km	Not permanent/flashy lower foothills river
Skoonspruit	10.08 km	Permanent lower foothills river	-	-	-
Slypsteenspruit	8.66 km	Permanent upper foothills river	-	-	-
Taaibosspruit	9.07 km	Not permanent/flashy to permanent upper and lower foothills river	-	-	-
Unnamed rivers	13.96 km	Not permanent/flashy lower foothills rivers to	-	-	-
Total	**55.90 km**		**Total**	**9.07 km**	

Table 67: River conditions as indicated in the NFEPA dataset (Nel *et al*., 2011) for Alternative corridors 1 and 2a.

River condition	Combined length of each river class in Alternative corridor 1	Combined length of each river class in Alternative corridor 2a
A (Unmodified/Natural)	-	-
B (Largely natural with few modifications)	-	-
AB (A or B above, considered intact and able to contribute towards river ecosystem biodiversity)	-	-
C (moderately modified)	53.45 km	9.07 km
D (Largely modified)	-	-
E (Seriously modified)	-	-
F (Critically/extremely modified)	-	-

EF (E or F above)	-	-
Z (Tributary condition modelled as not intact, according to natural land cover)	2.44 km	-
Total	55.90 km	9.07 km

Table 68: Different FEPA (Freshwater Ecosystem priority Area) categories and combined river lengths in Alternative corridors 1 and 2a.

	Combined river length for each FEPA category in Alternative corridor 1	Combined river length for each FEPA category in Alternative corridor 2a
No FEPA status	37.40 km	3.15 km
Freshwater Ecosystem Priority Area	-	-
Fish Support Area or Fish Corridor	8.02 km	5.92 km
Phase 2 FEPA	-	-
Upstream Management Area	10.47 km	-
Total	55.90 km	9.07 km

11.3.1.2 NFEPA Wetlands

This wetland layer provides coverage on a national scale and has been formed by combining information from the National Land Cover 2000 data set (NLC 2000), 1:50 000 topographic maps and sub national data (Van Deventer *et al*., 2010). The calculated natural wetland surface area coverage, obtained from the NFEPA dataset, indicate that Alternative corridor 2a contains close to double the area (1.85 times) than what is present Alternative corridor 1 (Table 69). The ratio between total wetland area (natural and artificial wetland habitat), is closer with the difference being 1.62 (Table 69). Artificial wetland habitat, which includes dams in the NFEPA Wetlands dataset, is regarded as less sensitive compared to natural wetlands. The NFEPA dataset also provides a rating of wetland condition based on a model that uses land cover classes and their respective overlap with wetland boundaries. Based on this model intact wetlands that are expected to have a class A or B Present Ecological State (PES) have a 2.30 times larger coverage within Alternative corridor 2a compared to Alternative corridor 1 (Table 70). Wetlands with a class C PES have basically the same coverage in the two corridors, while Alternative corridor 1 has the largest combined wetland area with the lowest ecological category (Table 70).

None of the wetlands in any of the two corridor alternatives are associated with a Ramsar site, located within 500 m of a Threatened IUCN frog locality point, located within 500 m of a Threatened waterbird point locality, or within a sub-quaternary catchment that has sightings or breeding areas for crane species (Table 71). Confirmed data regarding protected fauna species associated with wetlands in the study area that would increase the Ecological Importance and Sensitivity (EIS) of individual wetlands are therefore limited. Wetlands grouped close to one another are regarded to have an increase EIS value as they provide refugia and migration habitat to wetland-associated fauna species, such as frogs. This parameter was modelled to identify individual wetlands as wetland associated or non-wetland associated, based on nearby proximity criteria (Table 71). Wetlands that are associated with more than three other wetlands have a 2.33 times larger coverage within Alternative corridor 2a compared to Alternative corridor 1 (Table 71).

There are 1.77 times more wetlands classified as a Freshwater Ecosystem Priority Area (FEPA) systems within Alternative corridor 2a compared to Alternative corridor 1 (Table 72). This relates into FEPA associated wetlands having a 1.74 times larger combined wetland surface area in Alternative corridor 2a (Table 72). It is important to point out that these values have been created through a model. When wetlands with known (documented) examples of exceptional biodiversity, or good intact examples, are compared the difference becomes less stark, with Alternative corridor 1 containing 143.50 ha of wetland habitat that meet this criteria, compared to 191.18 ha in Alternative corridor 2a. This is a ratio difference of 1.33.Existing watercourse information, especially the NFEPA Wetland dataset, is expected to under underrepresent wetlands present within the study area. To be more specific, pan/depression wetlands are more frequent and more accurately incorporated in the NFEPA Wetland dataset compared to linear wetlands, such as floodplains and valley bottom wetlands that are neglected and underestimated. This is evident from the lack of NFEPA Wetlands adjacent to drainage lines from the 1:50000 topographical maps. Riparian habitat located adjacent to rivers are not expected to be included in the NFEPA Wetlands model.

Table 69: Number and combined surface area of natural and artificial wetlands indicated in the NFEPA Wetlands dataset (Nel et al., 2011) in Alternative corridors 1 and 2a.

	Alternative corridor 1	Alternative corridor 2a
Number of natural wetlands	100	109
Number of artificial wetlands	19	4
Total number of wetlands	119	113

Combined surface area of natural wetlands	252.17 ha	465.92 ha
Combined surface area of artificial wetlands	37.70 ha	3.99 ha
Total wetland surface area	289.86 ha	469.91 ha

Table 70: Wetland condition categories based on the NFEPA Wetlands dataset (Nel *et al.*, 2011) in Alternative corridors 1 and 2a.

	Alternative corridor 1			Alternative corridor 2a		
	Nr. of wetlands	Combined wetland area	% of total wetland area	Nr. of wetlands	Combined wetland area	% of total wetland area
AB (percentage natural land cover ≥ 75 %)	19	147.40 ha	50.85 %	46	338.68 ha	72.07
C (percentage natural land cover 25-75 %)	24	48.78 ha	16.83 %	26	46.98 ha	10.00 %
DEF (Riverine wetland associated with a D, E, F or Z ecological river category)	-	-	-	-	-	-
Z1 (wetland overlaps with a 1:50000 "artificial' inland water body)	33	46.28	15.97 %	37	80.26 ha	17.08 %
Z2 (Majority of the wetland is classified as "artificial" in the wetland layer)	24	9.70 ha	3.35 %	0	-	-
Z3 (Percentage natural land cover < 25 %)	19	37.70 ha	13.00 %	4	3.99 ha	0.85 %
Total	**119**	**289.86 ha**	**100.00 %**	**113**	**469.91 ha**	**100.00 %**

Table 71: Known wetlands that intersect with a Ramsar wetland site (RAMSAR), located within 500 m of a IUCN Threatened frog point locality (FROG), located within 500 m of a Threatened waterbird point locality (CWAC), within a sub-quaternary catchment that has sightings or breeding areas for crane species (CRANE) and associated with more than three other wetlands (WETASSOC), based on the NFEPA Wetlands dataset (Nel *et al*., 2011) in Alternative corridors 1 and 2a.

	Alternative corridor 1			Alternative corridor 2a		
	Number of wetlands	Combined wetland surface area	% of total wetland surface area	Number of wetlands	Combined wetland surface area	% of total wetland surface area
RAMSAR	-	-	-	-	-	-
FROG	-	-	-	-	-	-
CWAC	-	-	-	-	-	-
CRANE	-	-	-	-	-	-
WETASSOC	19	148.73 ha	51.31 %	53	347.03 ha	73.85 %

Table 72: Freshwater Ecosystem Priority Area (FEPA) wetlands (Nel *et al*., 2011) present in Alternative corridors 1 and 2a.

	Alternative corridor 1			Alternative corridor 2a		
	Number of wetlands	Combined wetland surface area	% of total wetland surface area	Number of wetlands	Combined wetland surface area	% of total wetland surface area
Non FEPA wetlands	93	139.79 ha	48.23 %	67	209.04 ha	44.48 %
FEPA wetlands	26	150.07 ha	51.77 %	46	260.87 ha	55.25 %

11.3.1.3 Drainage lines from the 1:50000 topographical maps

Drainage lines, which refer to the entire drainage network present within the study area, from first-order headwater streams to higher order perennial rivers, were derived from all of the 1:50 000 topographical maps that overlap with the two corridors. The drainage network is more extensive in Alternative corridor 1, with an 8.19 times longer combined length of drainage lines compared to Alternative corridor 2a (Table 73). The terrain in Alternative corridor 2a is interpreted to be flatter with fewer river valleys. Approximately half of Alternative corridor 2a is located along a higher lying area that drains towards Alternative corridor 1 that also forms an important recharge area for dolomitic eyes (NWBSP 2015).

This Malmani karst system and recharge area that is so prevalent in Alternative corridor 2a has developed overtime into a landscape that is characterised by generally flat plains due to the manner in which physical and chemical weathering takes place in an area with a dolomite associated geology. Bedrock material has a high solubility and can result in surface flow being directed underground into groundwater that can reappear as springs, such as dolomitic eyes. Rivers and streams can therefore be less common in karst landscapes compared to environments with another type of dominant geology.

Table 73: Combined length of drainage lines as indicated by the existing river lines from the 1:50000 topographical datasets, in Alternative corridors 1 and 2a. These drainage lines refer to the entire drainage network from headwater to higher order streams

	Alternative corridor 1	Alternative corridor 2a
Combined drainage line length	118.47 km	14.47 km

11.3.1.4 Land cover derived wetlands

Wetlands extracted from the 2013-2014 national land cover dataset and compared between the two corridors indicate a completely different result in terms of wetland coverage than the NFEPA Wetlands dataset (Tables 69 and 73). Alternative corridor 1 has a 3.49 times larger surface area wetland coverage than Alternative corridor 2a, and 181 more individual wetlands (Table 72). Results from this dataset assessment is the complete opposite compared to those from the NFEPA Wetland dataset (Tables 69 and 73).

Table 74: Summary of the wetland land cover class extracted from the 2013-2014 National Landcover dataset (GTI, 2015) for Alternative corridors 1 and 2a.

	Alternative corridor 1	Alternative corridor 2a
Number of wetland areas	456	275
Combined wetland area	371.28 ha	106.35 ha

11.3.1.5 Peatlands, dolomitic eyes, tufa waterfalls and karst recharge areas

The North West Biodiversity Sector Plan (NWBSP, 2015) provides spatial distribution data of peatlands (wetlands that contain peat), dolomitic eyes and tufa waterfalls. Figure 4 illustrates the location of these features in relation to the study area. Two peatlands from the NWBSP spatial dataset overlap with the study area. These include a channelled valley bottom wetland along the Molopo River within Mafikeng Nature Reserve, approximately 11 km east of Mahikeng, which intersects with both corridors, and a portion of the Witpan wetland complex that overlaps with Alternative corridor 2a, approximately 16 km east of Lichtenburg (Figures 51). Suspected peatlands from the NWSBP (2015) dataset have a larger surface area coverage in Alternative corridor 2a compared to Alternative corridor 1 (Table 75).

An inquiry was made to Dr Althea Grundling at the Institute for Soil, Climate and Water at the ARC, who is in the process of compiling a National Peatland Database. Peatland point information from the current version of the National Peatland Database does not indicate overlap with the study area. It does, however, illustrate a peatland located upstream of the Mafikeng Nature Reserve (outside of the study area), approximately 4 km downstream of a dolomitic eye that is located in the headwater of the Molopo River. Peatlands are not typically associated with pan wetlands (also known as depression wetlands), such as Witpan, but are common around dolomitic eyes (springs). The North West Biodiversity Sector Plan Report state that all dolomitic eyes of the of the Malmani karst system are associated with peatlands (NWBSP, 2015). The NWSBP (2015) dataset indicates a dolomitic eye located approximately 1 km south of the Witpan wetland in Alternative corridor 2a, outside of the study area, where peat is the most likely to occur.

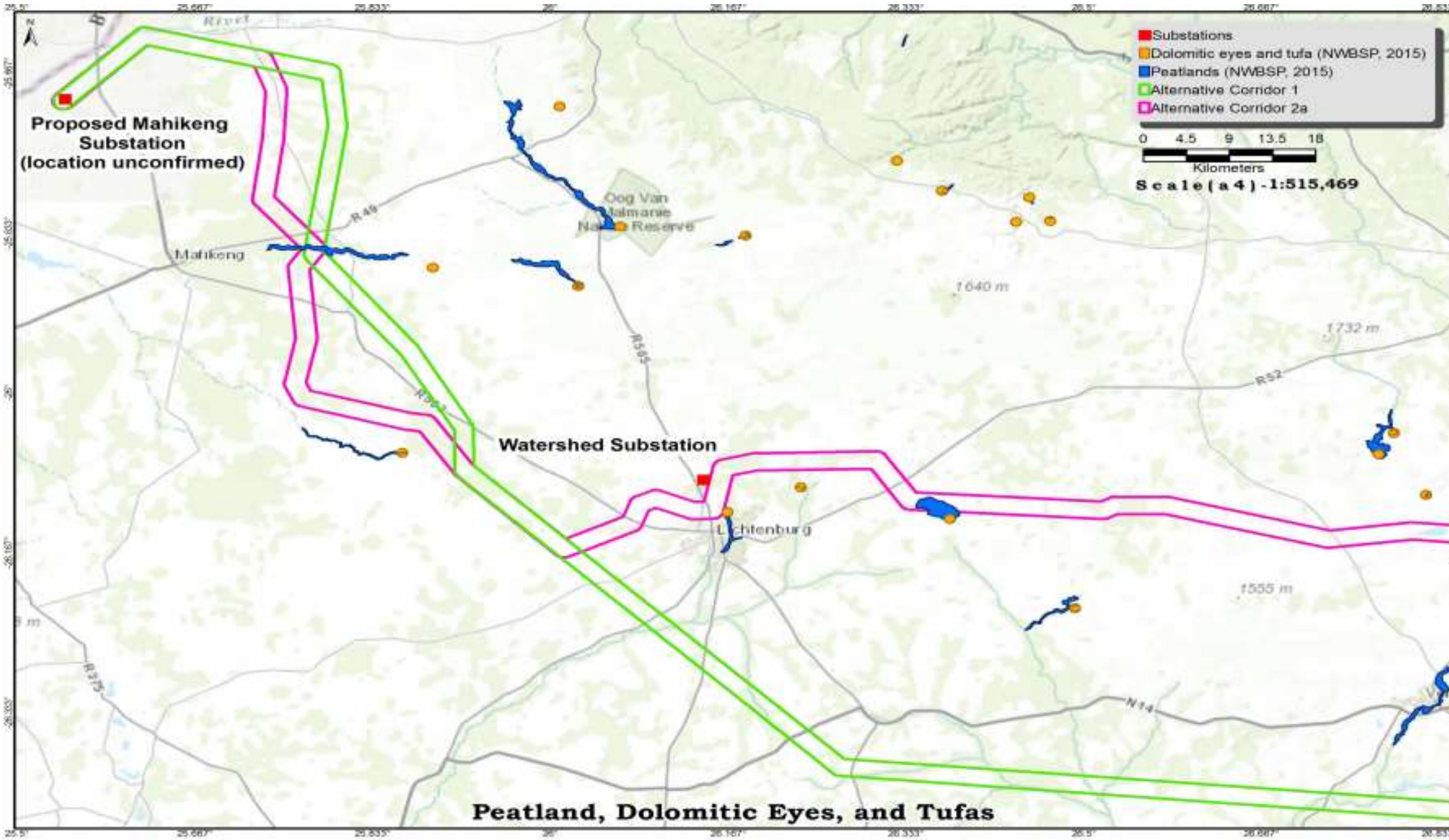


Figure 51: Location of peatlands, dolomitic eyes and tufa waterfalls obtained from the NWBSP (December 2015) in relation to the study area.

No point record of a peatland is present for the Witpan wetland complex, including the dolomitic eye, in the National Peatland Dataset. The presence of peat in the Witpan wetland complex in Alternative corridor 2a, which consists primarily of a pan/depression wetland within the study area, therefore remains uncertain (Figure 52).

It is expected that the Witpan wetland was indicated as a peatland in the NWSBP (2015) dataset due to its connectivity to the dolomitic eye located to the south and does not necessarily contain peat itself. The same applies to the reach of the Molopo River within the two corridor alternatives, which is connected to a dolomitic eye outside of the study area.

The surface area coverage of peatlands in the two corridor alternatives are likely to be lower and very similar due to the uncertainty in the confirmed presence and extent of a possible peatland within the Witpan wetland in Alternative corridor 2a. In addition, the expected presence of peat in the valley bottom wetland around the Molopo River is more likely located upstream of the Mafikeng Nature Reserve near the dolomitic eye, which is located outside of both corridor alternatives (Figure 52 and Table 75).

No dolomitic eyes are located directly within the study area, but a small sliver of approximately 3.85 ha of a 500 m wide buffer around a dolomitic eye north of Lichtenburg, overlaps with Alternative corridor 2a (Figure 52 and Table 75).

Close to half of the surface area of Alternative corridor 2a (48.54 %) is located within the Malmani karst system (24 820.02 ha in total), compare to only 1.32 % of Alternative corridor 1 (683.83 ha in total), (NWBSP, 2015). The Malmani karst system is a dolomite recharge area located between Ventersdorp and Molemane for all the large dolomitic eyes in the province. The area is regarded to potentially represent the single most important ecosystem service area in the province as it is responsible for maintaining freshwater resources, in the form of dolomitic eyes (springs) that provide drinking water for a large number of people in North West Province (NWBSP, 2015). There are eight known tufa waterfalls within North West Province that are regarded as unique habitat, but none of them overlap with either of the corridor alternatives.

Table 75: Peatlands, dolomitic eyes and tufa waterfalls as indicated in spatial datasets from the December 2015 North West Biodiversity Sector Plan (NWBSP) for Alternative corridors 1 and 2a.

	Alternative corridor 1	Alternative corridor 2a
Combined peatland surface area	74.24 ha	482.76 ha
Combined dolomitic eye surface area	-	3.85 ha
Number of tufa waterfalls	-	-

11.3.1.6 Instream wetlands and riparian areas

A spatial layer of modelled wetlands and riparian areas that include all types of wetlands was obtained from the NWSBP (2015) dataset and assessed to compare the two corridor alternatives. The result indicate a combined wetland and riparian habitat surface area that is 3.45 times larger in Alternative corridor 1 compared to Alternative corridor 2a (Table 76). This relation is very similar to the ratio of 3.49 calculated for the difference in wetland surface area obtained from the 2013-2014 national land cover dataset, even though the actual surface area values are much smaller in the latter dataset in each corridor alternative (Tables 76). The proportional relationship in the size of watercourse surface area being higher in Alternative corridor 1 compared to Alternative corridor 2a is therefore consistent between the two datasets, which subsequently increases the level of confidence associated with both datasets.

Table 76: Modelled instream wetlands and riparian areas as indicated in the as indicated in the December 2015 North West Biodiversity Sector Plan (NWBSP) for Alternative corridors 1 and 2a.

	Alternative corridor 1	Alternative corridor 2a
Number of instream wetlands and riparian areas	68	82
Combined instream wetland and riparian area	2937.46 ha	850.65 ha

11.3.1.7 Modelled pan and depression wetlands

A spatial layer of modelled pan and depression wetlands that only refer to a specific type of wetland was also obtained from the NWSBP (2015) dataset and calculated within the corridor alternatives. Pans and depression wetlands refer to endorheic, or inward draining systems, that are not connect to the surrounding drainage network, but associated with closed (or near-closed) elevation contour lines. Results from the model indicate a much higher likelihood for pan and depression wetlands within Alternative corridor 2a compared to Alternative corridor 1 (Table 77). The area of potential pan and depression wetlands in Alternative corridor 2a is nearly 10 times larger (9.94 times) than the combined surface area of all wetlands and riparian watercourses indicated in the instream wetlands and riparian area model for the same corridor (Tables 77 and 78). This large discrepancy creates uncertainty regarding which of the two NSBSP wetland-associated datasets are more accurate. It can, however, be inferred that the terrain in Alternative corridor 2a is flatter and more conducive for the development of pan and depressions wetlands compared to Alternative corridor 1. This is consistent with results from the drainage line comparison, which also indicates a flatter terrain with fewer streams in Alternative 2a.

Table 77: Modelled pan and depression wetlands as indicated by spatial data associated with the December 2015 North West Biodiversity Sector Plan (NWBSP) in Alternative corridors 1 and 2a.

	Alternative corridor 1	Alternative corridor 2a
Number of pan and depression wetlands	219	394
Combined pan and depression wetland area	2393.09 ha	8455.25 ha

11.3.2 Delineated Watercourses

The discrepancy in terms of the number of wetlands and the combined wetland surface area between the NFEPA Wetland (Nel *et* al., 2011) and National land cover (GTI, 2015) wetland datasets, as well as other watercourse-related datasets, need to be resolved. Wetland-associated datasets available in the public domain that focus on a smaller area (e.g. provincial as opposed to national scale) are expected to be more accurate. In order to resolve the uncertainty, an on-screen digitisation (delineation) of wetlands within the study area were undertaken that incorporate other watercourses as well, such as riparian habitat, drainages line and dams. This process included a review of the existing watercourse-associated datasets described and assessed in the above, as well as a site visit undertaken during March 2018. The site visit was used primarily to verify the presence and type of watercourses in different study area sections. New watercourse boundaries were subsequently captured through on-screen digitization, while simultaneously taking the above into consideration to create site specific watercourse layers (spatial datasets). The creation of new watercourse datasets specifically made for the project is regarded as the most accurate watercourse datasets available for the study area due to its scale, consideration of existing data and incorporation of data obtained during the site visit.

Watercourses identified and delineated within each corridor alternative were classified into three groups that are compared and illustrated (Figures 52-64; Table 78). The three classified watercourse classes include the following:

- Drainage lines
- Floodplain, valley bottom and seep wetlands, as well as rivers (including riparian habitat) and dams (specifically in-channel dams)
- Pan/depression and flat wetlands

A fourth category was identified and delineated, but has a low level of confidence due to uncertainty whether actual watercourse habitat present. This refers to man-made excavations that may contain water and potentially develop artificial wetland habitat (Figures 54-64; Table 78).

Figure 52: Overview of the extent and type of delineated watercourse classes captured within the study area.

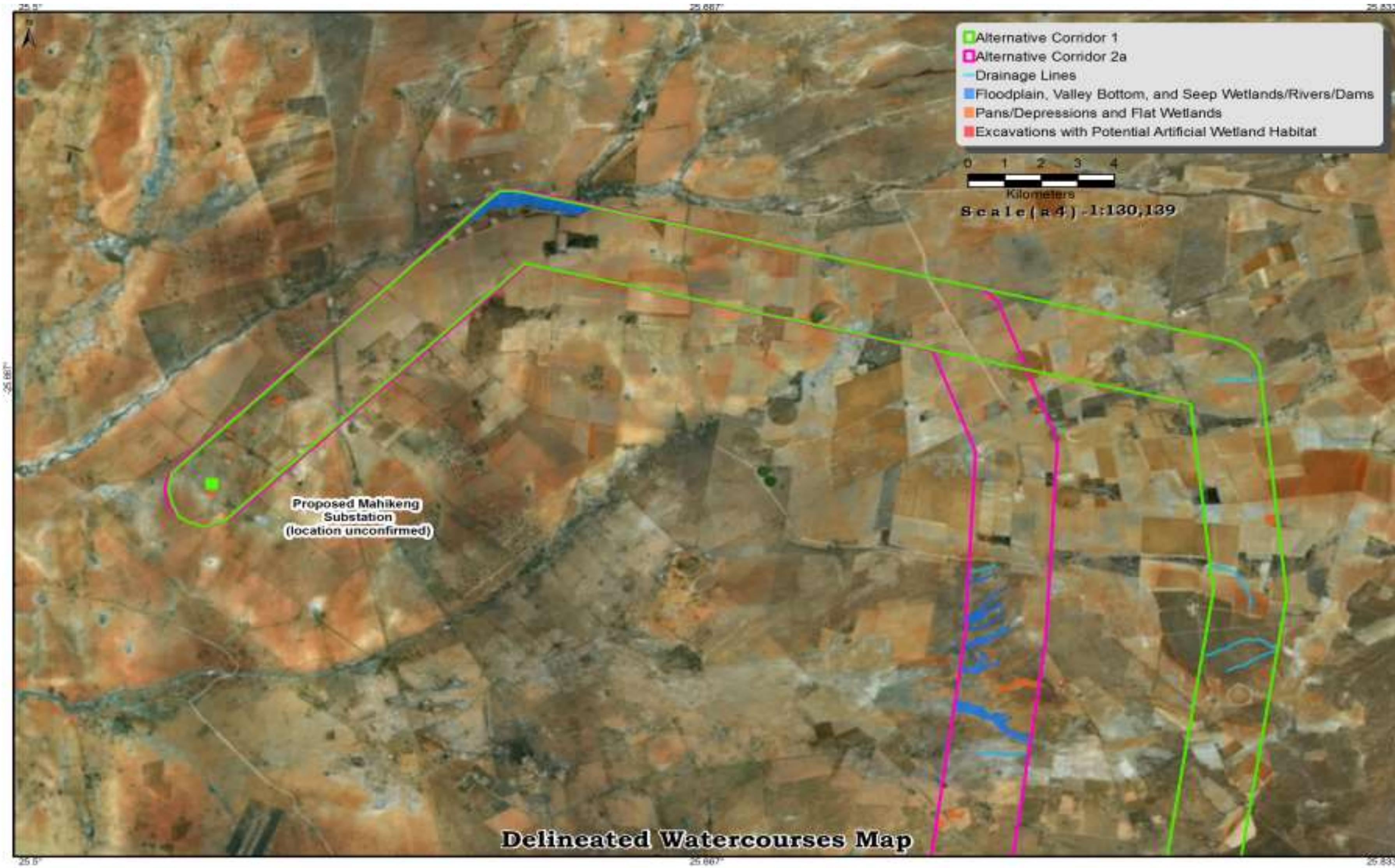


Figure 53: Delineated watercourses in the western-most portion of the study area that includes the still unconfirmed location of the proposed Mahikeng Substation.

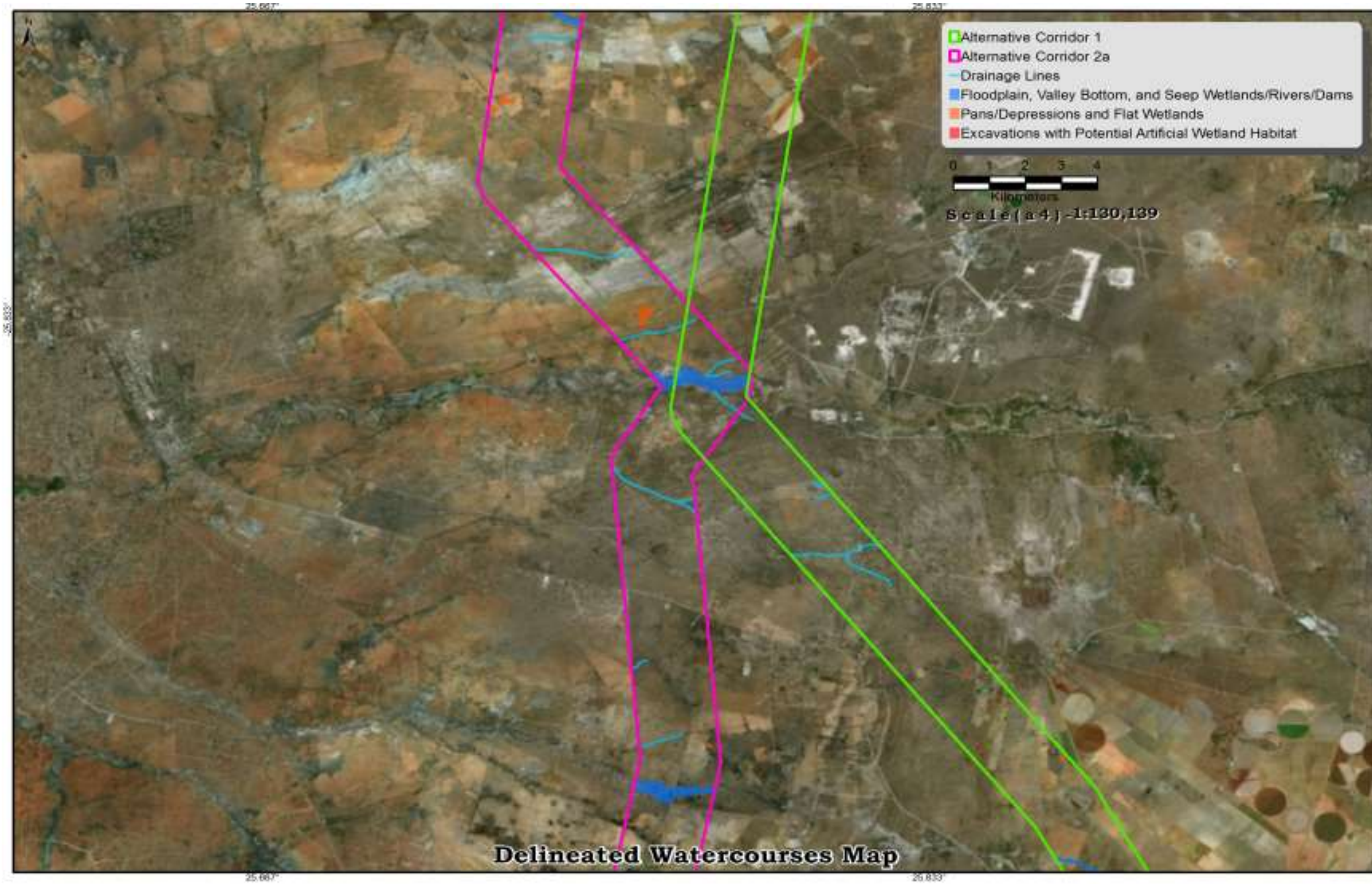


Figure 54: Delineated watercourses further east with the area of overlap located in Mafikeng Nature Reserve.

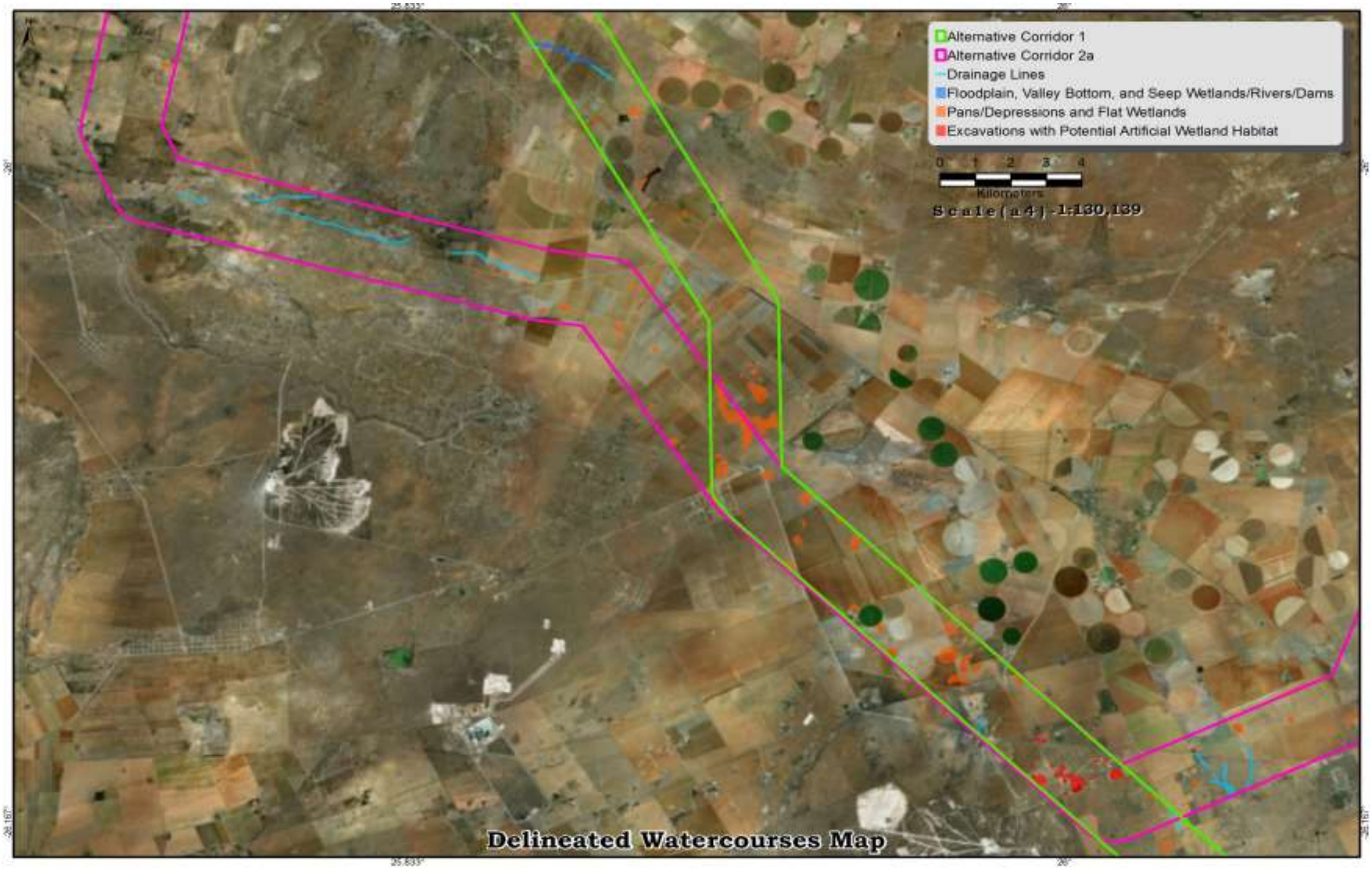


Figure 55: Delineated watercourses further east. Bodibe and Itsoseng informal settlements are present in the centre and Dudfield Mine in the southwest.

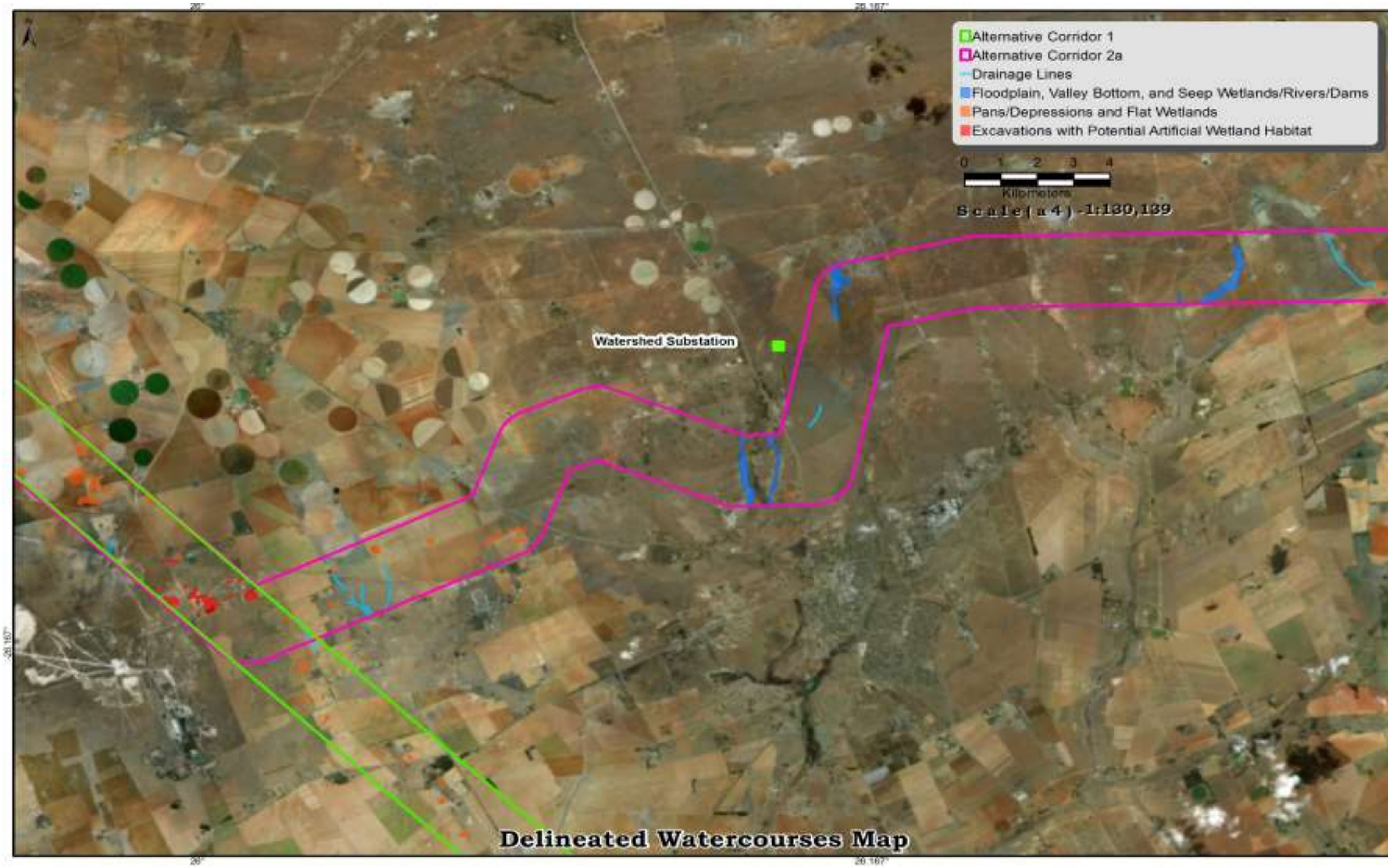


Figure 56: Delineated watercourses further west, with Lichtenburg and Watershed Substation visible in the centre.

Figure 57: Delineated watercourses south and southeast of Lichtenburg in Alternative corridor 1 only, near Coligny. The Harts River and Slypsteenspruit form prominent watercourses in the north-western and south-eastern portions of Alternative corridor 1 respectively.

Figure 58: Delineated watercourses further east in Alternative corridor 1 only, east of the R501 Road and west of the R30 Road.

Figure 59: Delineated watercourses further east in Alternative corridor 1 only, around the R30 in the west and the R53 in the east.

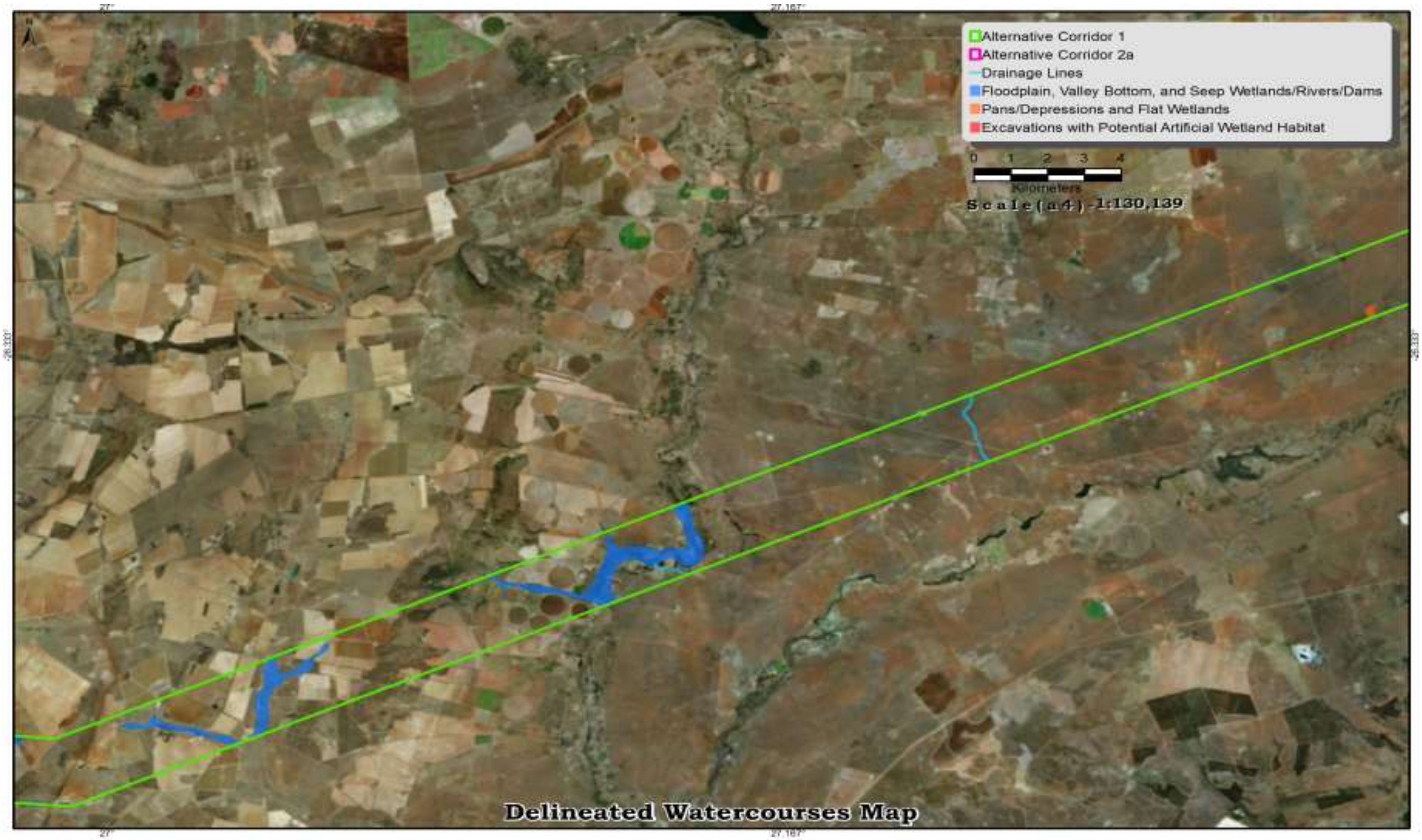


Figure 60: Delineated watercourses further east in Alternative corridor 1 only, between the R53 in the west and Khutsong informal settlement further east.

Figure 61: Delineated watercourses further east, between Khutsong informal settlement in the west and Pluto Substation in the east, where the two corridor alternatives re-join.

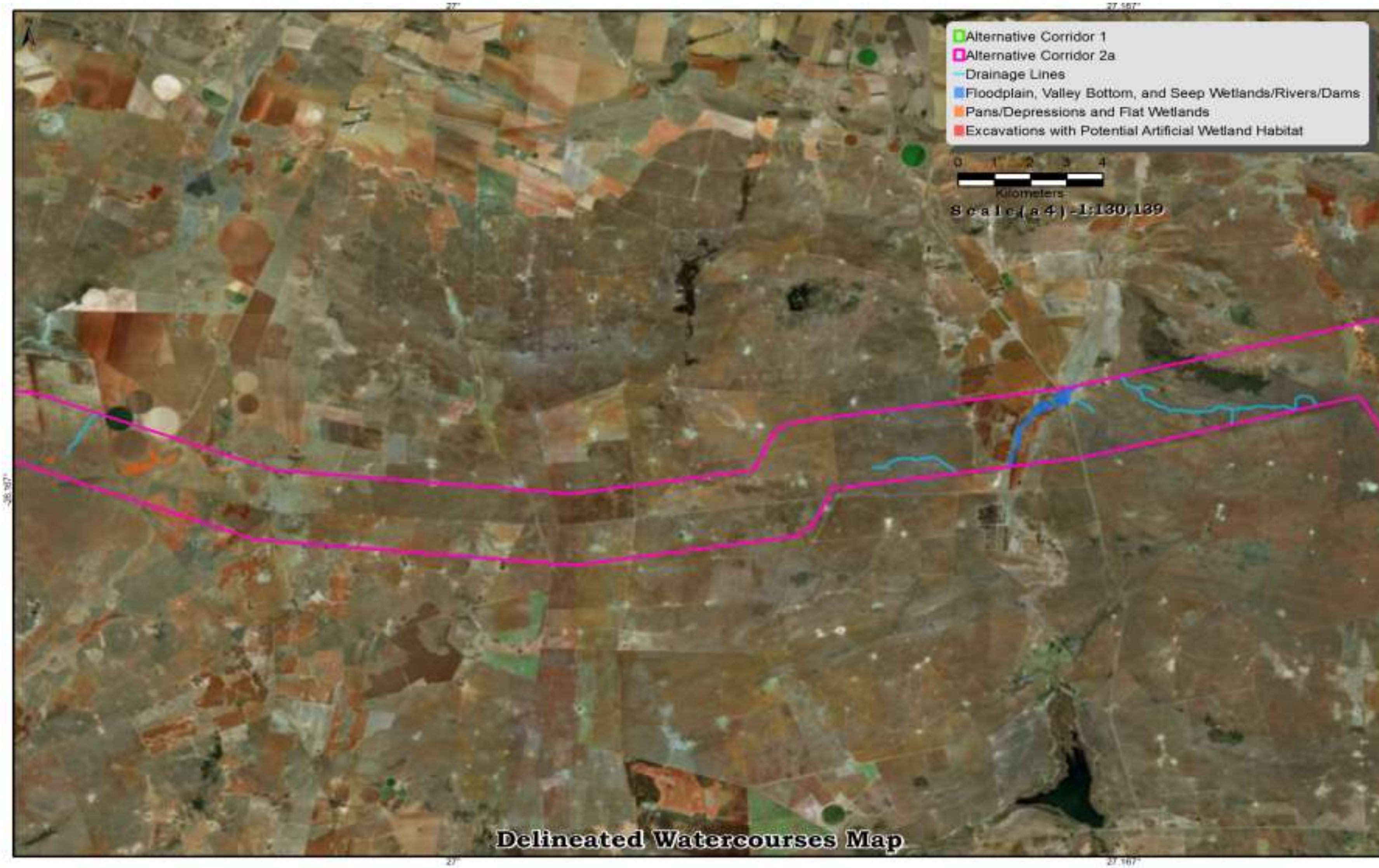


Figure 62: Delineated watercourses further west from Pluto Substation in Alternative corridor 2a only, with the R30 Road bisecting the corridor in the west.

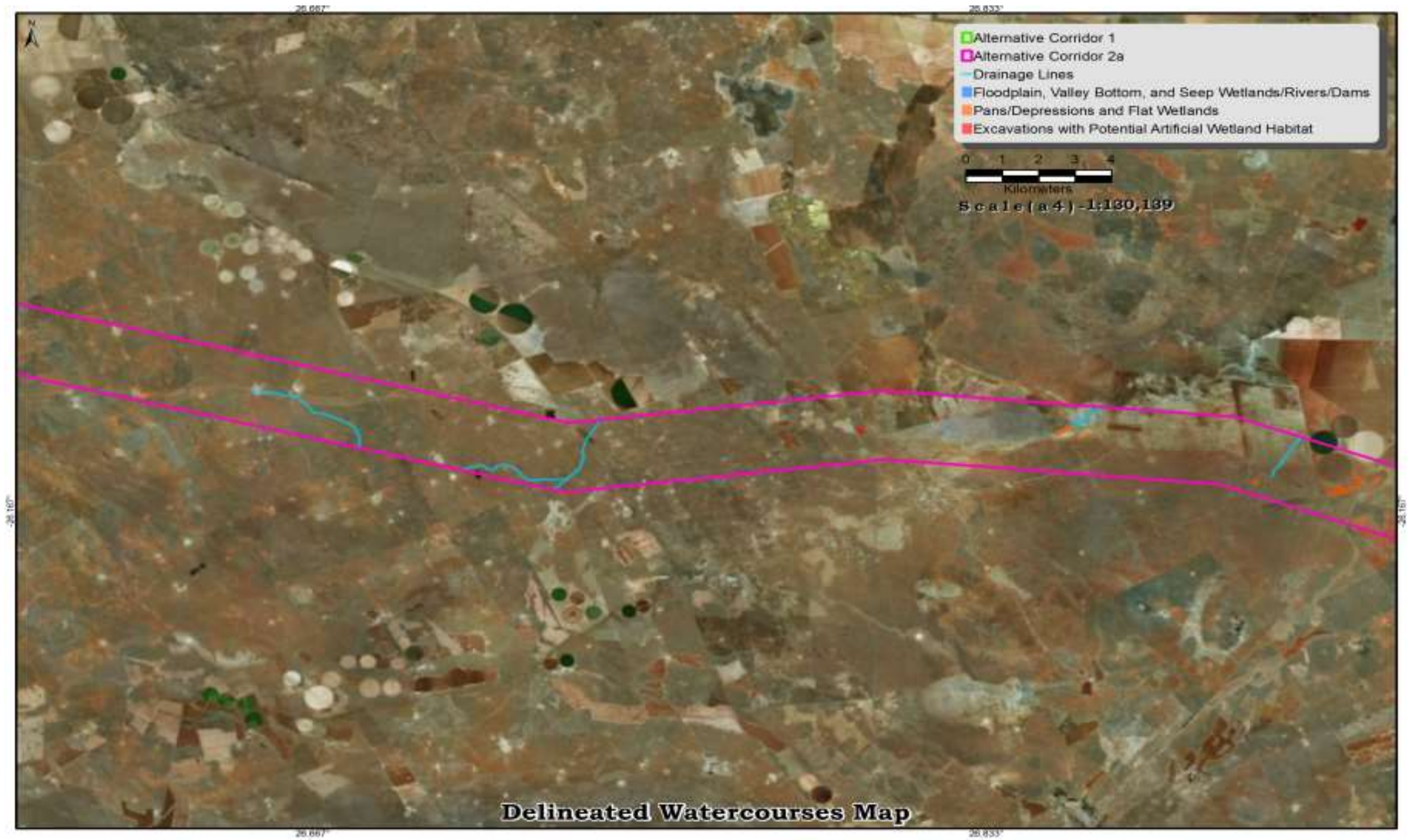


Figure 63: Delineated watercourses further west from Pluto Substation in Alternative corridor 2a only, with the R30 Road bisecting the corridor in the east and the R53 crossing it west of the centre of the map.

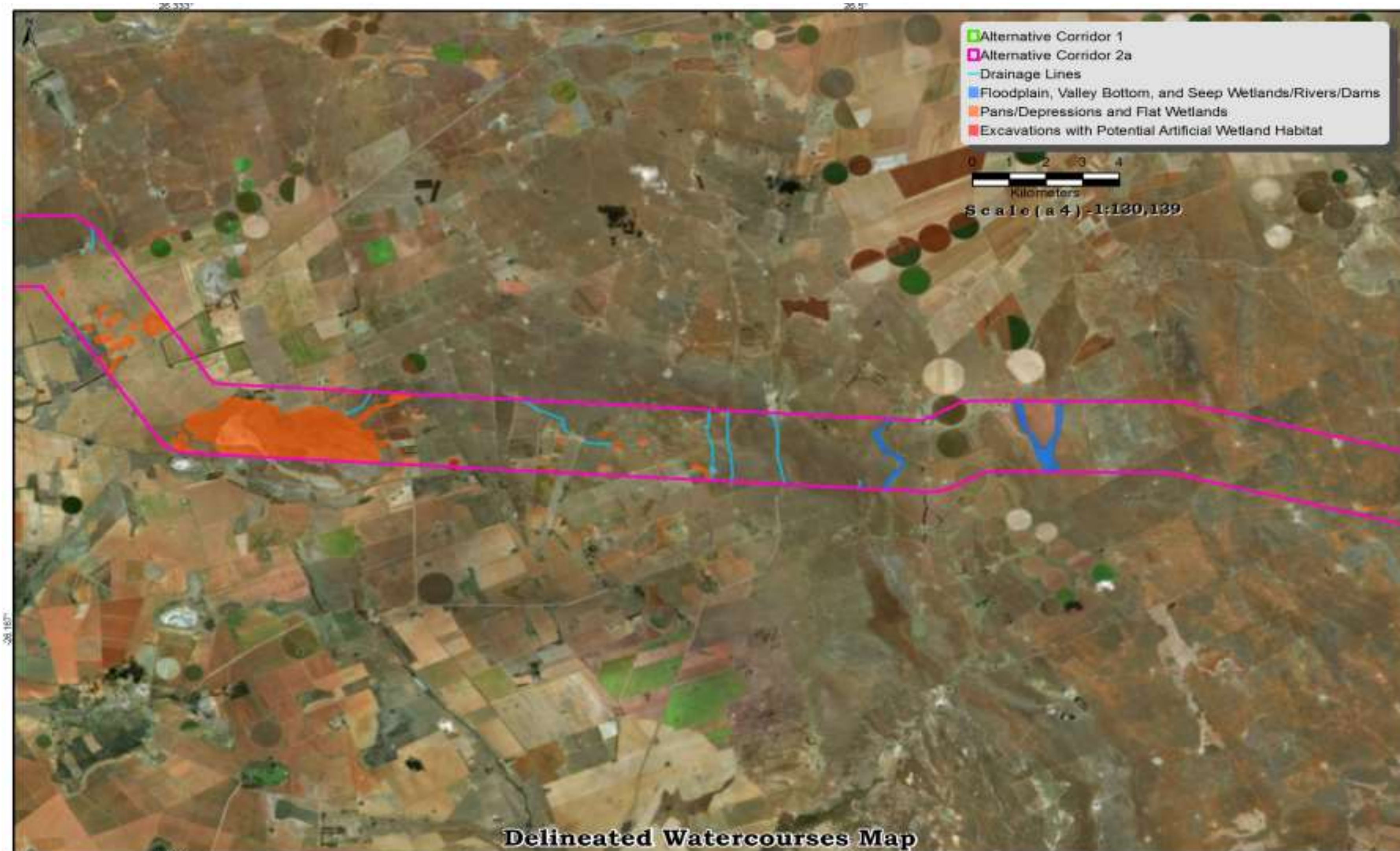


Figure 64: Delineated watercourses further west from Pluto Substation in Alternative corridor 2a only. Lichtenburg is the nearest town located approximately 12 km west. The R52 Road bisects the corridor in the western section of the map.

Table 78: Summary of delineated natural watercourse categories created through on-screen digitization in Alternative corridors 1 and 2a.

	Alternative corridor 1	Alternative corridor 2a
Watercourse lines		
Number of drainage lines sections	32	49
Combined length of drainage Lines	25.73 km	64.3 km
Watercourse polygons		
Number of floodplain, valley bottom and seep wetlands/rivers/dams	34	22
Combined area of floodplain, valley Bottom and seep wetlands/rivers/dams	2654.60 ha	740.28 ha
Number of pan/depression and flat wetlands	132	181
Combined area of pan/depression and flat wetlands	392.17 ha	1161.94 ha
Total natural watercourse surface area	3024.77 ha	1902.22 ha

11.3.2.1 Drainage lines

Specifically refers to lower order streams, such as headwaters (first and second order streams), and excludes rivers as demarcated on the NFEPA River dataset. These features were captured as lines during the delineation process and are expected to be consistent with the NWA watercourse definition of 'a natural channel in which water flows regularly or intermittently'. Delineated drainage lines include swales with an indistinct channel, as well as narrow systems with continuous or discontinuous channel reaches.

Alternative corridor 2a contains a 2.5 times longer combined length of drainage lines compared to Alternative 1 (Table 78). This is in direct contrast from the pattern identified in the comparison of drainage lines obtained from the 1:50 000 topographical maps dataset. Importantly the delineated drainage line dataset excludes rivers, which reduces the combined length and number of drainage line segments taken into consideration. A direct comparison between the two datasets is therefore not possible.

The total length of drainage lines and the number of drainage line sections is lower in both corridor alternatives than what is expected for a study area of this size. The occurrence of headwater and other drainage lines are therefore not that frequent, while the watercourse class is also narrow (Figures 54 to 64). The possibility of impact avoidance by positioning pylons (towers) away from these watercourse features is regarded as high.

11.3.2.2 Floodplain, valley bottom and seep wetlands/rivers/dams

These captured watercourse polygon class represent features that include floodplain wetlands, channelled and unchannelled wetlands, river channels and adjacent riparian habitat, and dams, specifically in-channel dams. Seep wetlands captured as part of this group are directly connected to linear watercourses, such as valley bottom and floodplain wetlands, as well as river channels and riparian habitat. This watercourse dataset is similar to the modelled in-stream wetlands and riparian areas dataset that forms part of the North West Biodiversity Sector Plan (NWBSP 2015).

This group of watercourses is 3.59 times larger in Alternative corridor 1 compared to Alternative corridor 2a (Table 78). This ratio of 3.59 is similar to the two calculated in the comparison of modelled in-stream wetlands and riparian areas (NWBSP, 2015), and wetlands obtained from the national land cover dataset (GTI, 2015), for the two corridor alternatives (ratios of 3.45 and 3.49 respectively). This watercourse class forms 5.37 % of Alternative corridor 1 and 1.45 % of Alternative corridor 2a. It is important to not only focus on the larger size of this watercourse class in Alternative corridor 1, but also the orientation of watercourses within this particular corridor. Several river channel sections are located parallel to the length of Alternative corridor 1 and within the centre of the corridor. The result is long and wide sections of riparian and wetland habitat that will have to be transected by the proposed 400kV powerline, which is likely to result in more pylon towers and associated access tracks in watercourses.

Specific river channel sections associated with large wetland and riparian areas in the centre and along the length of Alternative corridor 1 include the following:

Slypsteenspruit

Taaibosspruit

Schoonspruit

Mooi River

11.3.2.3 Pan/depression and flat wetlands

Represent pan and flat wetlands. Pan wetland is a synonym for depression wetland, as described by Ollis et al. (2013). This category also makes provision for seep wetlands that border pans and flat wetlands that are not distinctly connected to other watercourses (refer to the Glossary of terms for definitions of different wetland types). Wetlands that form part of this category can be difficult to distinguish from one another, especially in areas with a flat gradient is present.

This group of wetlands is 1.37 times larger in Alternative corridor 2a compared to Alternative corridor 1 (Figures 52 to 64; Table 78), which is a smaller difference compared to the ratio of 9.94 for Modelled pan and depression wetlands as calculated from the NWBSP (2015) dataset (Table 77). Pan/depression and flat wetlands are clearly more common in Alternative 2a, forming 2.27 % of the corridor surface area, compared to 0.79 % of Alternative corridor 1 (Table 78). There is, however, not such a large difference in the combined surface area of the wetland group for in two corridor alternatives compared to the difference in surface area indicated in the NWBSP (2015) dataset (Table 78).

Avoiding impacts, such as tower and road construction within this group of wetlands, by moving towers and the powerline alignment away from these watercourses is more practical compared to linear watercourses , as pans/depression and flats (as captured in this project) are generally isolated watercourses that are not connected to the drainage network. The result is that long continuous wetlands watercourses with a linear orientation are uncommon in this watercourse group. Towers can therefore be positioned easier outside of pan/depression and flat wetlands compared to linear watercourses by making changes to the alignment of the planned powerline route.

11.3.2.4 Excavations with potential artificial wetland habitat

Artificial wetlands, as captured in this report are regarded as wetland habitat that developed due to anthropogenic interventions, such as excavation works. Dams, in particular in-channel dams, are excluded from this group of wetlands. Artificial wetland that may or may not have developed in man-made excavations are expected to be of a lower ecological value and have a lower ecological sensitivity compared to natural wetland and other watercourses, as artificial wetlands are secondary systems that are caused by the transformation of natural habitat. Not all excavated areas will contain artificial wetland habitat due to fluctuations in the duration and frequency of inundation and sediment saturation in these areas. Excavations with potential artificial habitat are illustrated in Figures 52 to 64.

The combined surface area of delineated excavations with potential artificial wetland habitat is very similar in both corridor alternatives, and forms 0.09 % and 0.10 % of Alternative corridor 1 and Alternative corridor 2a respectively (Table 79). The extent and combined surface area of excavations with potential artificial habitat should therefore have no bearing on which of the two corridor alternatives are regarded as more favourable.

Table 79: Summary of delineated man-made excavations that may potentially be associated with artificial wetland habitat. These areas were demarcated through on-screen digitization as part of this study in Alternative corridors 1 and 2a.

	Alternative corridor 1	Alternative corridor 2a
Number of Excavations with Potential Artificial Wetland Habitat	14	18
Combined surface area of Excavations with Potential Artificial Wetland Habitat	43.27 ha	49.75 ha

11.4 Avi Fauna

11.4.1 Important avifaunal habitat types:

The composition and distribution of the vegetation communities on the study area are a consequence of a combination of factors simulated by soil texture (sandy vs. clay), topography (plains vs. undulating grassland), grazing disturbances (presence of livestock), vertical heterogeneity (tall open bushveld vs. low shrubland) and the presence of drainage and wetland features:

- Mixed Bushveld: This habitat unit (or vegetation association) is scattered on Corridor 1 and 2a where it is primarily represented by bush clumps located within the Vaal-Vet Sandy and Western Sandy Grasslands. Some sections have been converted to short dense microphyllous bushveld owing to inappropriate grazing by livestock. However, untransformed mixed Bushveld persist over most of the study area which provide habitat for a high richness of bird species, including large birds of prey taxa.
- Medium to tall open microphyllous woodland: This unit is dominant on the western part of the study area, which was also prominent at the proposed Mahikeng Main transmission substation. It occurs primarily on sandy soils dominated by a well-defined graminoid layer of Aristida canescens, Eragrostis rigidior, Cymbopogon pospischilii and Heteropogon contortus. The canopy is dominated by Vachellia erioloba and other noteworthy plant species include Vachellia tortilis, Senegalia mellifera, Peltophorum africanum and Searsia lancea. It is represented by Mafikeng Bushveld and Klerksdorp Thornveld. It provides potential suitable foraging and breeding habitat (especially the taller specimens of Vachellia erioloba) for large endangered and critically endangered scavenging birds of prey (e.g. Vultures and Tawny Eagle Aquila rapax), while the open structure of the graminoid layer provides foraging habitat for the vulnerable Secretarybird (Sagittarius serpentarius). Large Vachellia erioloba trees also provide habitat for Sociable Weavers (Philetairus socius) as evidenced by the presence of their nests . Sometimes the latter prefer to construct their nests within electrical infrastructure and pylons, which could cause electrical faults. However, this problem is more pronounced in areas where trees are scarce such as the central Karoo.
- Open grassland: The majority of the proposed corridors correspond to open grassland, either species-rich undulating dolomite grassland or flat Themeda triandra - Eragrostis dominated grassland on sandy soils. It provides important habitat for the endemic Melodious Lark (Mirafra cheniana), including a range of other terrestrial species such as the vulnerable White-

bellied Korhaan (Eupodotis senegalensis), Secretarybird (S.Serpentarius) and the near threatened Blue Crane (Anthropoides paradiseus).

- Perennial rivers and streams: This habitat type are important daily flyways for many waterbird species in the region while the prominent woody layer increases the local vertical heterogeneity and niche space which is directly proportional to avifaunal richness, especially "bushveld" birds. It is located along major drainage lines, especially perennial rivers such as the Mooi River, Harts River, Taaibosspruit and the Skoonspruit. The riparian vegetation is typified by a prominent woody component dominated by a dense layer of Vachellia karroo and Asparagus laricinus. The perennial rivers and streams are important foraging habitat for piscivorous bird taxa such as the Reed Cormorant (Microcarbo africanus) and African Darter (Anhinga rufa).
- Channelled and un-channelled valley bottom seeps: These wetland features are scattered on the study area. They consist of linear landscape features which are often part of the upper catchment of the previous habitat type. They are mostly covered in open grassland. The large and extensive systems provide ephemeral foraging habitat for Blue Cranes (Anthropoides paradiseus).

A number of azonal habitat units were also identified in the study area, and it was necessary to elaborate on their importance, primarily from an avifaunal perspective:

- Man-made impoundments (dams) – these represent water bodies of variable size which were mainly created to act as irrigation for cultivation. They have undoubtedly benefit the colonisation and range expansion of many waterbird species that favours open water habitat (e.g. Red-knobbed Coot Fulica cristata, Egyptian Goose Alopochen aegyptiaca, South African Shelduck Tadorna cana, various members of Anas ducks and heron members of the genus Ardea and Egretta, including the globally vulnerable Maccoa Duck5 (Oxyura maccoa). These water bodies provide a safe refuge and nesting habitat for waterbird species. Some of the dams are surrounded by large alien trees, which provide nesting structure for the African Fish Eagle (Haliaeetus vocifer).
- Arable land, pastures and secondary bushveld – These are cultivated land or areas that were historically cleared of vegetation. They provide ephemeral foraging habitat for large terrestrial taxa such as the White Stork (Ciconia ciconia), Secretarybird (Sagittarius serpentarius) and Abdim's Stork (Ciconia abdimii). Some areas are covered in secondary grassland, especially in the vicinity of Mahikeng and these provide ephemeral foraging habitat for the regionally near threatened Kori Bustard (Ardeotis kori);

- Pans – These consist of small to medium basins which temporarily contain surface water. Most of the larger pans provide critical ephemeral foraging habitat for the near threatened Greater Flamingo (Phoenicopterus roseus), Lesser Flamingo (Phoeniconaias minor) and the globally vulnerable Maccoa Duck (Oxyura maccoa); and
- Reservoirs and cattle drinking troughs - These provide drinking water for large terrestrial bird species although they often act as congregation areas for vultures and birds of prey.

11.4.2 Threatened and Near-threatened Species

Approximately 31 regional and globally threatened and near-threatened bird species are present on the study area. Table 80 summarizes the Red listed species that have been recorded on the study area based on the SABAP1 database. It is evident that the highest number of Red listed species was recorded from the eastern (near Carletonville) and central (near Lichtenburg) parts of the study area (according to Harrison et al., 1997).

It is also evident that the highest reporting rates for Red listed bird species (according to Harrison et al., 1997) were recorded on the northern parts of the study site (Figure 68). The highest mean reporting rates occurred along Corridor 2a with nine QDSs of which the mean reporting rates exceed 5 % for Red Listed species. Corridor 1 represents only six QDSs where the mean reporting rates exceed 5 %. In addition, the QDSs with the highest reporting rates include Ramathlabama (2525DA), Thusong (2625BA) and Rooigrond (2525DD).

The most widespread and dominant Red listed species is the regionally vulnerable Secretarybird (S. serpentarius), globally endangered Cape Vulture (Gyps coprotheres), regionally near threatened Blue Crane (Anthropoides paradiseus) and regionally endangered Yellow-billed Stork (Mycteria ibis). Other noteworthy species on the study area include the regionally near threatened Short-clawed Lark (Certhilauda chuana), regionally near threatened Greater Flamingo (Phoenicopterus roseus), regionally near threatened Abdim's Stork (Ciconia abdimii), globally critically endangered White-backed Vulture (Gyps africanus), globally near threatened Curlew Sandpiper (Calidris ferruginea), globally vulnerable Maccoa Duck (Oxyura maccoa) and the globally near threatened Black-winged Pratincole (Glareola nordmanni).

11.4.3 Non-threatened species

A number of other bird species are also likely to be affected by the proposed transmission line and include species such as the White Stork (Ciconia ciconia) and a number of waterbird species pertaining to the Anatidae (ducks and geese), Phalacrocoracidae (cormorants), Anhingidae (darters), Ardeidae (herons and egrets) as well as Threskiornithidae (ibises)

Table 80: A summary table illustrating the number of quarter degree squares for each proposed corridor in terms of bird's richness, number of Red listed bird species, mean reporting rates (%) for Red listed bird species and foraging hotspots for flamingos.

	Number of QDS			
	Bird Richness (between 210-300 ssp)	Number of RL species (between 7-20 spp)	Mean Reporting Rates (for RL species of >5%)	Foraging hotspots for flamingos (Reporting rates of >3 %)
Corridor 1	6	6	6	3
Corridor 2a	7	8	9	5

11.5 Soil and Agriculture

11.5.1 Soil

11.5.1.1 Phase 1: Broad Geological Setting

The broad geology patterns (1:1 000 000 Geological Map of South Africa, Council for Geoscience) of the survey area are provided in **Figures 72** (legend) and **73** (map). Corridors 2a traverses an area dominated by dolomite with Corridor 1 traversing only a small section of this geology. The dolomite geology yields a limited range of soils and agricultural conditions. The southern section of the area (traversed by Corridor 1) is characterised by a range of rock type namely: diamictite, basalt, shale, gneiss, andesitic lava, conglomerate, quartzite and granite. This varied geology yields a range of varied soils and landscapes. In the west the landscape is dominated by aeolian sands that cover the underlying rock yielding deep sandy soils in flat topography.

Figure 65: Legend to the 1:1 000 000 Geological Map of South Africa, Council for Geoscience for the investigation area

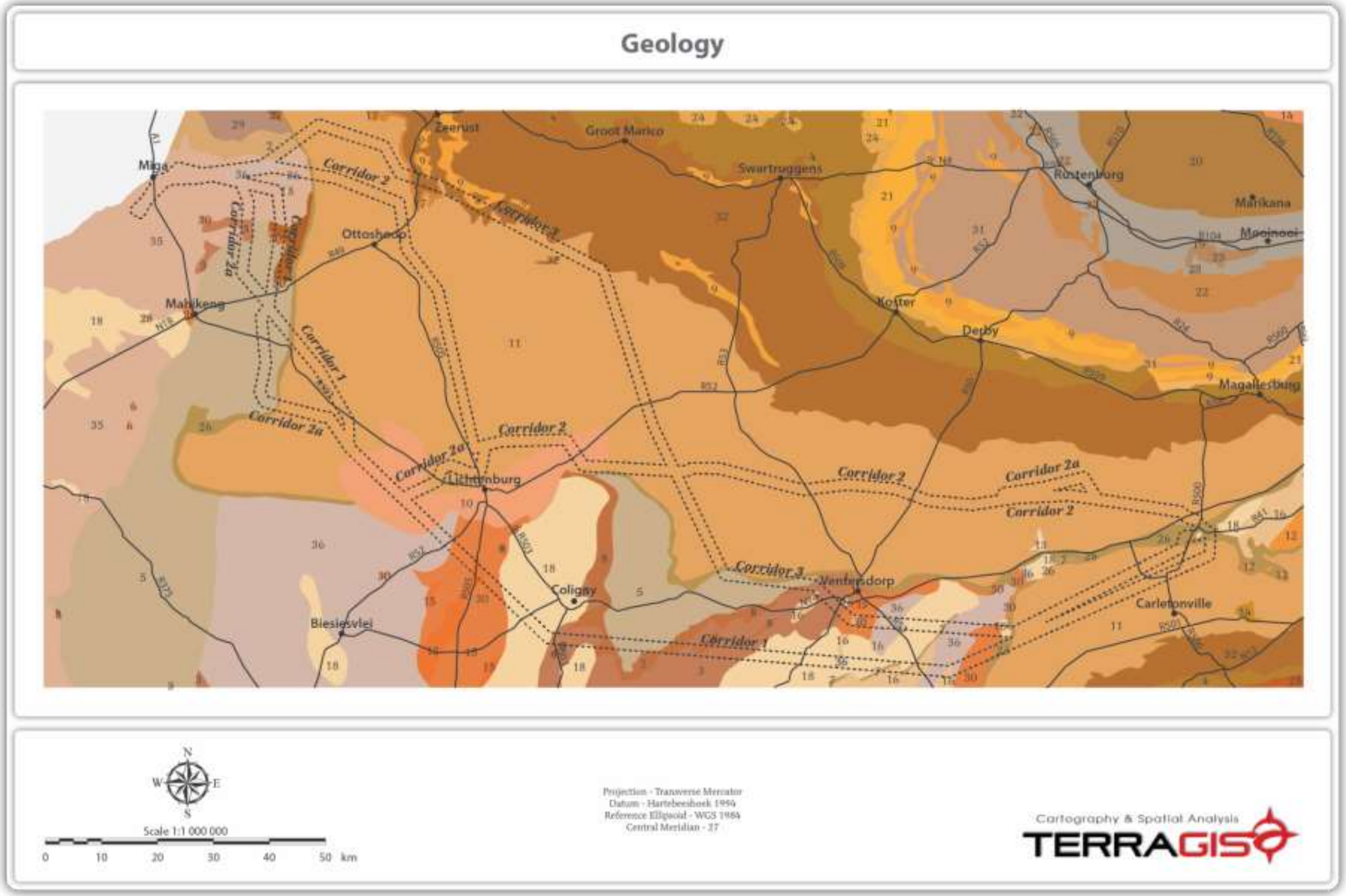


Figure 66: Geological map of the investigation area (1:1 000 000 Geological Map of South Africa, Council for Geoscience)

11.5.1.2 Phase 2: Land Type Data

Figure 74 presents the land type distribution for the corridors and surrounding area. **Table 82** provides the land type occurrence per corridor. The land type inventory data for each land type (Land Type Survey Staff, 1972 – 2006) is summarised below with a description of the dominant soils, land capability, land use and agricultural potential.

Table 81: Land Types along the various corridors

Corridor	Land types (from west to east)
1	Ah13, Fb4, Fa9, Bc11, Bd6, Bd10, Ba25, Bc33, Ba41, Ba42, Ae41, Fb15, Fa14, Ab7, Ba36
2	Ah13, Fa9, Fa10, Fa11, Bd10, Fa15, Fa16, Ba36
2a	Ah13, Fb4, Bd6, Bc11, Fa11, Bd10, Fb8, Ba43
3	Ah13, Fa9, Ib40, Ae59, Ac71, Fa10, Fa15, Bc33, Ba42, Fb15, Ae41, Fa14, Ab7, Ba36

11.5.1.2.1 Land Type Ab7

Land Type – General: Ab land types denote landscapes where the dominant soils are red dystrophic/mesotrophic.

Soils: Soils are red coloured, mesotrophic, well-drained and interspersed with sections of dolomite and chert outcrops. Soils in drainage depressions are also red and only soils in watercourses exhibit structure and brown to dark brown colours. Signs of hydromorphism (grey colours and mottling in a bleached or grey matrix) are absent in the entire landscape due to the high Mn content of the soils. Land capability and land use: The land use in the general land type area is predominantly dryland and irrigated crop production where soil depth and rockiness allow. The land capability mimics the land use.

Agricultural potential: The agricultural potential is moderate to high in areas with suitable soils. Rocky soil areas inhibit crop production in many areas. The rainfall is suitable for dryland agriculture (**Figure 75**) but soil limitations determine specific and localised suitability. Irrigation activities on dolomites may cause sinkhole formation.

11.5.1.3. Land Type Ac71

Land Type – General: Ac land types denote landscapes where red and yellow dystrophic/mesotrophic soils occur in equal frequency.

Soils: Soils are red and yellow coloured, mesotrophic, well-drained and interspersed with sections of shale and slate in the bulk of the land type and dolomite and chert derived soils in the south-west. Soils in drainage depressions are also red/yellow and only soils in watercourses exhibit structure and brown to dark brown colours. Signs of hydromorphism (grey colours and mottling in ableached or grey matrix) are more prevalent in shale dominated areas and are absent in the dolomite dominated areas due to the high Mn content of the soils.

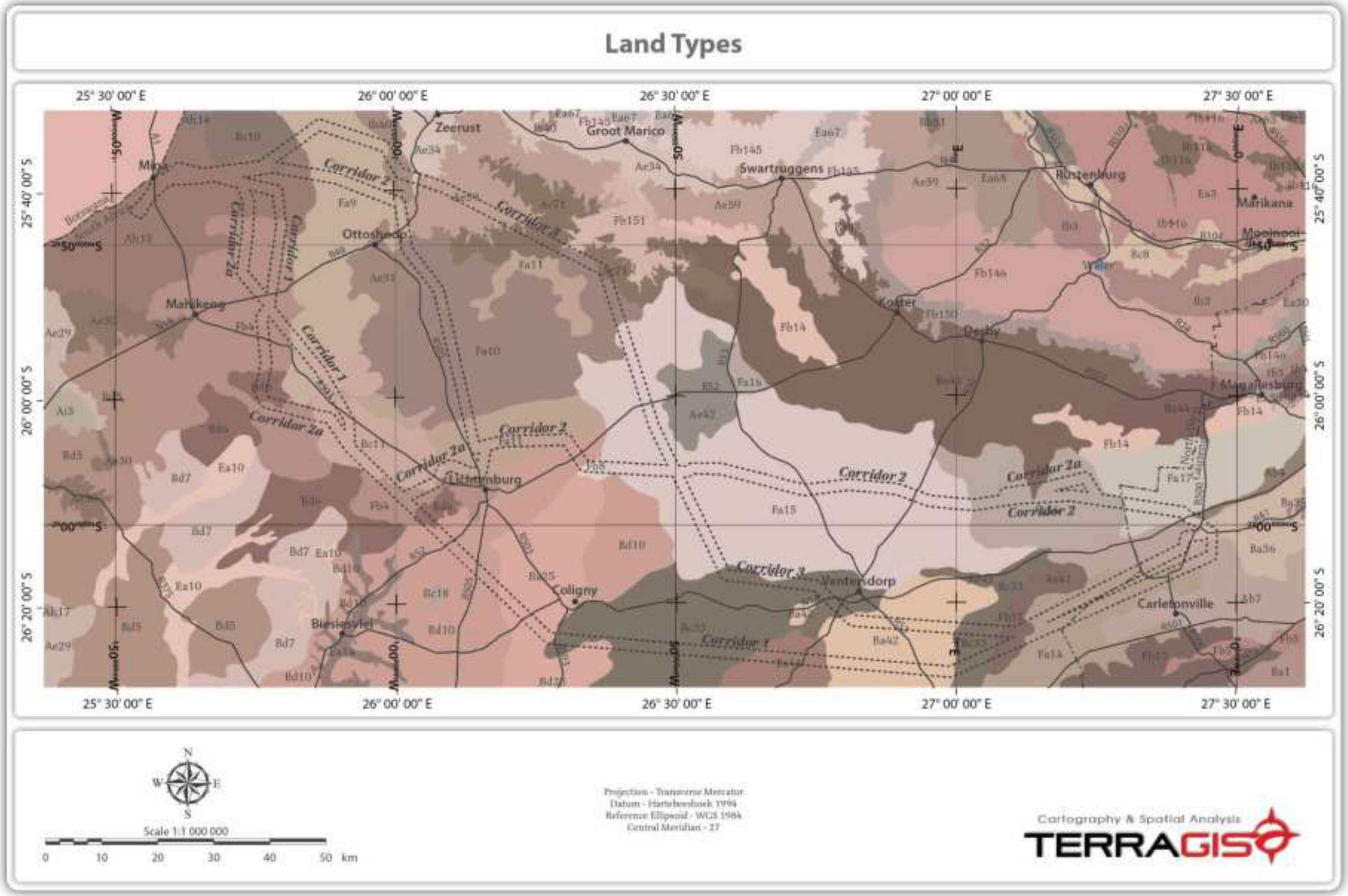


Figure 67: Land type map of the survey site and its surrounding area

Land capability and land use: The land use in the general land type area is predominantly dryland and irrigated crop production where soil depth and rockiness allow. The land capability mimics the land use.

Agricultural potential: The agricultural potential is moderate to high in areas with suitable soils. Rocky soil areas inhibit crop production in many areas. The rainfall is suitable for dryland agriculture (**Figure 75**) but soil limitations determine specific and localised suitability. Irrigation activities on dolomites may cause sinkhole formation.

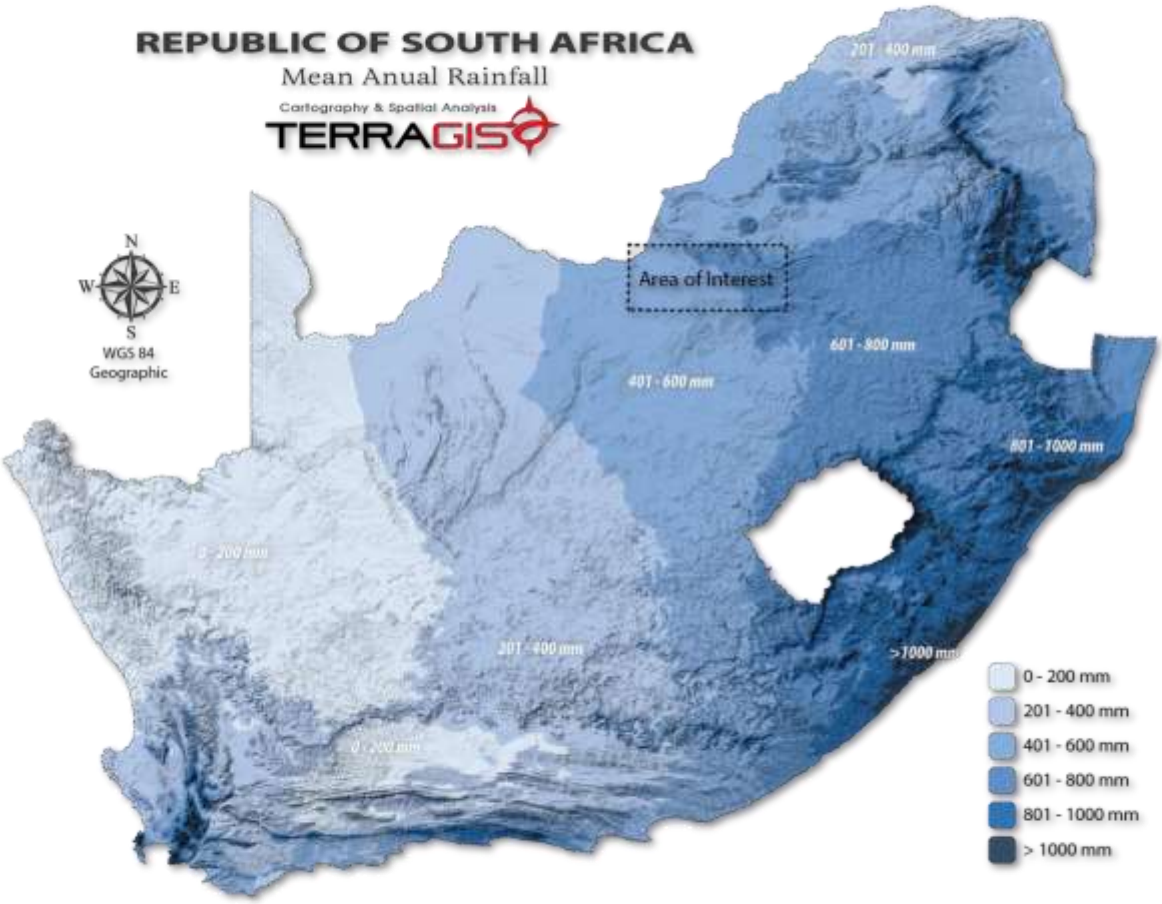


Figure 68: Rainfall map of South Africa indicating the survey site

11.5.1.4 Land Type Ae41

Refer to description of land types Ab7, Fa9, Fa10, Fa11, Fa14, Fa15, Fa16. Soils are similar except for leaching status that is dominantly eutrophic in the Ae41 land type.

11.5.1.5 Land Type Ae59

Land Type – General: Ae land types accommodate landscapes where the dominant soils are red, deeper than 300 mm and of high base status.

Soils: Soils are predominantly red coloured, eutrophic and moderately deep to shallow, often structured red or duplex soil profiles (derived from shales). Structured soils occur in valley bottom positions.

Land capability and land use: The land use in the general land type area is predominantly grazing with limited dryland and irrigated crop production. Irrigated agriculture can be practised where water is available. The land capability mimics the land use.

Agricultural potential: The agricultural potential is moderate to low due to the dominance of relatively shallow soils even though the rainfall may be suitable for dryland agriculture in areas (**Figure 75**). The soils are suited to localised irrigation projects if sufficient water is available.

11.5.1.6 Land Type Ah13

Land Type – General: Ah land types accommodate landscapes where the soils are sandy (less than 15 % clay), red and yellow, with high base status.

Soils: Soils are sandy red and yellow coloured, eutrophic and moderately deep to deep in flat topography. Soils in drainage depressions are structured and lime containing.

Land capability and land use: The land use in the general land type area is predominantly grazing and limited dryland crop production. Irrigated agriculture can be practised where water is available. The land capability mimics the land use.

Agricultural potential: The agricultural potential is moderate due to the deep sandy soils and the rainfall is considered to be borderline for dryland agriculture (**Figure 75**). The soils are suited to localised irrigation projects if sufficient water is available.

11.5.1.7 Land Types Ba25, Ba36, Ba41, Ba42, Ba43

Land Type – General: Ba land types denote plinthic catena landscapes where the dominant soils are red dystrophic/mesotrophic.

Soils: Soils are predominantly red coloured, mesotrophic and well-drained in upland positions with extensive soft and hard plinthite soil profiles in midslope and footslope positions. Footslope and valley bottom positions are dominated by structured soils, with and without swelling properties. Signs of hydromorphism (grey colours and mottling in a bleached or grey matrix) are prominent in the plinthic soils in lower horizons and in the structured soils of the lower landscape positions.

Land capability and land use: The land use in the general land type area is predominantly dryland and irrigated crop production where soil depth and rockiness allow. The land capability mimics the land use.

Agricultural potential: The agricultural potential is moderate to high in areas with suitable soils. Rocky soil areas inhibit crop production in many areas. The rainfall is suitable for dryland agriculture (**Figure 75**) but soil limitations determine specific and localised suitability.

11.5.1.8 Land Types Bc11, Bc33

Land Type – General: Bc land types denote plinthic catena landscapes where the dominant soils are red eutrophic.

Soils: Soils are predominantly red coloured, eutrophic, sandy and well-drained in upland positions with extensive soft plinthite and gleycutanic (Binomial System) soil profiles in midslope and footslope positions. Footslope and valley bottom positions are dominated by structured soils, with and without swelling properties. Signs of hydromorphism (grey colours and mottling in a bleached or grey matrix) are prominent in the plinthic soils in lower horizons and in the structured soils of the lower landscape positions as lime accumulation.

Land capability and land use: The land use in the general land type area is predominantly dryland and irrigated crop production where soil depth and rockiness allow. The land capability mimics the land use.

Agricultural potential: The agricultural potential is moderate to high in areas with suitable soils. Rocky soil areas inhibit crop production in many areas. The rainfall is marginal for dryland agriculture (**Figure 75**) but deep soil water tables occur that improve the potential if adequately exploited and managed.

11.5.1.9 Land Types Bd6, Bd10

Land Type – General: Bd land types denote plinthic catena landscapes where the dominant soils are yellow eutrophic.

Soils: Soils are predominantly yellow-brown coloured, eutrophic, sandy and well-drained in upland positions with extensive soft plinthite and gleycutanic (Binomial System) soil profiles in midslope and footslope positions. Footslope and valley bottom positions are dominated by structured soils, with and without swelling properties and with extensive lime rich horizons. Signs of hydromorphism (grey colours and mottling in a bleached or grey matrix) are prominent in the plinthic soils in lower horizons and in the structured soils of the lower landscape positions as lime accumulation.

Land capability and land use: The land use in the general land type area is predominantly dryland and irrigated crop production where soil depth and rockiness allow. The land capability mimics the land use.

Agricultural potential: The agricultural potential is moderate to high in areas with suitable soils. Rocky soil areas inhibit crop production in many areas. The rainfall is marginal for dryland agriculture (**Figure 75**) but deep soil water tables occur that improve the potential if adequately exploited and managed.

11.5.1.10 Land Types Fa9, Fa10, Fa11, Fa14, Fa15, Fa16

Land Type – General: Fa land types denote landscapes with young and shallow soils of the Mispah and Glenrosa forms without lime.

Soils: Soils are shallow, red coloured, mesotrophic, well-drained and interspersed with numerous sections of dolomite and chert outcrops. Soils in drainage depressions are also red and only soils in watercourses exhibit structure and brown to dark brown colours. Signs of hydromorphism (grey colours and mottling in a bleached or grey matrix) are absent in the entire landscape due to the high Mn content of the soils.

Land capability and land use: The land use in the general land type area is predominantly grazing due to soil depth limitations. The land capability mimics the land use.

Agricultural potential: The agricultural potential is low and dryland agriculture is limited to small sections with deep soils. Rocky soil areas inhibit crop production in most areas. The rainfall is suitable for dryland agriculture (**Figure 75**) but soil limitations determine specific and localised suitability. Irrigation activities on dolomites may cause sinkhole formation.

11.5.1.11 Land Types Fb4, Fb7, Fb8, Fb15

Land Type – General: Fb land types denote landscapes with young and shallow soils of the Mispah and Glenrosa forms with lime in lower landscape positions.

Soils: Soils are shallow and rocky in most landscape positions with structured and pedologically young soils dominating footslope and valley-bottom positions. Lime rich horizons occur throughout in low lying landscape positions and in some cases hardpan carbonate horizons dominate.

Land capability and land use: The land use in the general land type area is predominantly grazing due to soil depth limitations. The land capability mimics the land use.

Agricultural potential: The agricultural potential is low and dryland agriculture is limited to small sections with deep soils. Rocky soil areas inhibit crop production in most areas. The rainfall is suitable for dryland agriculture (**Figure 75**) but soil limitations determine specific and localised suitability.

11.5.1.12 Land Type Ib40

Land Type – General: Ib land types denote landscapes dominated by rock outcrops (60 – 80 % of the surface area) with a range of other soils interspersed in between.

Soils: Soils are shallow and rocky throughout the landscape in most landscape positions with structured and pedologically young soils dominating footslope and valley-bottom positions. Lime rich horizons occur in low lying landscape positions.

Land capability and land use: The land use in the general land type area is predominantly grazing due to soil depth limitations. The land capability mimics the land use.

Agricultural potential: The agricultural potential is low. Rocky soil areas inhibit crop production in most areas. The rainfall is suitable for dryland agriculture (**Figure 75**) but soil limitations determine specific and localised suitability.

11.5.1.3 Phase 3: Topographic Parameters

Contours of the entire site were used to generate a digital elevation model (**Figure 76**) and topographic wetness index (**Figure 77**). It is evident that the area is very large and traversed by numerous surface depressions and drainage features (**Figure 77**). The topography along the corridors is secondary to the geological setting regarding the agricultural potential of the general area.

11.5.1.4 Phase 4: Satellite Image Interpretation

The satellite image of the entire corridor and surrounding area is provided in **Figure 78**. From the image it is apparent that the northern half of the survey area is characterised by grasslands without significant dryland agriculture activities. The southern section is characterised by a range of agricultural activities that is dominated by dryland maize and sunflower production.

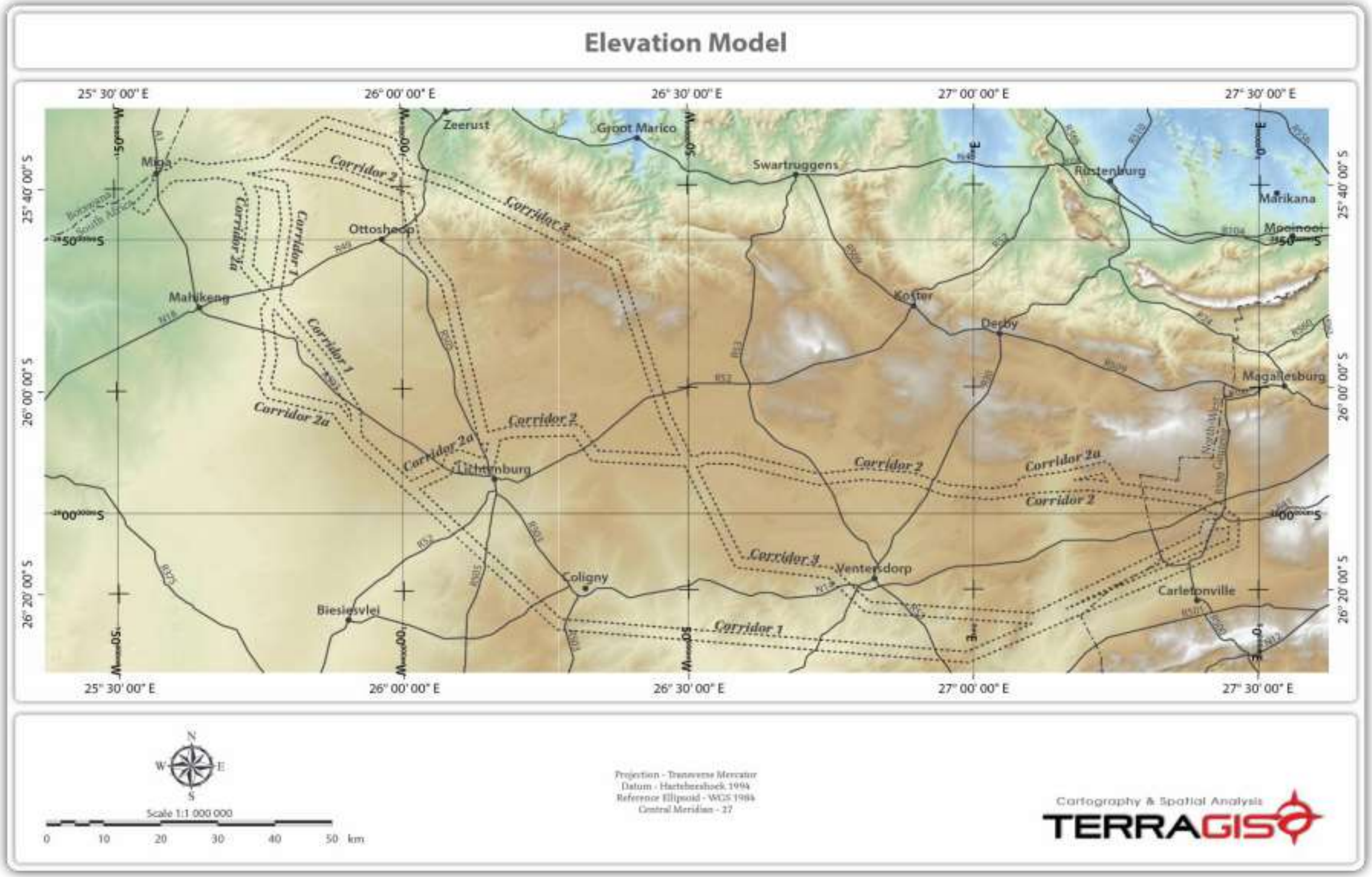


Figure 69: Digital elevation model for the entire survey area

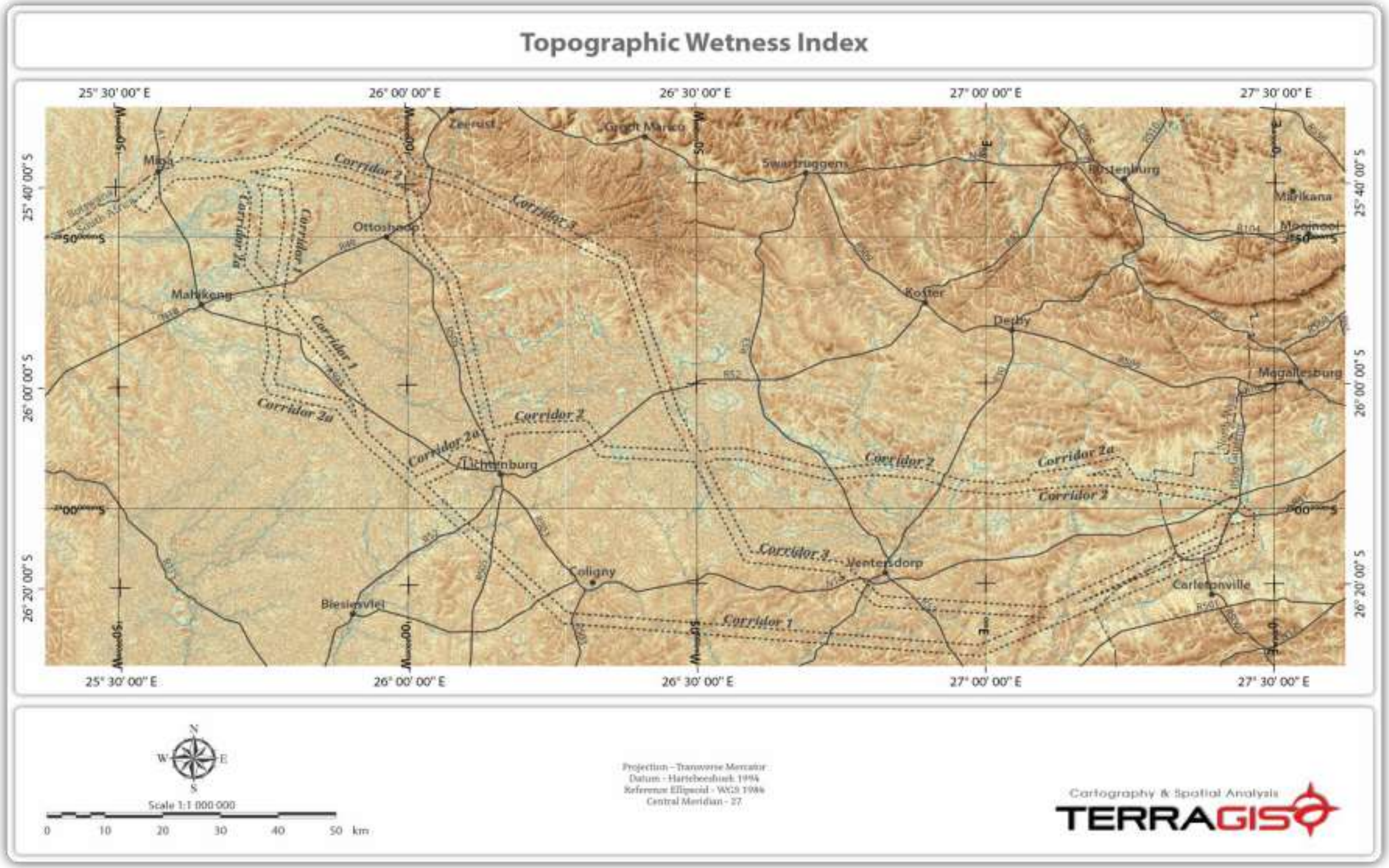


Figure 70: Topograhic wetness index (TWI) for the entire survey area

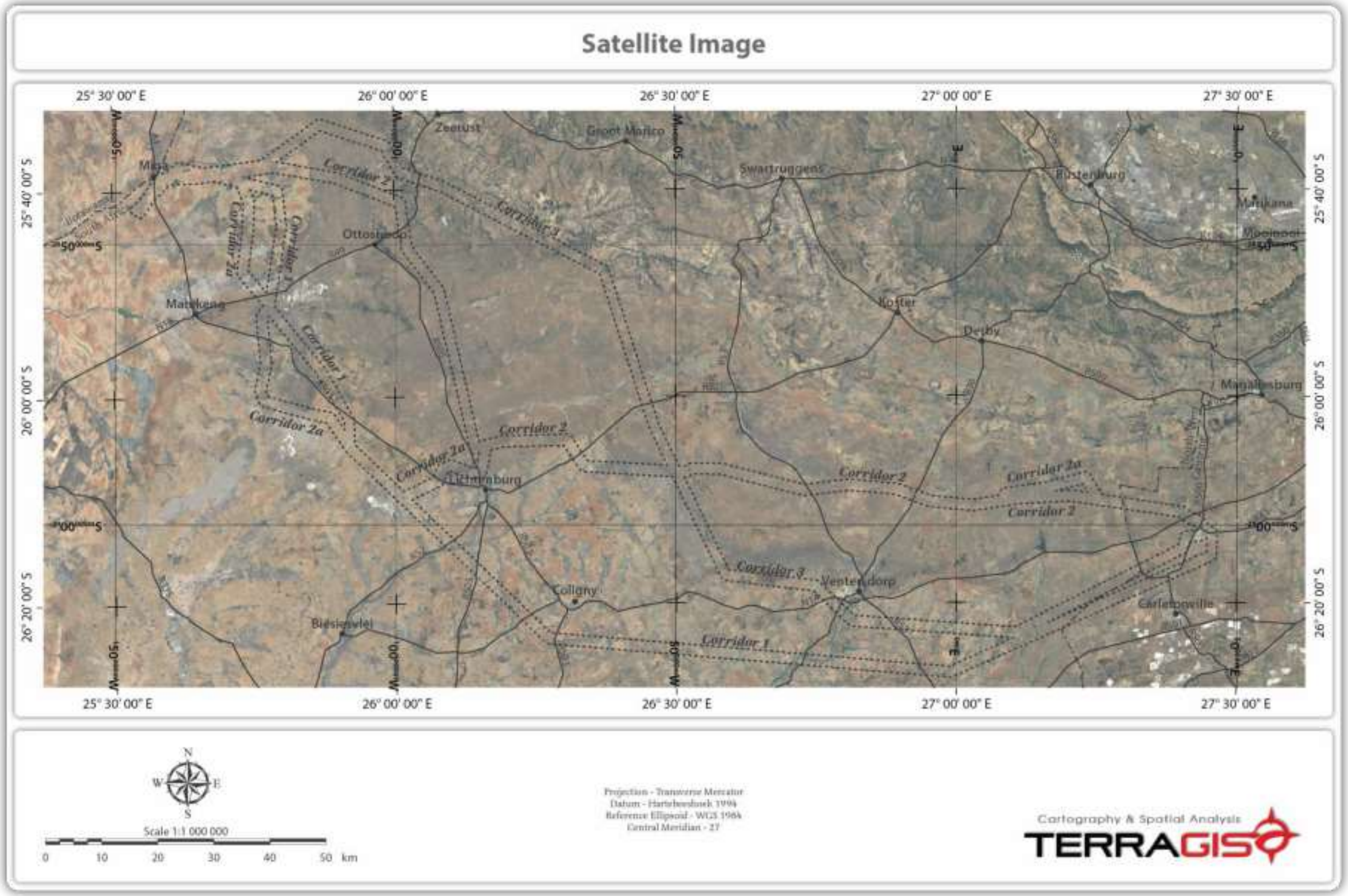


Figure 71: Satellite image of the entire corridor and surrounding area

The land cover (GTI, 2015) of the corridor area is provided in **Figure 79** and the areas covered per corridor are provided in **Table 83**. The data confirms the dominance of grassland and grazing in the northern sections of the corridor area and dryland agriculture activities in the southern sections. The corridor with the lowest agriculture surface area coverage is Corridor 2a and the one with the highest is Corridor 1.

Table 82: Areas for various land cover categories per corridor

Land Cover	Land Capability Class	Corridor (Area)							
		1		2		3		2a	
		ha	%	ha	%	ha	%	ha	%
Veld	VI/VII	23923	48.4	35841	78.1	33838	71.1	32999	64.5
Bare Earth / Erosion	-	25	0.1	33	0.1	70	0.1	36	0.1
Dryland Agriculture	I, II, III, IV,V	21833	44.2	9185	20.0	12663	26.6	13477	26.4
Irrigated Agriculture	I	1375	2.8	263	0.6	335	0.7	648	1.3
Mining	-	176	0.4	231	0.5	88	0.2	433	0.8
Orchards	I	9	0.0	3	0.0	5	0.0	3	0.0
Plantations / Woodlots	VII	172	0.3	32	0.1	184	0.4	37	0.1
Subsistence Farming	IV	1106	2.2	0	0.0	5	0.0	3121	6.1
Urban	-	435	0.9	231	0.5	164	0.3	275	0.5
Water	-	7	0.0	2	0.0	35	0.1	4	0.0
Wetland	VIII	371	0.7	54	0.1	187	0.4	106	0.2
Total		49431		45876		47573		51137	

11.5.1.5 Site Visit and Soil Survey

During the field investigation and high-level reconnaissance soil survey it was found that the land type data provides a very good indication of the soil and landscape variability in the survey area. The summaries of the land types, as provided in section 11.5.1, therefore apply. In addition, the land cover data indicates to a very large degree of accuracy the land capability of the corridors.

Figures 79 to **80** provide an indication of the dominant land uses and land cover as determined by the geological setting of the landscape and corridor areas.

11.5.2 Agricultural Potential

11.5.2.1 Agricultural Potential of the Site

The agricultural potential of the survey area is determined by the soils and the availability of water. The land cover data provides a very good indication of the agricultural potential in that the land appears to have been developed to its potential in most areas. The variability in agricultural potential is indicated by the variability in land capability with the potential being higher the lower the land capability class value.

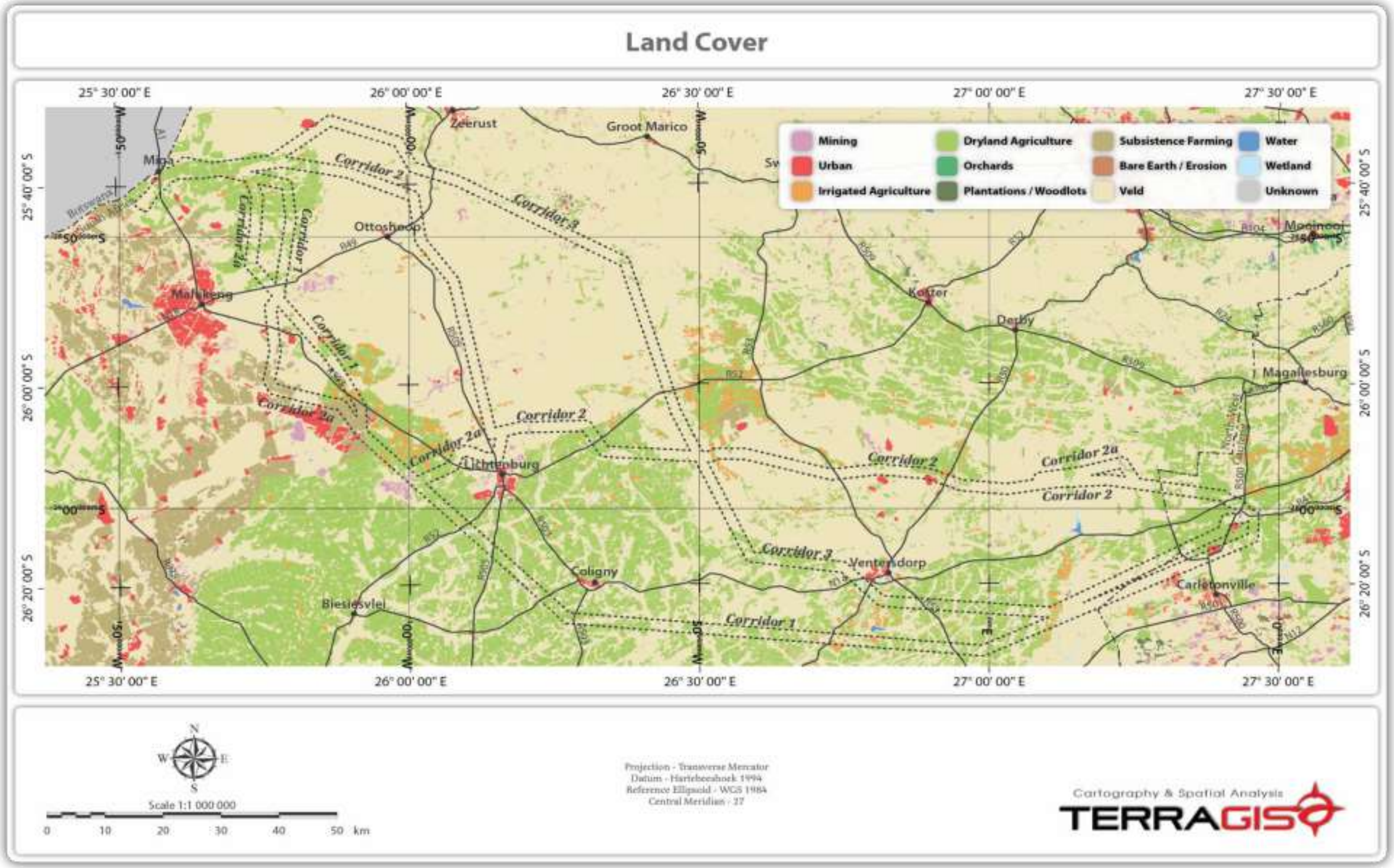


Figure 72: Land Type of the survey site and its surrounding area

Figure 73: Dolomite and Chert dominated landscapes with grass cover and limited dryland agricultural activities

Figure 74: Various grassland and bushveld land cover areas along corridors

Figure 75: Various dryland agricultural activities and land cover area along the corridor

11.5.2.2 Land Capability Classification

The discussion above on the agricultural potential applies to the land capability as well. The land capability classes for the various land cover categories are provided in **Table 83**.

11.5.2.3 Type of Impact

The type of impact associated with transmission lines is limited to a small footprint along transects and with a relatively small area sterilised per pylon. In the case of agricultural potential and within the context of the specific land and climatic conditions experience in the survey area these impacts are expected to be small to negligible. In cases where irrigated agriculture is to be practiced (should enough water be available) the placement of the pylon footprints can be coordinated with the irrigation field layout so as to ensure a minimal impact. In this regard existing alignments are preferred as the initial impacts have already been incurred and new impacts will be negligible if managed.

11.6 Visual

11.6.1 Visibility

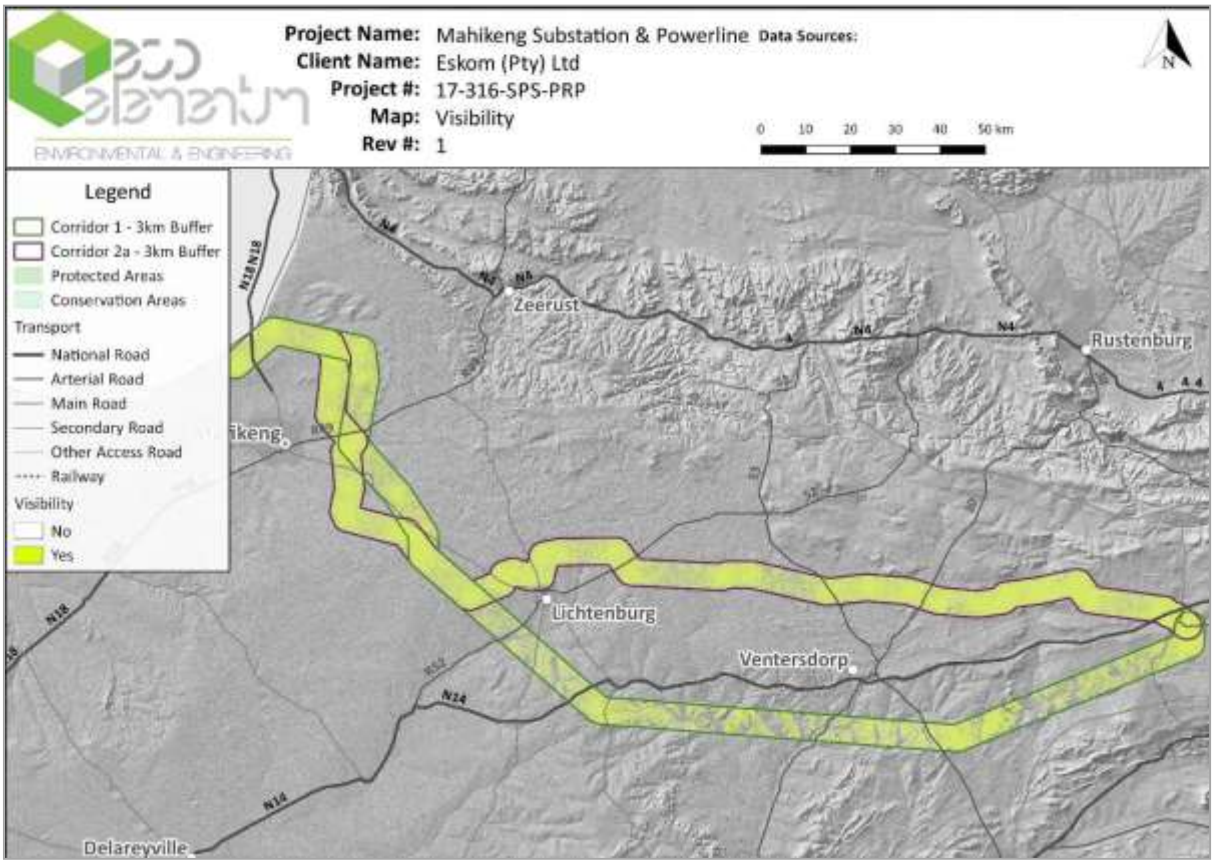


Figure 76: Visibility of the proposed Mahikeng Substation and Power Line Project

A visibility analysis was run to determine the locations from which the proposed infrastructure would be visible within the 3km buffer of the centre line of the proposed powerlines.

11.6.2 Visual Exposure

Visual exposure is based on distance from the project within the 3km buffer zone from the proposed centre line of the Powerlines. Visual exposure or visual impact tends to diminish exponentially with distance. The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed structures were not visible, no visual impact would occur. Visual exposure is determined by the following variables:

- Slope angle
- Aspect of slope
- Landforms
- Slope Position of structure
- Relative Elevation of structure
- Terrain Ruggedness

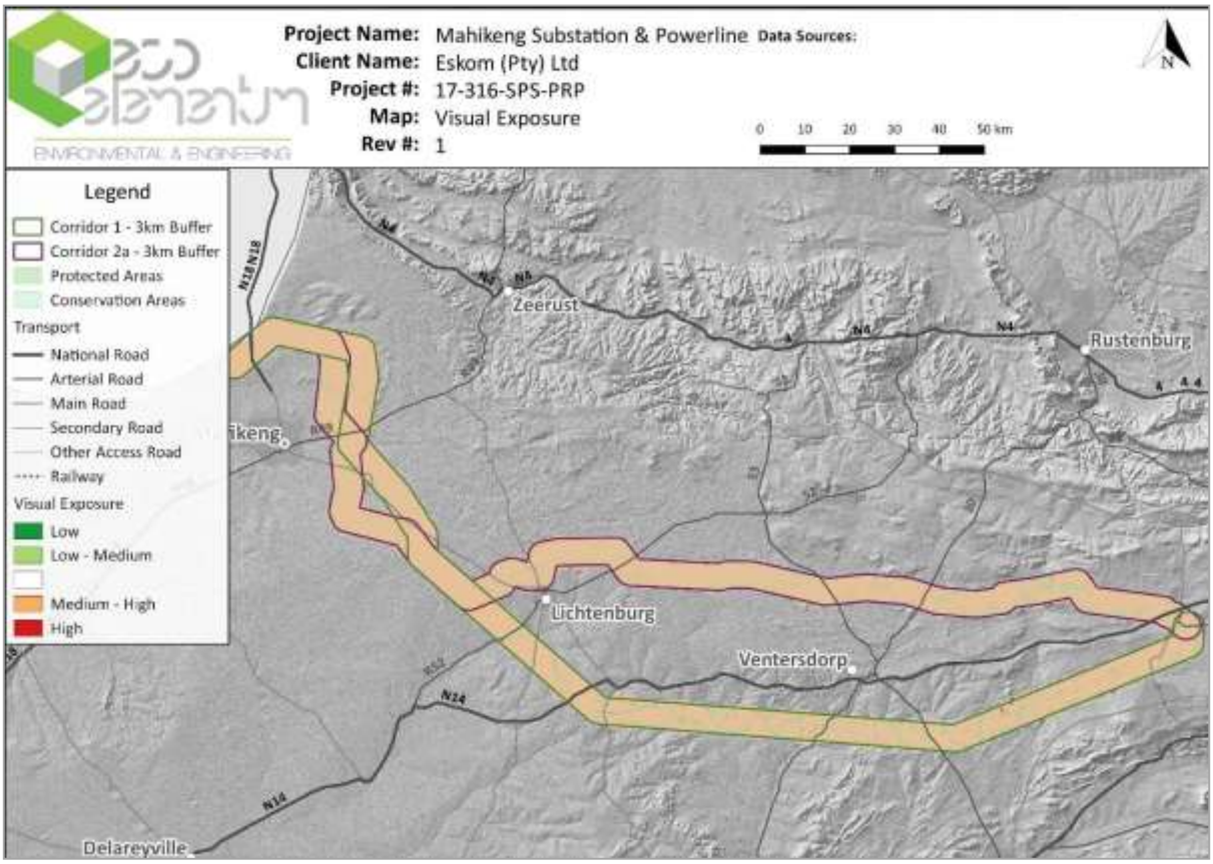


Figure 77: Final Visual Exposure within the 3km Buffer zone of the proposed Mahikeng Substation and Powerline Project

11.6.3 Slope

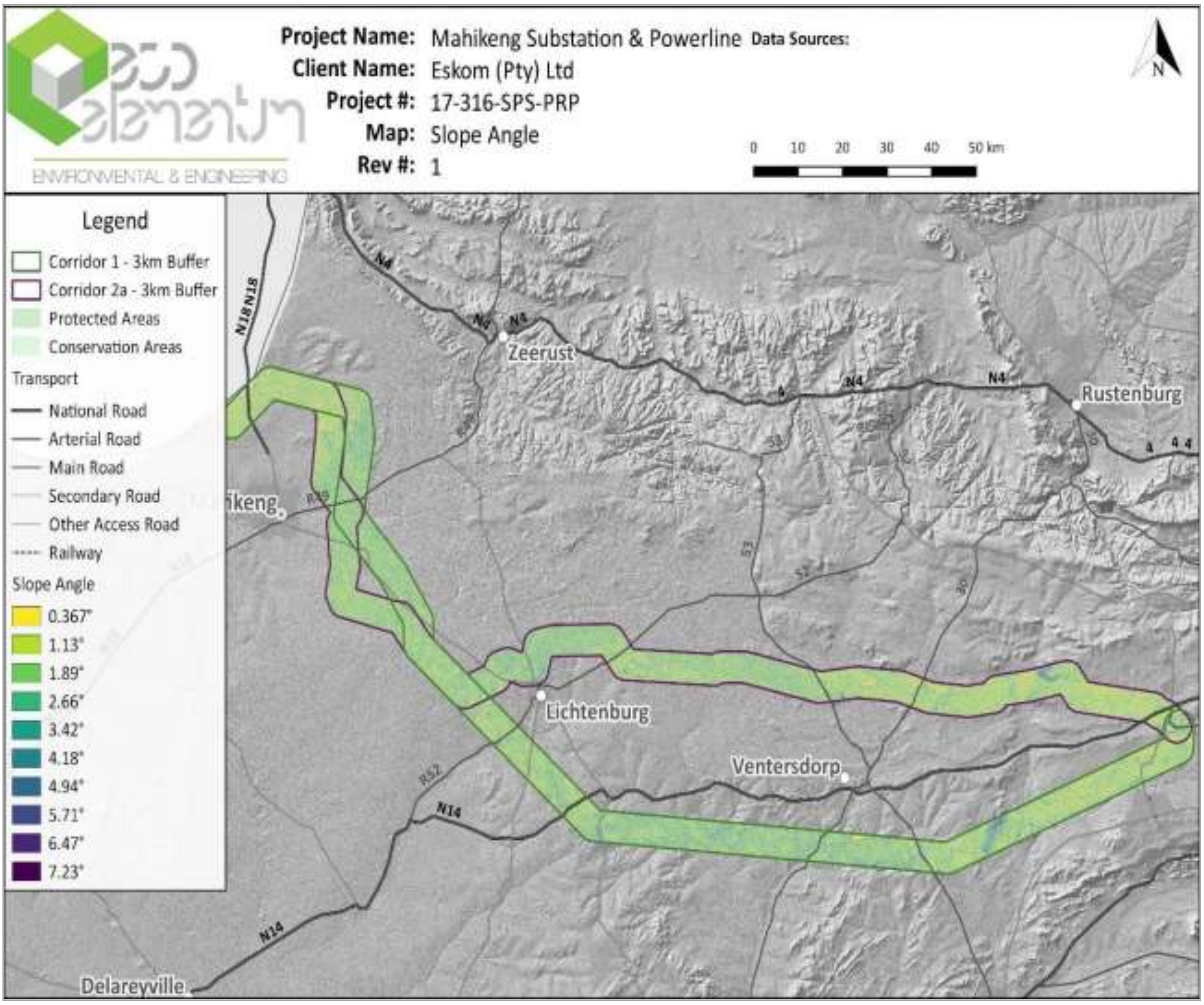


Figure 78: Slope anglesof the terrain in the 3km buffer area surrounding the proposed Mahikeng Substation and Powerline Project.

11.6.4 Aspect

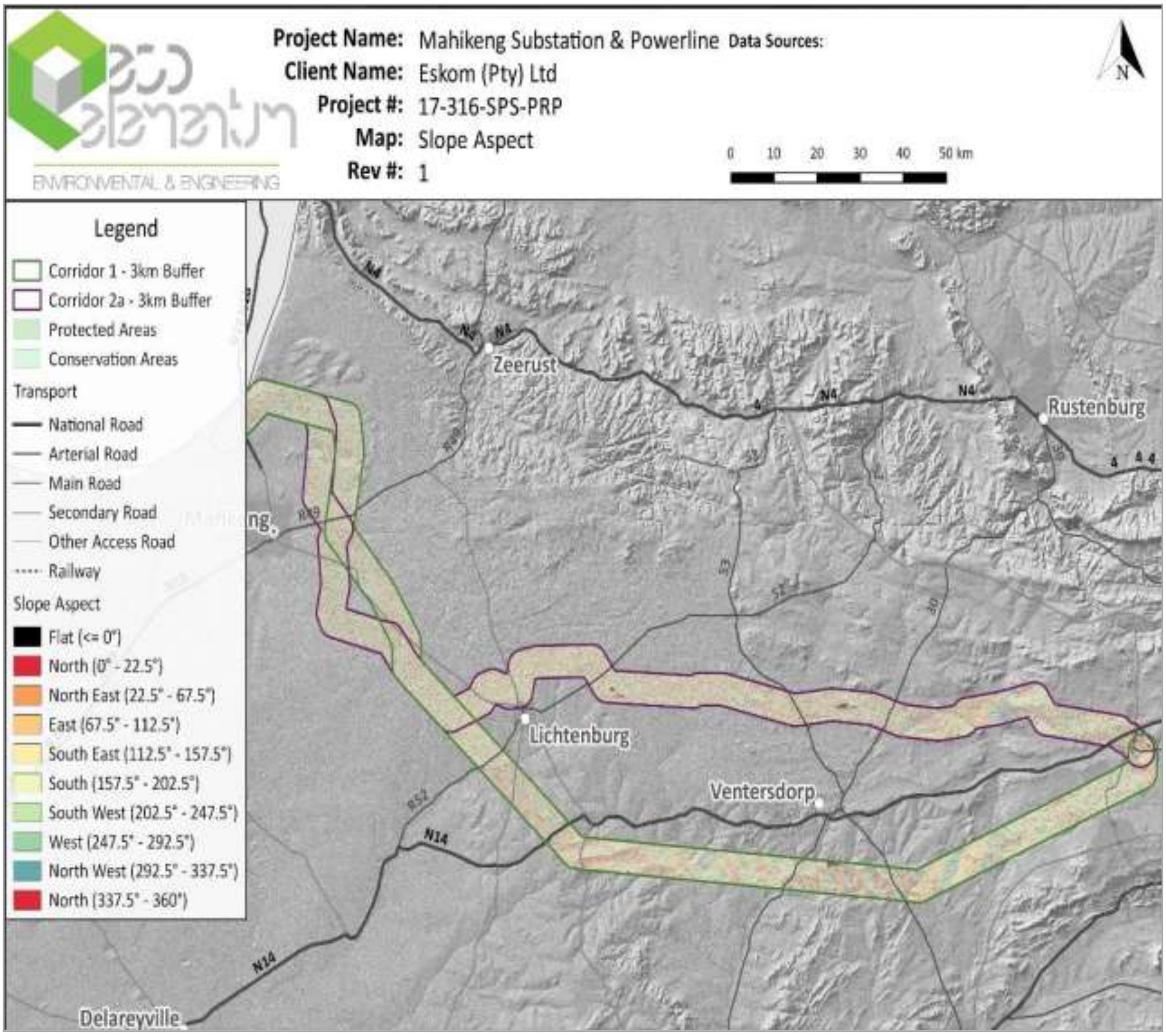


Figure 79: Apect direction in the 3km buffer area surrounding the proposed Mahikeng Substation and Powerline Project

11.6.5 Terrain Ruggedness

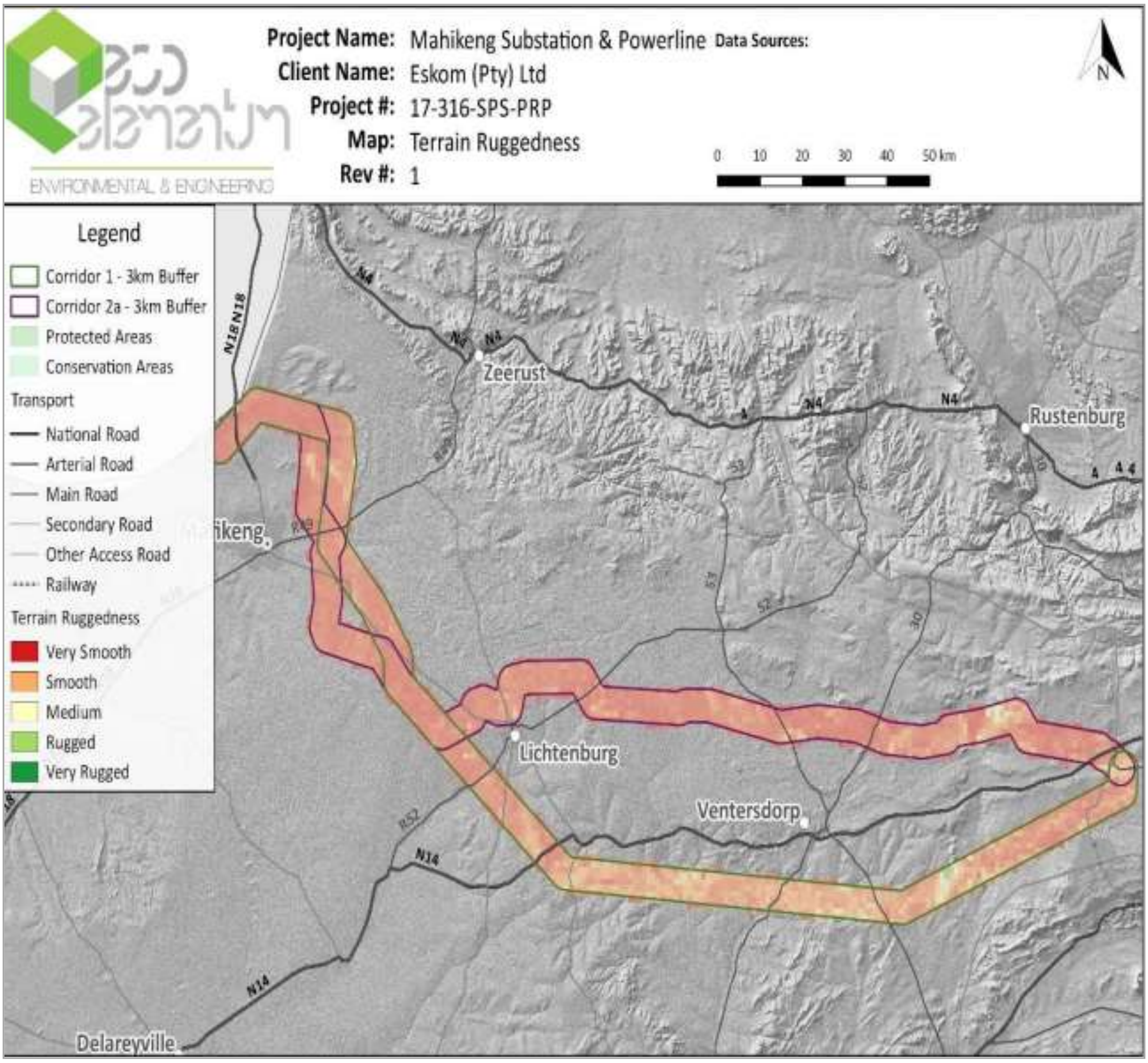


Figure 80: Terrain ruggedness in the 3km buffer area surrounding the proposed Mahikeng Substation and Powerline Project

11.6.6 Relative Elevation

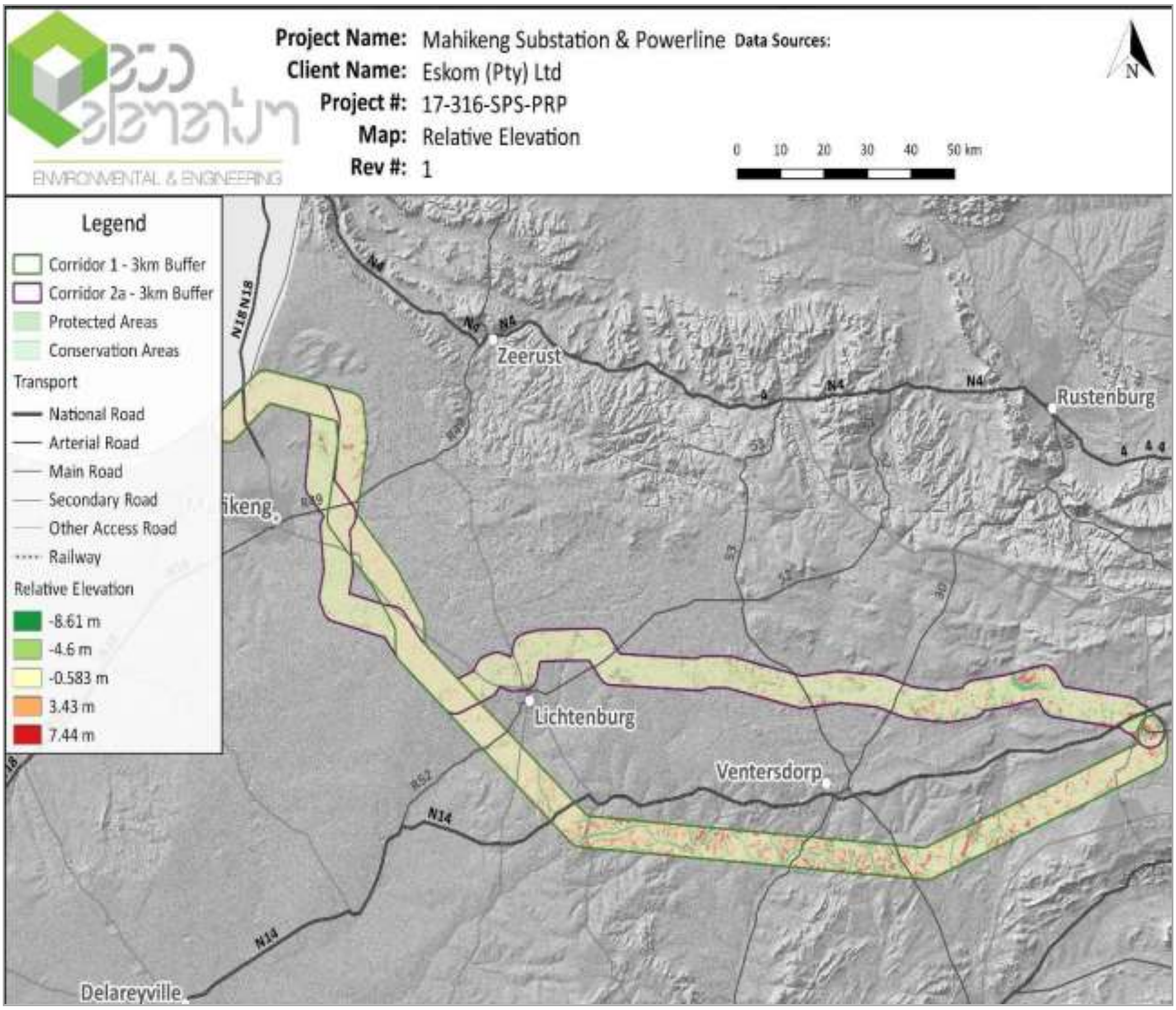


Figure 81: Relative Elevation of terrain in the 3km buffer area surrounding the proposed Mahikeng Substation and Powerline Project

11.6.7 Landforms

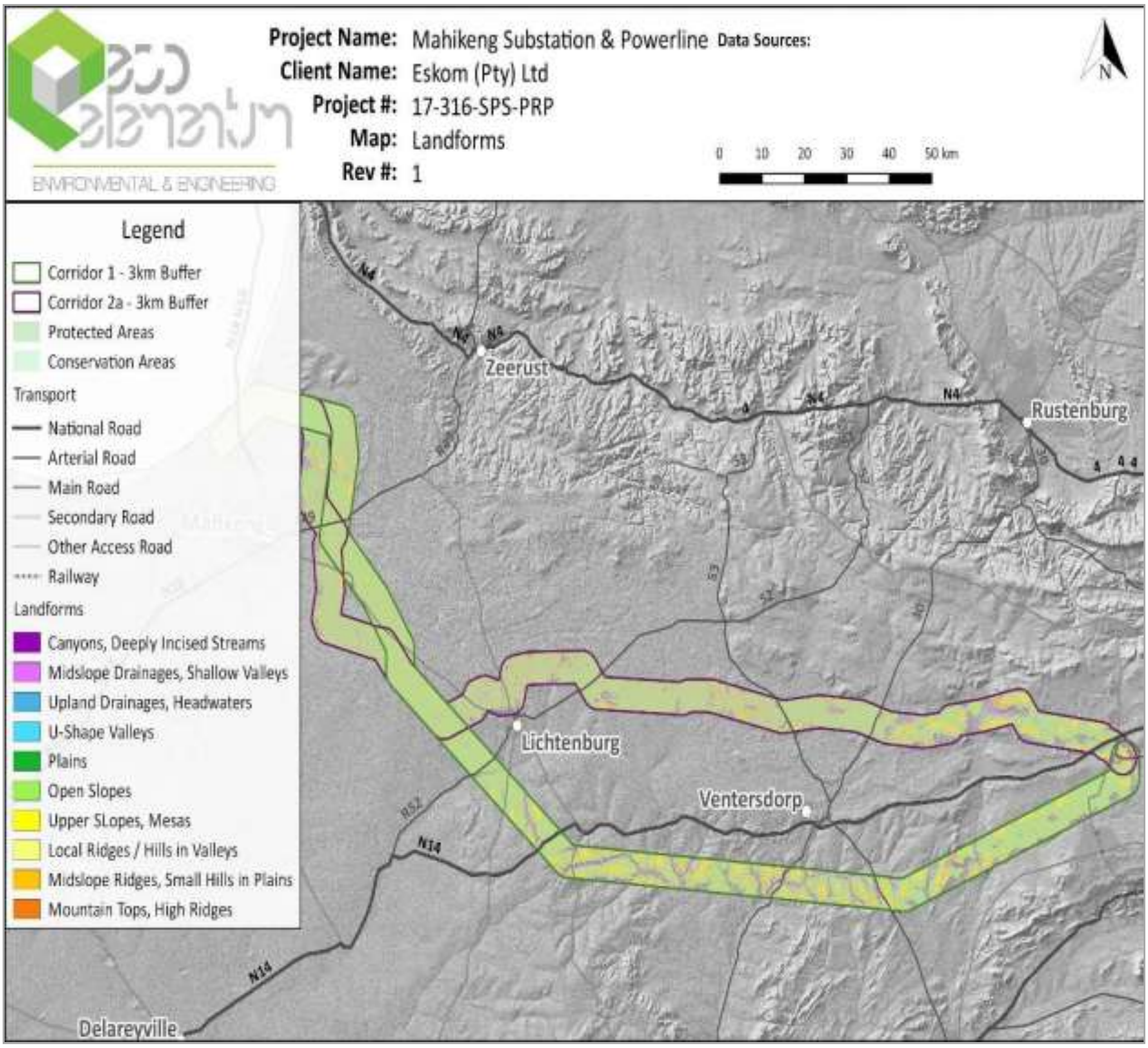


Figure 82: Landform in a 3km buffer area surrounding the proposed Mahikeng Substation and Powerlines Project

11.6.8 Slope Position

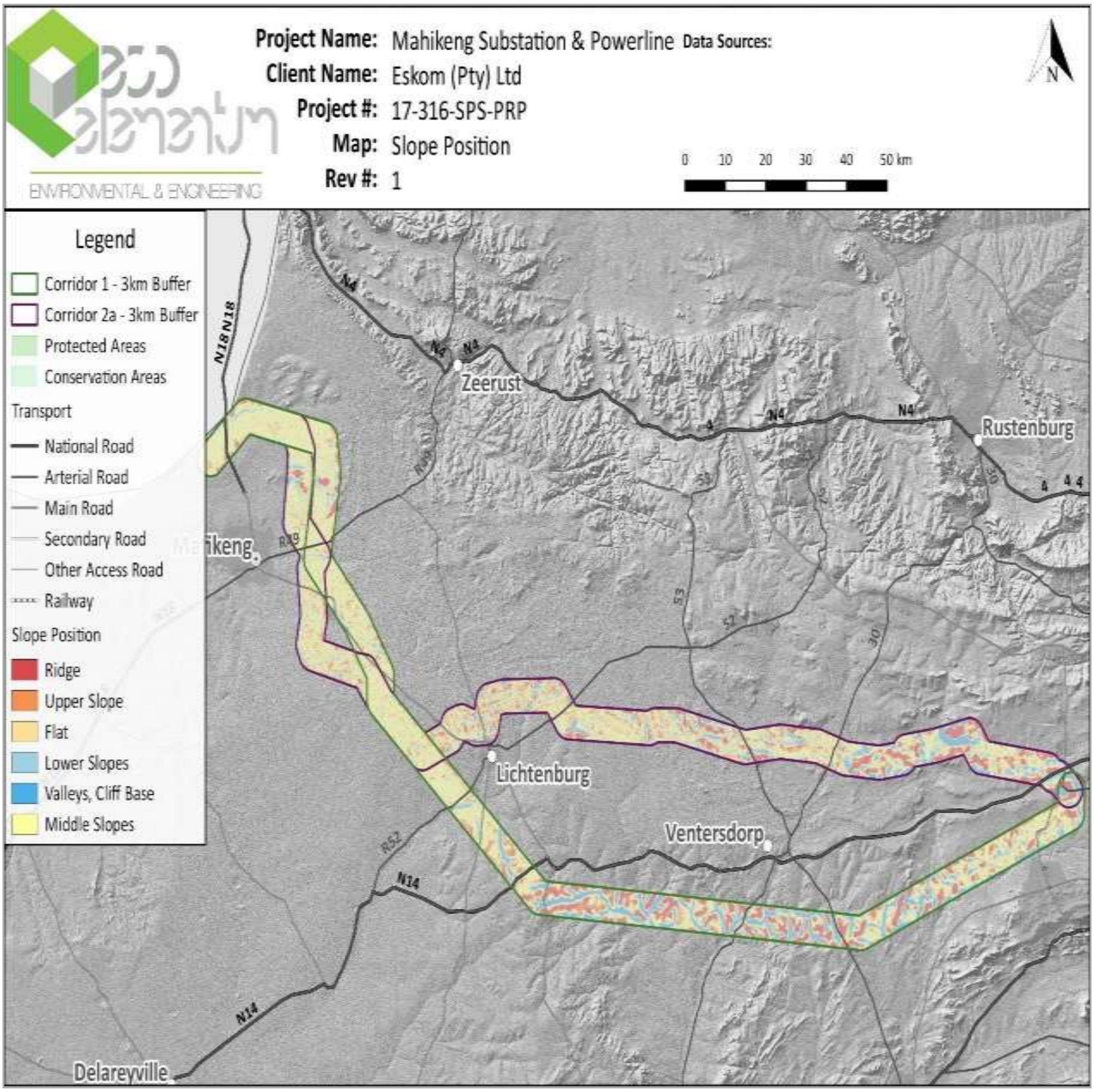


Figure 83: Slope Position in the 3km buffer area surrounding the proposed Mahikeng Substation and Powerline Project

10. 6.9 Viewer Sensitivity

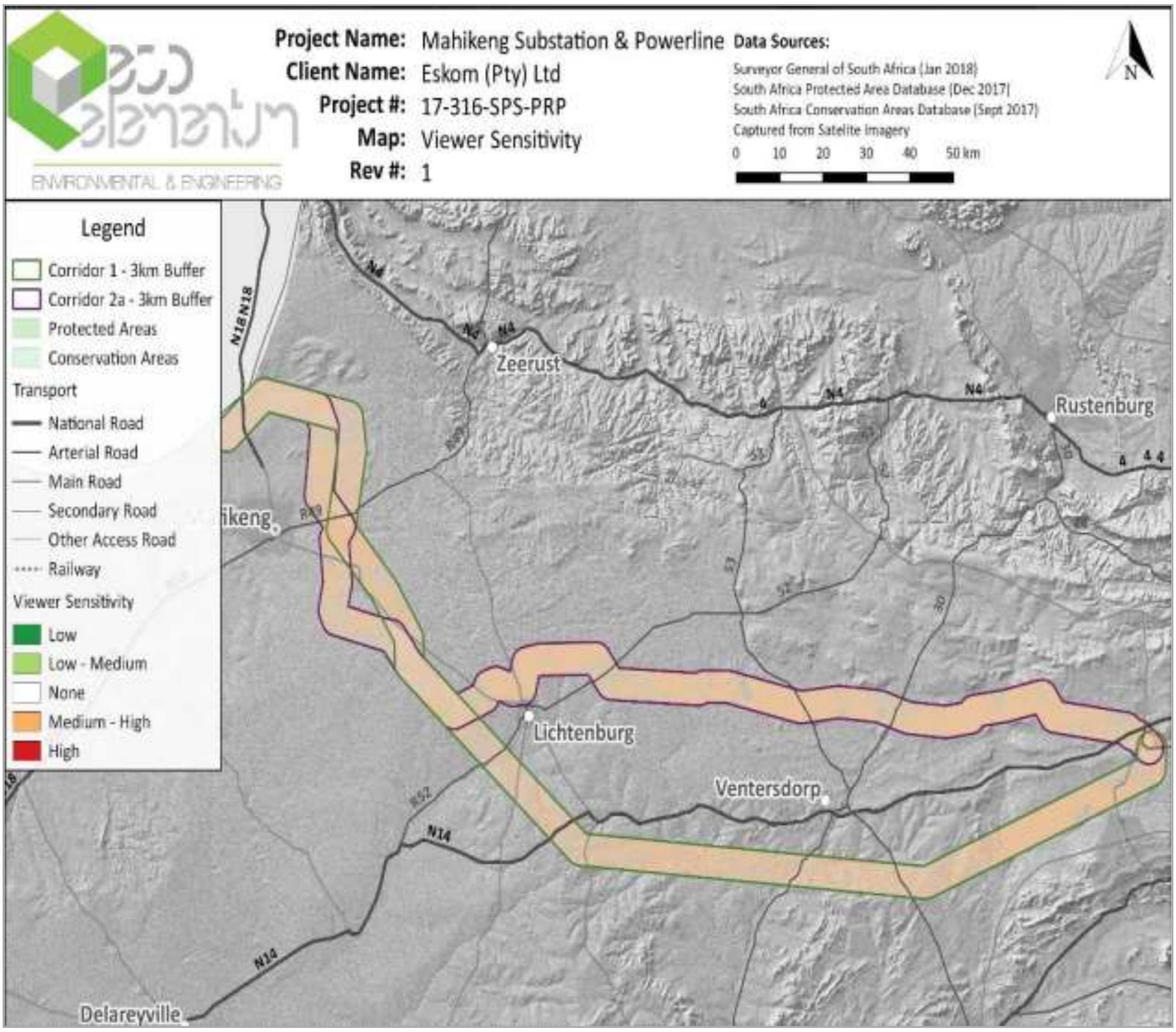


Figure 84: Viewer Sensitivity of the proposed Mahikeng Substation and Powerline Project

11.6.10 Visual Impact

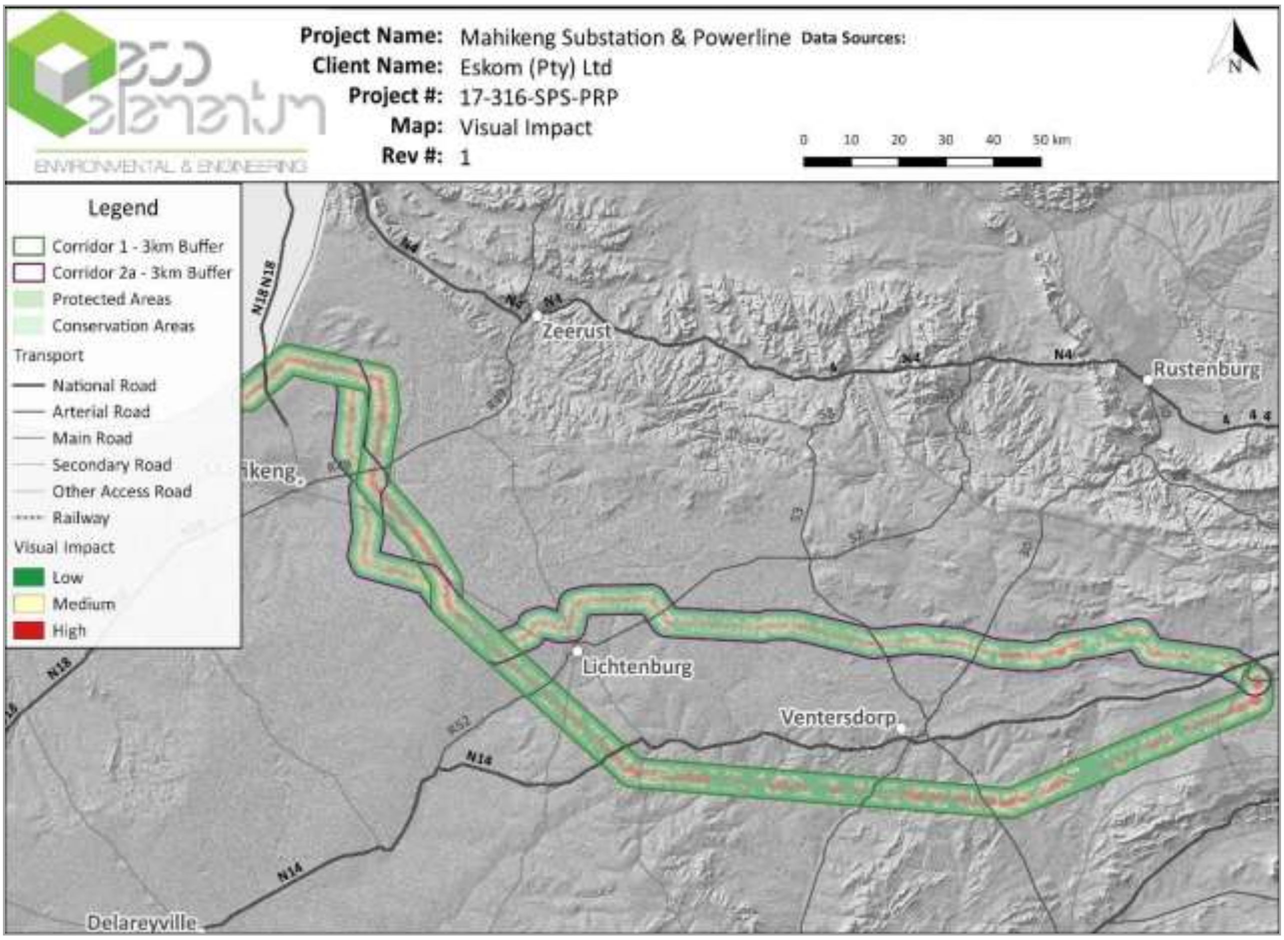


Figure 85: GIS Visual Impact of the Proposed Mahikeng Substation and Powerline Project

The final Visual impact of the proposed infrastructure were calculated using all the datasets above then summing all the pixel values of each corridor option to get to a final rating as shown in Table 90 below. **Corridor 2a** is the preferred option but only by 15% difference.

Table 83: GIS Calculated Visual Impact

Alternative	Sum of GIS Pixel Values	% Difference
Corridor 1	2389773	15%
Corridor 2a	2031924	

11.6.11 Ground Verification

A variety of ground locations were visited to ground truth the GIS data. The GIS data revealed the Features and Landcover in Table 85 within a 1 km buffer zone from the various photo locations. The different photo locations show good individual correlation with the GIS data used for the analysis. Some features however can't be seen in the photos due to the distance from the location of the photo being too far to identify the features, which include but not limited to only, diggings and river etc. that would possibly be obscured by vegetation.

Table 84: GIS Data Verification

Features	Landcover
Arterial Route	Water
Bridge	Wetlands
Canal	Dense Bush
Dam Wall	Open Bush
Fence	Low Shrubland
Furrow	Cultivated Fields
Main Road	Plantation
National Route	Mines
River – Non Perennial	Erosion
Other Access Road	Bare – No Vegetation
River - Perennial	Urban
Secondary Road	Urban School
Street	Urban – Township
Footpath	
Dam	
Digging	
Dry Pan	
Excavation	
Urban	
Large Building	
Marsh	
Pan – Non Perennial	
Recreation Area	
School Area	

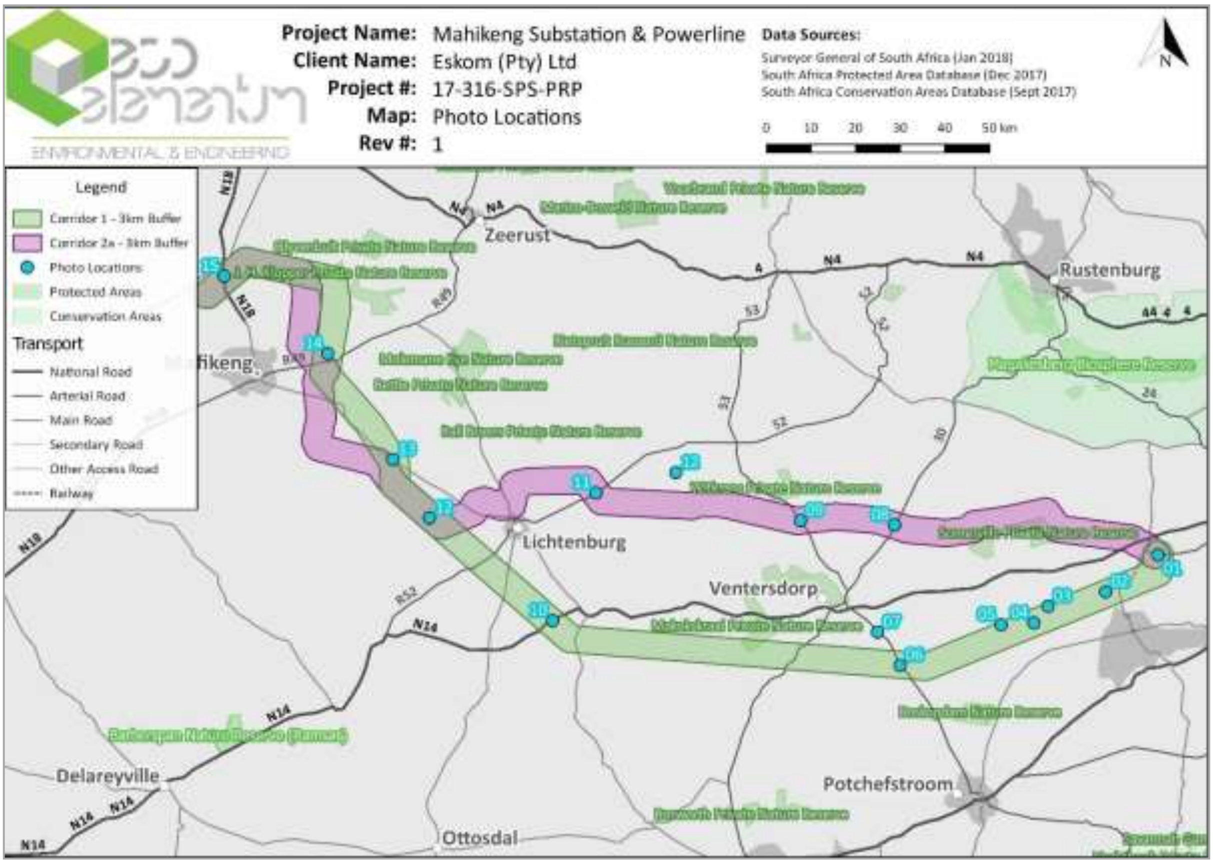


Figure 86: Location of Photos taken for the proposed Mahikeng Substation and Powerline Project

Figure 87: View from Location 01

Figure 88: View from location 02

Figure 89: View from location 03

Figure 90: View from location 04

Figure 91: View from location 05

Figure 92: View from location 06

Figure 93: View from location 07

Figure 94: View from location 08

Figure 95: View from location

Figure 96: View from location 10

Figure 97: View from location 11


Figure 98: View from location 12


Figure 99: View from location 13

Figure 100: View from location 14

Figure 101: View from location 15

11.7 Heritage

The proposed alternative corridors cut through mixed land use areas of the North West Province. The proposed powerline routes and substation sites have been established through consideration of biophysical, social, technical, and cultural aspects. The Environmental Impact Assessment process aims to provide a final site assessment of the proposed development site based on biophysical, social, cultural, and technical considerations. The following section presents results of the archaeological and Heritage survey conducted along the proposed projectarea.

Table 85: Heritage Resources key findings

Heritage Resource	Status/Findings
Buildings, structures, places and equipment of cultural significance	There sparsely located farmstead and farm structures of varying significance throughout the project area. Significant historical buildings occur in urban locations such as Ventersdrop, Lichtenburg and Mahikeng
Areas to which oral traditions are attached or which are associated with intangible heritage	None exists on the study area
Historical settlements and townscapes	The proposed powerline bypasses major towns in the project area
Landscapes and natural features of cultural significance	None
Archaeological and palaeontological sites	The project area is archaeologically and palaeontological sensitive however no significant archaeological remains were recorded during the survey
Graves and burial grounds	There are farms and villages where graves occur at varying distances from the proposed routes. Farm owners have been requested to declare burial sites within their farms
Movable objects	None
Overall comment	The surveyed area has heritage resources of varying significance most of which may be located within privately owned farms where access is very restricted. The substation sites are located within grazing area With limited chances of encountering heritage resources.

11.7.1 Alternative corridor 1

11.7.1.1 Archaeological and Heritage Site

The proposed alternative corridor 1 did not yield any confirmable archaeological sites or material. The affected landscape is heavily degraded from current agriculture activities, small scale mining, infrastructure developments and human settlements. There are corn fields, residential, small scale mining, grazing land, powerlines, roads, and other associated infrastructures along the entire project area. As such the proposed powerline, will be an additional development on the project area. It is assumed that the chances of recovering significant archaeological materials were seriously compromised and limited due to destructive land use patterns such as clearance and residential developments.

11.7.1.2 Buildings and Structures older than 60 years

The field study identified several buildings and structures of varying significance along the proposed Alternative 1 powerline route. Most of these building are farmsteads and farm structures which are still in use (figure 116 and 118). The study did not assess their significance and could not establish their ages because the farm owners restricted access to their premises and farms (Nicoline peers.com). There are also ruined farm buildings and structures some of which may have been for farm workers or for evicted African populations to pave way for European settlements and farms (figure 118). Although most of the ruined buildings are not of any architectural value they are very significant in respected of ongoing land restitution and must not be destroyed. The survey recorded several ruined homesteads along the proposed powerline route. The ruined buildings and structures are protected by Section 34 of the NHRA. The ages and significance of potentially affected buildings and structures will be assessed in detail once the final route selection is concluded. In addition, the 2km wide surveyed corridor provides adequate space for avoiding any significant buildings and structures on the direct footprint of the proposed powerline route.

11.7.1.3 Burial grounds and graves

Human remains and burials are commonly found close to archaeological sites; they may be found in abandoned and neglected burial sites, or occur sporadically anywhere as a result of prehistoric activity, victims of conflict or crime. It is often difficult to detect the presence of archaeological human remains on the landscape as these burials, in most cases, are not marked at the surface. Archaeological and historical burials are usually identified when they are exposed through erosion and earth moving activities for infrastructure developments such as powerlines and roads. In some instances, packed stones or stones may indicate the presence of informal pre-colonial burials.

The field survey confirmed that there are several burial sites located within settlements and farmsteads. In this regard farm owners were consulted to find out if any burial sites are located within their farms. Some farmers confirmed that that they are graves located in their farms. They indicated that some belong to farm labourers and previous farm owners. However, access to the affected farms is highly restricted and the matter is being dealt with by the Public Participation Practitioner for the project. Given the length of the line and restricted access to some farms and mining operations, a walk down survey is necessary once the final route is selected. Formal cemeteries do not create problems for any infrastructure developments because they are known and developments can be planned to avoid them. The possibility of encountering previously unidentified burial sites is high along the proposed Aaternative corridor 1, should such sites be identified during construction, they are still protected by applicable legislations and they should be protected. Burial sites older than 60 years are protected by the NHRA and those younger than 60 years are protected by the Human Tissue Act. Exhumation of graves must confirm to the standards set out in the ordinance on excavation (Ordinance no.12 of 1980 which replaced the old Transvaal Ordinance no.7 of 1925.

Significance valuation for Burial Ground, Historic Cemeteries, and Individual Graves:

The significance of burial grounds and gravesites is closely tied to their age and historical, cultural, and social context. Nonetheless, every burial should be considered as of high socio-cultural significance protected by practices, a series of legislations, and municipal ordinances.

11.7.1.4 Historical Monuments and Memorials

The survey did not identify any historical monument and public memorials along the proposed alternative corridor 1. There are no sites within the proposed development site that are on the National Heritage or provincial List. However, it should be noted that there are Historical Monuments listed on SAHRIS Data base in the Ventersdorp, Lichtenburg, Coligny and Mahikeng areas of North West Province. The proposed development will not impact on any listed monuments and memorials in the project area because it was designed to avoid known heritage sites.

11.7.1.5 Battle fields

The survey did not identify any battle fields along the proposed alternative corridor 1. Most battlefields are located in the Mahikeng area but none of them is located along the proposed powerline route.

11.7.1.6 Palaeontology

The Palaentological sensitivity map shows that the proposed alternative corridor 1 cuts through a sensitive area. Limestone deposits which may contain fossilised remains of animals, plants or early hominids occur in the project area. For example, the skeleton of the Taung child, which is related to Australopithecine family, was found in limestone deposits at Taung in the North-West Province whilst limestone deposits near Makapans Cave in Mokopane revealed remains of Homo erectus and other extinct animal species.

11.7.1.7 Archaeo-Metallurgy, Prehistoric Mining and Mining Heritage

There are historical and current mining activities in the entire North West Province, however the proposed Alternative 1 powerline route will not affect any of the listed heritage sites such as Bekkerville Provincial Heritage site. Evidence of previous diggings were recorded during the survey but most of them are fairly recent and not protected by the NHRA (figure 119).

11.7.1.8 Natural Heritage

The survey recorded several patches of blue gums scattered throughout the project area. Patches of blue gums mark the footprint of early European settlements in the project area, they are associated with farmsteads and historical graves (figure 117 and 121). As such where ever they occur they provide insights about colonial history of the area and must be avoided where possible.

11.7.1.9 Visual impacts

The proposed alternative corridors will certainly spoil the visual quality of the landscape. A full visual study was commissioned as part of the specialist studies. Results of the survey will be share during Specialist Integration meetings for the project.

11.7.2 Alternative corridor 2a Archaeological and Heritage Site

The proposed alternative corridor 2a did not yield any confirmable archaeological sites or material within the 2km corridor. Three isolated potsherds were retrieved along the road construction site at Tshoneng (figure 122). The affected landscape is heavily degraded from previous and current mining, infrastructure development and agriculture activities along the entire route. There are residential, grazing land, powerlines, roads, and other associated infrastructures around the entire project area. As such the proposed powerline development, will be an additional development on the project area. It is assumed that the chances of recovering significant archaeological materials were seriously compromised and limited due to destructive land use patterns such as clearance and residential developments.

11.7.2.1 Buildings and Structures older than 60 years

The survey identified several ruined buildings and farm structures along the proposed alternative corridor 1 (figure 116 and 118). Most of the recorded buildings and structures are located within privately owned farms where access is restricted due to security reasons. As such the study could not establish the exact ages of the structures to determine their significance and subsequent protection. The study team sent questionnaires to farmers along the powerline route to declare heritage resources in their farms and responses are trickling in slowly.

11.7.2.2 Burial grounds and graves

The field survey confirmed one burial site located on the farm Farm Wildfontein in Merafong Local Municipality. They are located at GPS coordinates S26° 9' 50.4" E 027° 22' 9.4" (see Plate 29 and 30. The burial site is located approximately 400m from the proposed Alternative 1 powerline route. The site has more than 200 graves probably of farm workers. The graves are arranged in rows and are marked by oval shaped stone piles, a significant number is marked by cement plaster and inscribed tombstones. The oldest grave is for 1937, which may mean that the graves belongs to former labour tenants. Although the possibility of encountering previously unidentified burial sites is low on the proposed development sites, should such sites be identified during construction, they are still protected by applicable legislations and they should be protected (also see Appendixes for more details). Burial sites older than 60 years are protected by the NHRA and those younger than 60 years are protected by the Human Tissue Act. Exhumation of graves must confirm to the standards set out in the ordinance on excavation (Ordinance no.12 of 1980 which replaced the old Transvaal Ordinance no.7 of 1925.

11.7.2.3 Historical Monuments and Memorials

The survey did not identify any historical monument and public memorials along the proposed powerline route. There are no sites within the proposed development site that are on the National Heritage or provincial List. However, it should be noted that there are Historical Monuments listed on SAHRIS Data base in the Ventersdorp, Lichtenburg and Mahikeng areas. The proposed construction of powerlline will not impact on any listed heritage sites in the project area.

11.7.2.4 Palaeontology

The SAHRIS Palaeontological sensitive map indicates that the greater part of the proposed alternative corridor 2 cuts through palaeontologically sensitive areas. Limestone deposits which may contain fossilised remains of animals, plants or early hominids occur in the project area. For example, the skeleton of the Taung child, which is related to Australopithecine family, was found in limestone deposits at Taung in the North- West Province whilst limestone deposits near Makapans Cave in Mokopane revealed remains of Homo Erectus and other extinct animal species. As such a palaeontological study was commissioned and finding will be shared during the integration meetings for finalisation of this report.

11.7.2.5 Mining Heritage

The survey observed that there are several historical diggings and prospecting activities in the entire project area. The proposed alternative corridor 2 powerline route was shifted to the south at Watershed Substation to avoid impacting on the Bekkerville Grade 2 Diamond Rush site. Diggings recorded within privately owned farms were not assessed because entry to the farms is restricted.

11.7.2.6 Natural Heritage

The survey recorded patches of blue gums along the proposed powerline route. Most of them occur in private farms where access is highly restricted. Patches of blue gums are significant because they are often associated with farmsteads/homesteads and burials and they mark and define footprints of early European settlements such as farms, stores and homesteads in the project area.

11.7.3 Alternative 1 Substation Site Archaeological and Heritage Site

The proposed substation sites was assessed alongside the proposed powerline routes. The proposed substation site did not yield any confirmable archaeological sites or material. The affected landscape is heavily degraded from previous agriculture activities. The site is located within a communal residential and grazing area. As such the proposed substation, will be an additional development on the project area (Figure 123).

It is assumed that the chances of recovering significant archaeological materials were seriously compromised and limited due to destructive land use patterns such as clearance and residential developments.

11.7.3.1 Buildings and Structures older than 60 years

The proposed substation site is located in a grazing area approximately 3km from the nearest village. There are no buildings or structures within the proposed substation site. Therefore, the proposed substation does not trigger Section 34 of the NHRA.

11.7.3.2 Burial grounds and graves

The field survey did not record any burial site within the proposed substation site. Although the possibility of encountering previously unidentified burial sites is low on the proposed substation sites, should such sites be identified during construction, they are still protected by applicable legislations and they should be protected. Burial sites older than 60 years are protected by the NHRA and those younger than 60 years are protected by the Human Tissue Act. Exhumation of graves must confirm to the standards set out in the ordinance on excavation (Ordinance no.12 of 1980 which replaced the old Transvaal Ordinance No.7 Of 1925.

11.7.3.3 Historical Monuments and Memorials

The survey did not identify and historical monument and public memorials within the proposed substation site. There are no sites within the proposed development site that are on the National Heritage or Provincial List. However, it should be noted that there are Historical Monuments listed on SAHRIS Data base in the Mahikeng area. The proposed substation will not impact on any listed heritage sites in the project area.

11.7.4 Alternative 2 Substation Site (Purple) Archaeological and Heritage Site

The proposed substation site did not yield any confirmable archaeological sites or remains. The site is located adjacent to Alternative 1 substation site. Similarly, the site did not yield any confirmable archaeological remains.

11.7.4.1 Buildings and Structures older than 60 years

The proposed substation site is located within a communal grazing area where there are no settlements. The survey did not record any buildings or structures within the proposed substation site. Similarly, the site does not trigger Section 4 of the NHRA (figure 116 and 118).

11.7.4.2 Burial grounds and graves

The field survey did not record any burial site within the proposed substation site. The site is located within a communal grazing area located approximately 3km from the nearest village. It is understood that the nearest village has formal cemetery and the chances of encountering contemporary graves within the site are limited. Although the possibility of encountering previously unidentified burial sites is low on the proposed development site, should such sites be identified during construction, they are still protected by applicable legislations and they should be protected (also see Appendixes for more details). Burial sites older than 60 years are protected by the NHRA and those younger than 60 years are protected by the Human Tissue Act. Exhumation of graves must confirm to the standards set out in the ordinance on excavation (Ordinance no.12 of 1980 which replaced the old Transvaal Ordinance no.7 of 1925.

11.7.4.3 Historical Monuments and Memorials

The survey did not identify and historical monument and public memorials within the proposed substation site. There are no sites within the proposed development site that are on the National Heritage or provincial List. However, it should be noted that there are Historical Monuments listed on SAHRIS Data base in the Mahikeng area. The proposed powerline and sudation development will not impact on any listed heritage sites in the project area.

Figure 102: Pluto Substation in Gauteng

Figure 103: View of Agricultural fields

Figure 105: Sunflower plants within the study area

Figure 106: Maize fields in study area

Figure 107: Cultivated fields in the study area

Figure 108: View of existing Powerline from Pluto substation to Watershed substation

Figure 109: Existing isolated Farm structure

Figure 110: View of the Blue gum patches with the study area

Figure 111: Abandoned settlement with the study area


Figure 112: Small Scale mining site


Figure 113: Farm burial site

Figure 114: Widfontein Burial site

Figure 115: Potsherds retrieved from a construction site near alternative corridor 2


Figure 116: Substation site

11.8 Economic

The study area was divided into different zones, the following activities were used to identify the different zones:

- Irrigation activities, vegetables and orchard production, as the construction of a power line and the maintenance can impact on these activities, especially in the case of centre pivots;
- Urban settlements, as a power line and servitude area is required to bypass existing built-up areas;
- Mining and industrial activities;
- Dryland activities: maize, sunflower, groundnuts and soya production;
- Livestock farming;
- Game farming;
- Tourism activities; and
- Conservation areas.

The zones were identified by grouping a number of similar identified activities which are of varying lengths, but at least make economic sense. The following zones are used to differentiate the two alternative corridors:

- P – (Purple) alternative corridor 1
- G – (Green) alternative corridor 2

11.8.1 Economic Zone Description

From the desktop studies and site visits the findings of activities along the routes were verified. A summary of the activities along the two alternative routes are reflected below:

Each of the two routes of the proposed alternative corridors was divided into Corridor Economic Zones in order to group the landuse, urban areas and industrial/mining activities.

- Alternative corridor 1 was generally referred to as the agricultural corridor as it was found that there are many farming activities within the buffer zone of this proposed corridor. Agricultural activities such as irrigation maize, wheat and cattle farming, pigs, sheep as well as chicken farms (broilers) were observed. The economic impact will, on the one side, negatively impact on the farming community, however, on the other side could also be beneficial in providing added power supply to the farmers (especially irrigation farmers), towns and industries. The western leg of this route was slightly amended in order to bypass some possible problem areas. This route was divided, according to the dominant economic activates along the route, into seven segments , namely:

- CEZ-G1 covers the area along the route from Pluto Sub-station to Rysmierbult, a distance of approximately 40km. This segment of the route passes through an area mainly used for grazing with very limited dryland crop production. Khutsong is the closest settlement, approximately 3km to the south of the route. The Route is located outside of and along the northern perimeter of the Abe Bailey Nature Reserve which is located north of the Khutsong settlement.
- CEZ-G2 covers the area along the route from Rysmierbult to the point where the corridor merges with the Purple Route, a distance of approximately 120km. This segment of the route passes through an area of intensive dryland maize and wheat fields, with some irrigation and layer houses in the vicinity of Rysmierbult and a cluster of pivots south of Ventersdorp. Cattle farming, pigs and sheep are also present. Cement quarries such as those on Dudfield 21km from Lichtenburg in the buffer zone (between Itsoneng and Lichtenburg) may be affected. The Lafarge quarry, also extracting cement, lies outside of the corridor in Bodibe between Mahikeng and Lichtenburg. The towns of Ventersdorp, Coligny and the settlements at Boikhutso and Blydeville (south of Lichtenburg) are located approximately 9.7km, 4.8km and 4.8km respectively from the corridor. The Lichtenburg airport is approximately 9km north-east of the corridor.
- CEZ-G3 covers the area where alternative corridor 1 route and alternative corridor 2 route follow the same route, a distance of approximately 14km. This segment of the route passes through an area of intensive dryland maize and wheat fields, with limited pivot irrigation. A quarry, also extracting cement, operates in this area.
- CEZ-G4 covers the area along the alternative corridor 1 route from south of the village Sheila to Buhrmannsdrif (railway siding), a distance of approximately 30km. The route passes through an area of continuous dryland maize with very little irrigation, including a pomegranate orchard. In the south the village near Sheila – Itsoneng (or Itsoseng) is the closest settlement and also needs to be considered for possible affects due to the proposed power line development. At Rooigrond, west of the corridor, a number of broilers are present within the buffer zone of the route.

- CEZ-G5 covers the area from Buhrmannsdrif (railway siding) in a northern direction for approximately 28km. The route passes through an area of continuous dryland maize farming.
- CEZ-G6 covers the area in a western, then southern direction to the proposed Mahikeng Substation Site, a distance of approximately 22km. The route avoids the urban areas and passes south of the Khunotswana Settlement and crosses an area with several dryland crops. Many layer houses are present (the same layer houses as along the Purple Route) where the line turns south in the direction of the proposed Mahikeng Substation Site.
- CEZ-G7 covers the area of the proposed Mahikeng Substation Site. The area has settlements with subsistence farming.

- Alternative corridor 2a runs from the Pluto substation near Carletonville to the existing Watershed Substation 5km north of Lichtenburg, then continues north to the vicinity of Ottoshoop and then east to proposed Mahikeng Substation sites. The corridor was divided into four segments, according to the dominant economic activities along the route, namely:
  - CEZ-P1 covers the area along the route from the Pluto Sub-station for a distance of approximately 155km to the point where the Green and Purple Corridors merge. The corridor crosses a number of dry land maize fields in the initial 10km where after only grazing, cattle and sheep farming were observed. At Goedgevonden a number of irrigation pivots are present north of the proposed power line. At the Watershed Substation the route crosses the Lichtenburg Game Breeding Centre. No urban areas are located close to the corridor. Should it be possible to schedule the construction period to take place after the harvesting of crops it will mitigate the impact on the farmers.
  - CEZ-P2 covers the area where both the proposed alternative corridors follow the same route, a distance of approximately 14km. This segment of the route passes through an area of intensive dryland maize and wheat fields, with limited pivot irrigation. A quarry, also extracting cement, operates in this area, but located outside the proposed power line development.
  - CEZ-P3 covers the area from the point where the two routes split to the point the two routes meet again east of Mmabatho. The route passes through an area of continuous dryland maize, broilers and very limited irrigation and includes a pomegranate orchard. At Rooigrond, east of the corridor, a number of broiler units are present outside the buffer zone of the route.

- CEZ-P4 covers the area from where the two routes met to where the two routes again merge, a distance of approximately 24km. The corridor crosses an area of mainly dryland crops and stock farming.
- CEZ-P5 covers the area from the vicinity south of the R49 main road to Mahikeng Substation Site at distance of approximately 22km. This route avoids the urban areas and passes south of the Khunotswana settlement and crosses an area with several dryland crops. A large number of layer houses are present (the same layer houses as on the alternative corridor 1 where the route turns south-west to the Mahikeng Substation Site. As in the case of the alternative corridor 1 the Mahikeng International Airport is located approximately 8km south, and the and the Mahiking North landing strip approximately 9km south-east of the Mahikeng Substation sites.
- CEZ-P6 covers the area of the proposed Mahikeng Substation Site. The area has settlements with subsistence farming.

11.9 Paleontological

The largest part of the study area is underlain by the Malmani Subgroup dolomites. This subgroup is subdivided into five formations based on the chert content, stromatolite structure, intercalated shales, erosion surfaces and colour of the dolomite (Eriksson et al., 2009). The Malmani Subgroup which follows on the Black Reef Formation is in places up to 2000 m thick and forms a substantial part of the geology of the North West Province. The proposed alternative corridor 2a runs for most of its length along the dolomitic region between Carletonville and Mafikeng.

The Oaktree Formation which forms the oldest unit of the Malmani Subgroup consists of 10-200 m of carbonaceous shales, stromatolitic dolomites and quartzites. The following Monte Christo Formation is a 300-500 m thick sedimentary unit which consists of erosive breccia and stromatolitic and oolitic platformal dolomites. The Lyttelton Formation which follows the Monte Christo Formation consists of a 100-200 m thick sequence of shales, quartzites and stromatolitic dolomites. This formation is covered by the up to 600m chert-rich Eccles Formation which also contains a series of erosion breccias which seperates it from the upper up to 400 m thick unit of the Malmani Subgroup – the Frisco Formation - which is characterised by its stromatolitic dolomites which becomes shale-rich towards the top of this unit (Eriksson et al., 2009).

The proposed alternative corridor 1 runs along a variety of older geological units of the Witwatersrand and Transvaal Supergroup. In places it also traverses Tertiary calcrete and unconsolidated Quaternary sediments. During the field assessment particular attention was given to the areas demarcated as having a high palaeontological sensitivity. These areas are underlain by dolomite and chert. Sections that are demarcated as having a medium palaeontological sensitivity were also visited. These areas are underlain mostly by non-fossiliferous shales, conglomerate, lavas and tuff and potentially fossiliferous Carboniferous-aged diamictite and shale and Quaternary aged calcrete, gravel, sand and soil and Carboniferous-aged diamictite and shale. No distinct fossils were discovered during the field assessment.

12. COMPARATIVE ASSESSMENT OF THE ALTERNATIVES IN TERMS OF PREFERENCE

The comparative assessment of the alternative corridors within the study area is represented on the Table 87 below. As can be seen Figure 5, there are basically two alternative corridors, namely, Corridor 1 (green) and Corridor 2a (purple). The substation site alternatives will be compared after the 30 day public participation period.

Table 86: The Table represents the comparative assessment of the alignment alternatives based on the socio-economic and environmental aspects of the study area

Specialist Study	Alternative corridor 1	Alternative corridor 2a	Summary
Flora	Alternative corridor 1 has more number of flora species due to many patches of natural remaining vegetation. Although sensitive plants have been identified along both alternative corridors.	Alternative corridor 2 runs along an already existing powerline and access road and from the sensitivity it is less sensitive when compared to alternative corridor 1.	Alternative corridor 2a is preferred.
Fauna	Faunal compositions are believed to remain the same irrespective of the intensity of the construction activities (e.g. road construction) associated with the power lines, but the distribution and abundance of species could effectively change. Many habitat specialists could suffer from local range contraction.	High numbers of fauna (mammals, reptiles, amphibians) corresponded to Corridor 2a, which also hold a higher richness of bird species, a higher number of Red listed bird species and higher reporting rates for Red Listed birds (sensu SABAP1 & SABAP2) when compared to Corridor 1	Alternative corridor 1 is preferred.
Avi-Fauna	Alternative corridor 1, when compared to Corridor 2a, is "more feasible". In addition, Corridor 1 also contains lower	Alternative corridor 2a is "less preferred" since it contains higher faunal richness values and bird reporting rates for threatened and near	Alternative corridor 1 is preferred.

Specialist Study	Alternative corridor 1	Alternative corridor 2a	Summary
	recorded bird richness values and has lower reporting rates for threatened and near threatened birds when compared to Alternative corridor 2a.	threatened bird species when compared to Alternative corridor 1. In addition, a large part of Alternative corridor 2a is utilised as foraging habitat for the endangered Cape Vulture (Gyps coprotheres) and additional transmission lines within this corridor may increase the risk of vultures colliding with the overhead cables and result in mortalities, especially since Cape Vultures tend to forage in loose aggregations (and feed on carcasses in large numbers).	
Watercourse	Alternative corridor 1 is regarded as more sensitive in terms of watercourses, including wetlands, compared to alternative corridor 2a based on results and interpretations from this study. This is also reflected in the two High post-mitigation significance ratings in Alternative corridor 1 during the construction phase, with none in Alternative corridor 2a From a watercourse consideration. It is recommended that Alternative corridor	It is recommended that Alternative corridor 2a be selected for the final 1X400 kV powerline because alternative corridor 2a traversed the highest number (when compared to Corridor 1) of drainage lines (per unit area) and the highest number of pans, depressions and flat wetlands.	Alternative corridor 2a is preferred.

Specialist Study	Alternative corridor 1	Alternative corridor 2a	Summary
	2a be selected for the final 1X400 kV powerline.		
Soil & Agricultural Potential	Alternative corridor 1 will have the largest potential impact due to the large areas of agriculture land uses (dryland, irrigated, orchards, subsistence agriculture) it traverses.	Alternative corridor 2a will have the smallest potential impact due to the limited areas of agriculture land uses (dryland, irrigated, orchards and subsistence agriculture) it traverses.	Alternative corridor 2a is preferred.
Visual (VIA)	Alternative corridor 1 is the highest visibility when compared to alternative corridor 2a.	Alternative corridor 2a is the preferred option but only by 15% difference in GIS Pixel values. Alternative corridor 2a was less exposed when compared to alternative corridor 1.	Alternative corridor 2a is preferred.
Social (SIA)	A trend in the social concerns that would display a likeness between the two corridors. Corridor 1 is also the corridor with the most impacts that are associated with it and therefore there would need to be greater effort and measures put into place to mitigate them.	Corridor 2a did not yield any high impact ratings pre or post mitigation. There are moderate ratings for the farming linked land uses and low ratings for pivot type farming and the impact on the Mafikeng Game Reserve and quality of life impacts. It has half the amount of impacts associated it compared to corridor 1.	Alternative corridor 2a is preferred.
Economic	There is a very small difference in the overall results in respect of the two corridors. According to our study Alternative corridor 1 is the preferable option because it	Alternative corridor 2a is dominated by small holdings and agricultural activities.	Alternative corridor 1 is preferred.

Specialist Study	Alternative corridor 1	Alternative corridor 2a	Summary
	consists of less small holdings and agricultural activities.		
Heritage (HIA)	Alternative corridor 1 is relatively longer than alternative corridor 2a.	Alternative corridor 2a has a slight advantage because of it is relatively shorter and also runs along existing powerline from Pluto Substation to Watershed Substation.	Alternative corridor 2a is preferred.
Paleontology	Alternative Corridor 1 has an advantage because alternative 2a has got a much higher probability to impact on fossils than the proposed alternative corridor 1.	Alternative Corridor 2a is demarcated as having a High Palaeontological Sensitivity due to the probability of finding stromatolites along the proposed route.	Alternative corridor 1 is preferred.

13. PLAN OF STUDY FOR ENVIRONMENTAL IMPACT ASSESSMENT (POS EIA)

13.1 Introduction

The PoS EIA outlines how Baagi Environmental Consultancy will approach the Environmental Impact Assessment Phase of the EIA Process and provide information as required for such a document in terms of Appendix 3 of the EIA Regulations (December 2014, as Amended on the 07th of April 2017) compiled in terms of Chapter 5 of the National Environmental Management Act, 1998 (Act 107 of 1998) as amended.

According to DEA's guideline documents the Plan of Study for Environmental Impact Assessments must include (as per Regulation):

i. A description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity.
ii. A description of the aspects to be assessed as part of the environmental impact assessment process.
iii. Aspects to be assessed by specialists.
iv. A description of the proposed method of assessing the environmental aspects, including a description of the proposed method of assessing the environmental aspects including aspects to be assessed by specialists.
v. A description of the proposed method of assessing duration and significance.
vi. An indication of the stages at which the competent authority will be consulted.
vii. Particulars of the public participation process that will be conducted during the environmental impact assessment process.
viii. A description of the tasks that will be undertaken as part of the environmental impact assessment process.
ix. Identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

13.2 Description of the Activity

The Proposed Mahikeng Main Transmission Substation (MTS) and 1x400kV Pluto-Mahikeng Powerline Project includes the following activities, but are not limited to:

- Establishing the Mafikeng MTS and design for an end state of 3x 500MVA 400/132kV transformers and 2 of the 500MVA transformers on commissioning;
- Designing for an end state of 8x 132kV and equip 3 of the 132kV feeder bays on commissioning;
- The erection of a communication tower at the Mahikeng Main Transmission Substation;
- The construction of access roads; and

- The establishment of an approximately 250km 400kV transmission powerline from Pluto Main Transmission Substation to the proposed Mahikeng Main Transmission Substation.

13.3 A description of the Tasks to be performed

13.3.1 Authority Consultation

There will be a consultation meeting if necessary with the various authorities (DEA) on issues that need to be addressed.

13.3.2 Public Participation Process (Impact Assessment Phase)

13.3.2.1 Project Advertisement

The Scoping Report has been accepted by the DEA, the next step of the project would be the announcement of the impact assessment phase, with an invitation to the public and registered I&AP's to participate in the EIA Phase Public Participation Process. The methods of announcing the impact assessment phase to I&APs will be through newspaper advertisements (local, regional and/or national) and a letter, emails and bulk SMS's will be used to inform or invite all I&APs within the established database. This newspaper advertisement will invite the I&APs and broader public to attend the public meetings and will include the date, time and venue as well as the purpose of the public meetings. Also included in this newspaper advertisement will be the availability of the draft Environmental Impact Assessment Report (DEIAR) for public comment, where it will be available, and the review period and to whom and where their written comments can be submitted.

Table 87: List of Newspapers that will be used during the DEIAR Phase

<table>
<tr><th>Newspaper</th><th>Language</th><th>Distribution areas</th></tr>
<tr><td>Carletonville Herald</td><td>English & Setswana</td><td>Gauteng Province</td></tr>
<tr><td>Mafikeng Mail</td><td>English & Setswana</td><td rowspan="2">North West Province</td></tr>
<tr><td>Noordwester</td><td>Afrikaans</td></tr>
<tr><td>Star</td><td>English</td><td>Gauteng & North West Province</td></tr>
</table>

13.3.2.2 Consultation with I&APs and Authorities

Meetings will be arranged by Baagi Environmental Consultancy with the authorities if necessary. However, consultation with authorities will be an ongoing process. Public Meetings will be arranged for I&AP's to have an opportunity to deliberate about the approach and issues during Impact Assessment. There will be on-going communication through letters via both post and email or advertisements every time key milestones are achieved (i.e. availability of Draft EIAR and the EMPr).The following meetings will be held during the DEIAR Phase:

Table 88: Proposed meetings to be held during the DEIAR Phase

Focus Group Meetings	**FGM #1:** Authority #1 – Ventersdorp	14 August 2018	09h00 – 11h30
	FGM #3: LOs #2 – Coligny		14h30 - 15h00
	FGM #4: LOs #3– Lichtenburg	15 August 2018	17h30 – 19h30
	FGM #5: Authority #2 – Mahikeng		09h00 – 11h30
	FGM #6: LOs #4 - Buhrmannsdrif		13h00 – 15h30
Key Stakeholder Workshops	**KSW #1:** Carletonville / Pretoria (Gauteng Province)	13 August 2018	09h00 – 11h30
	KSW #2: Mahikeng	16 August 2018	09h00 – 11h30
Focus Group Meeting	**FGM #** Carletonville	16 August 2018	14h00-16h00
Public Meetings	**PM #1:** Khutsong	21 August 2018	09h00 – 12h00
	PM #2: Goedgevonden Village		15h00 – 18h00
	PM #3: Coligny	22 August 2018	09h00 – 12h00
	PM #4: Lichtenburg		14h00 – 17h00
	PM #5: Verdwaal 1	23 August 2018	09h00 – 12h00
	PM #6: Miga Village		15h00 – 18h00

13.3.2.3 Compilation of Issues and Responses Report (IRR)

An IRR will be prepared based on the issues identified as well as the findings from the specialists engaged in the process. Issues from I&APs can be obtained in different ways, either via fax, postal, telephone and e-mail. The IRR will be regularly updated as more issues arise during Impact Assessment Phase.

13.3.2.4 Announcement of Availability of Draft EIR and EMPr

A Draft EIR and EMPr is prepared based on the information derived during the Scoping Process. Specialist findings contribute to the compilation of the Draft EIAR. Some of the public comments that formed part of the FSR may be taken further into the Impact Assessment Phase.

Once the draft EIR and EMPr are available, the public will be informed by letters and newspaper advertisement. The report will also be circulated or distributed to the public venues for public review for a period of at least 30 days.Hard copies of the DEIAR will be delivered/courier to the following commenting authorities:

- Department of Environmental Affairs (3 copies, at this stage)
- Gauteng Department of Agriculture and Rural Development
- North West Department of Rural, Environment and Agricultural Development
- Department of Agriculture, Forestry and Fisheries: Gauteng and North West Province
- Department of Water and Sanitation: Gauteng and North-West Provinces

Hard copies of the DEIAR will also be delivered/courier to the following public places within the study area (listed according to towns along the two proposed Corridors from Carletonville to Mahikeng):

- Carletonville Library
- Khutsong South Library
- Welverdiend Library (as requested by Cllr Thabo Mokuke at the FGM held 19 January 2018)
- Ventersdorp Library
- Coligny Library
- Lichtenburg Library
- Boikhutso Library
- Itsoseng Library
- Ottoshoop Library
- Mahikeng Library
- Miga Library
- Zeerust Library

It is therefore envisaged that **21** hard copies of the DEIAR will be distributed.

It is envisaged, at this stage, that 21 soft copies on compact discs (CDs) of the DEIAR will be delivered/courier to the following stakeholders:

- West Rand District Municipality
- Merafong City Local Municipality
- Dr Kenneth Kaunda District Municipality
- JB Marks Local Municipality
- Ngaka Modiri Molema District Municipality
- Ditsobotla Local Municipality
- Mahikeng Local Municipality
- South African National Biodiversity Institute
- Department of Sports, Arts & Culture (Heritage Resources Units: Gauteng & North West Provinces
- Department of Public Works and Roads: Gauteng and North West Provinces
- Square Kilometre Array
- South African Civil Aviation Authority
- Air Traffic and Navigation Services
- Transnet Freight Rail: Gauteng & North West Provinces
- Sentech
- Telkom and OpenServe
- Endangered Wildlife Trust
- Birdlife South Africa
- AgriSA
- TLU SA

The DEIAR will up uploaded on SAHRIS, the official site for all Reports (including Heritage) to be uploaded for the South African Heritage Resources Agency's review and comment.

13.3.3 Final Environmental Impact Report and Draft EMPr

Public Participation will commence from the 30th of July 2018 to the 31st of August 2018. Once the period for commenting on the draft EIR and EMPr has elapsed, the Final Environmental Impact Report and Draft Environmental Management Plan will be compiled. The compilation of the Final EIR and EMPr will incorporate issues identified during the public review. Final reports will be placed on the Eskom EIA website and sent to the authority (DEA) for approval.

13.3.4 Authority Review

The final report will be submitted to the competent authority for decision-making. The authority (DEA) may still require additional information if deemed necessary while reviewing the Final EIR.

(Refer to Appendix D for the Authority Communication, I&APs Communication, Landowner Communication, Database and the Public Participation Plan from the Scoping Phase)

13.4 Timetable of Tasks

Table 89: The Anticipated Timeframes of the Tasks for the Proposed Project

TASKS	TIMING
Registration of Project with the Relevant Authority	November 2017
Reference Number Received	04 December 2017
Draft Scoping Report & Public Review	22 November 2017-23 January 2018
Extended Public Review Period	February 2018
Amended Draft Scoping Report & Public Review	March 2018
Submission of Final Draft Scoping Report	April 2018
Specialist Studies	April 2018
Draft EIR & EMP	June 2018
Stakeholder & I&AP Engagement	July 2018
Final EIR & draft EMP	August 2018
Review of Final EIR & EMPr	September 2018
Submission to Authority	September 2018
Environmental Authorisation	January 2019
Appeal Period	January 2019 to February 2019

13.5 Impact Assessment Methodology

The impact methodology will concentrate on addressing key issues. The methodology employed in this report thus results in a circular route, which allows for the evaluation of the efficiency of the process itself. The assessment of actions in each phase will be conducted in the following order:

- Assessment of key issues.
- Analysis of the activities relating to the proposed development.
- Assessment of the potential impacts arising from the activities, without mitigation.

- Investigation of the relevant measures to avoid, mitigate or manage negative impacts. Should irreplaceable harm to the environment (both the social and bio-physical) be expected, this will be stated as such.

Activities within the framework of the proposed project give rise to certain impacts. For the purposes of assessing these impacts, the project has been divided into three phases from which impact activities can be identified, namely:

13.5.1 Construction Phase

This phase is concerned with all the construction and construction related activities on site, until the contractor leaves the site. Thus, the main activities will be the establishment of construction camp sites, access routes, clearance of servitude to facilitate access, digging the foundations for towers, excavation of pits for transformer foundation, erection of transformers and associated structures, movement of construction workforce, equipment, construction vehicles and materials, etc. The above-mentioned activities result in different types of impacts and some contribute to cumulative impacts.

13.5.2 Operational Phase

This phase involve activities that are post construction, i.e. the transmission of power between substations. This phase requires a rehabilitation plan and monitoring system that will ensure the impacts of construction, such as vegetation pruning, erosion, colonisation of area by alien species, etc. are monitored and inspected as an ongoing process. This involves the maintenance of the facilities to ensure continuous proper functioning of the equipment or resource.

The impact rating is only clear once the impact is summarised in terms of its ratings. This approach enables analysis of the impact results, in terms of:

1. The number of severity criteria applicable as an indicator of influence / severity.
2. The changes in number of low, moderate and high ratings before and after avoidance, mitigation or management.
3. The changes in quantitative / weighted magnitude before and after mitigation.

The methodology also takes into consideration the three phases of development, construction, operational and decommissioning when applicable to the activity.

13.5.3 Assessment Criteria

An **impact** can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need. The significance of the aspects / impacts of the process will be rated by using a matrix derived from Plomp (2004) and adapted to some extent to fit this process. These matrices use the consequence and the likelihood of the different aspects and associated impacts to determine the significance of the impacts. The significance of the impacts will be determined through a synthesis of the criteria below:

Probability:	**This describes the likelihood of the impact actually occurring**
Improbable:	The possibility of the impact occurring is very low, due to the circumstances, design or experience.
Probable:	There is a probability that the impact will occur to the extent that provision must be made therefore.
Highly Probable:	It is most likely that the impact will occur at some stage of the development.
Definite:	The impact will take place regardless of any prevention plans and there can only be relied on mitigatory measures or contingency plans to contain the effect.
Duration:	**The lifetime of the impact**
Short Term:	The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
Medium Term:	The impact will last up to the end of the phases, where after it will be negated.
Long Term:	The impact will last for the entire operational phase of the project, but will be mitigated by direct human action or by natural processes thereafter.
Permanent:	The impact is non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.
Scale:	**The physical and spatial size of the impact**
Local:	The impacted area extends only as far as the activity, e.g. footprint
Site:	The impact could affect the whole, or a measurable portion of the above-mentioned properties.
Regional:	The impact could affect the area including the neighbouring residential areas.
Magnitude / Severity:	**Does the impact destroy the environment, or alter its function?**

Low: The impact alters the affected environment in such a way that natural processes are not affected.

Medium: The affected environment is altered, but functions and processes continue in a modified way.

High: Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Significance: This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required

Negligible: The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.

Low: The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.

Moderate: The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.

High: The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

Table 90: Weights Assigned to Each Attribute

Aspect	Description	Weight
Probability	Improbable	**1**
	Probable	**2**
	Highly Probable	**4**
	Definite	**5**
Duration	Short term	**1**
	Medium term	**3**
	Long term	**4**
	Permanent	**5**
Scale	Local	**1**
	Site	**2**
	Regional	**3**
Magnitude / Severity	Low	**2**
	Medium	**6**

	High	**8**
Significance	**SUM (Duration, Scale, Magnitude) x Probability**	
	Negligible	**≤ 20**
	Low	**> 20 ≤ 40**
	Moderate	**> 40 ≤ 60**
	High	**> 60**

The significance of each activity is rated without mitigation measures (WOM) and with mitigation (WM) measures for both construction, operational and closure phases of the proposed development.

13.6 Process to Identify Alternatives and Issues

The Integrated Environmental Management (IEM) procedure stipulates that an environmental investigation needs to consider feasible alternatives for any proposed development. The Department of Environmental Affairs therefore requires that a number of possible alternatives for accomplishing the same objectives should be considered. The considered alternatives during a Scoping Phase include technical alternatives, technology alternatives, alignment alternatives, source of energy alternatives, and the No-Go alternative. However, the following alternatives, namely alignment and No-Go alternatives will be assessed in detail during the Impact Assessment Phase.

The assessment of these alternatives will be investigated thoroughly to until a justifiable preferred alternative has been identified. The project team, specialists, landowners, technical advisor, I&APs and authorities (SAHRA, etc.) will collaborate in determining the most viable alternative. Specialists will assist with assessment of the cumulative impacts and later will contribute to the overall assessment of cumulative impacts when all relevant studies have been completed.

13.6.1 Impact Assessment with the Proposed Mitigation Measures and Recommendations for the Proposed Project

The purpose of this section is to identify potential impacts and to recommend mitigation measures to minimise detrimental environmental impacts. The following are identified as possible activities that will have impacts on the environment.

13.6.1.1 Impacts on Flora

13.6.1.1.1 Impacts of Powerlines on Vegetation

The most significant impact of electrical powerlines are expected to occur during the construction phase, as during the operational phase the impacts on the vegetation and can successfully be mitigated to limit or even negate the negative impacts. Arguably the greatest threat to the rehabilitation of disturbed areas, are the potential of invasive plant species to colonise the disturbed soil and spread into adjacent natural areas. If remedial measures and monitoring is properly employed, as well as the invasive alien management plan is employed (e.g. ESKOM's erosion guidelines and environmental policies as well as mitigation as set out by this report), the vegetation that will be disturbed during construction could rehabilitate well over time, and long term impacts on vegetation and faunal habitats could thus be minimal. Furthermore, where existing roads or servitudes are employed during construction and implementation, the impacts of these when compared with extensive agriculture or rural settlements, can be considered as medium to low.

13.6.1.1.2 Impacts of Substations

The construction of a substation necessitates the clearing of vegetation for the whole of the development footprint. It is thus assumed that no vegetation cover will be left on site and that some edge effects can occur within the surrounding vegetation. Once constructed, the substation is unlikely to significantly impact on the adjacent vegetation. The most probable impact in mixed bushveld is that due to the threat it poses to the substation infrastructure, natural fires will likely be prevented which could lead to a decrease in the health of adjacent natural vegetation.

Table 91: Flora Impact Asessment

Impact	Stage	Management measures	Magnitude	Scale	Duration	Probability	Significance before mitigation
Destruction of listed or protected plant species	Construction	Without Management	8	3	5	5	80
		With Management	6	1	5	2	24
Removal of the natural vegetation	Construction	Without Management	8	3	5	5	80
		With Management	6	1	5	4	48
Increased soil erosion, increase in silt loads and sedimentation	Construction	Without Management	8	3	5	5	75
		With Management	2	2	3	2	14
Establishment and spread of declared weeds	Construction	Without Management	8	2	4	5	70
		With Management	2	1	2	5	20
Positive impact by removing alien invasive plants, although care must be taken not to remove all vegetation at once, especially within the rainy season (could result in soil erosion and soil loss).	Operational and maintenance	Without Management	8	1	3	2	24
		With Management	6	1	1	2	12
Bush encroachment	Operational	Without Management	8	2	3	4	52
		With Management	6	1	3	2	20

13.6.1.1.3 Mitigation Measures and Recommendations

The following recommendations and mitigation measures should be taken into consideration in the EMPr and Environmental Authorisation:

- The construction of the powerline route and substation would inevitably require the removal of vegetation for the purpose of access roads, servitudes and the pylon footprint. Areas where structures are stored would flatten vegetation that could be detrimental to the persistence of the vegetation. In addition, the illegal disposal of construction material such as oil, cement etc. could destroy natural vegetation.
- An independent Ecological Control Officer (ECO) should be appointed to oversee construction.
- Areas designated for vegetation clearing should be identified and visibly marked off.

- Vegetation clearing in natural areas should be kept to a minimum and restricted to the proposed development footprint only, i.e. the confirmed servitude and access road.
- A temporary fence or demarcation must be erected around the construction area (include the servitude, construction camps, areas where material is stored and the actual footprint of the development) to prevent access to sensitive environs.
- Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area.
- No open fires are permitted within naturally vegetated areas.
- Formalise access roads and make use of existing roads including farm roadscand tracks where feasible, rather than creating new routes through naturally vegetated areas.
- A vegetation rehabilitation plan should be implemented. Grass can be removed as sods and stored within transformed vegetation, remove alien invasive vegetation prior to storing grasslands sods in transformed areas. Smaller shrubs and bulbs should also be removed and used for rehabilitation. The plants must preferably be removed during the winter months and be replanted by latest springtime. The grass sods should not be stacked on top of each other. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks.
- Construction workers may not remove flora and neither may anyone collect seed from the plants without permission from the local authority.
- No activities should take place during rainy events and at least 2 days afterwards.
- Re-alignment of some of the routes should be considered – especially where routes traverse riverine/wetland vegetation.
- Do not allow erosion to develop on a large scale before taking action.
- Make use of existing roads and tracks where feasible, rather than creating new routes through grassland areas.
- Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area.
- Runoff from roads must be managed to avoid erosion and pollution problems.
- Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover. The grassland can be removed as sods and re-established after construction is completed.

- Colonisation of the disturbed areas by plants species from the surrounding natural vegetation must be monitored to ensure that vegetation cover is sufficient within one growing season. If not, then the areas need to be rehabilitated with a grass seed mix containing species that naturally occur within the study area.
- Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.
- The plants of conservation concern should be removed by a suitably qualified specialist prior to construction. This can only be done if authorised by the local conservation authority (GDARD and NWREAD) by means of a permit. Once construction is complete, the plants should be reused as part of rehabilitation of the disturbed areas and replanted from where they were removed. The survival of these plants should be monitored for at least 3 years after rehabilitation.
- Where possible, construction activities must be restricted to previously disturbed areas.
- Implement a Plant Rescue and Rehabilitation Plan: Where the plants of conservation concern are deemed to be under threat from the construction activity, the plants should be removed by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the construction (Note, these plants may only be removed with the permission of the provincial authority - permit).
- Route deviations that take place after this report, should be checked by an ecologist / botanist for presence of plants of conservation concern.
- Construction workers may not tamper or remove these plants and neither may anyone collect seed from the plants without permission from the local authority.
- Cordon off the sensitive vegetation that house the protected plant species and the plants of conservation concern and protect from construction activities and vehicles.
- Slight deviations of access road / pylon alignments must be permitted, so as to avoid plant populations of conservation concern (DWA, 2005).
- Alien invasive species that were identified within the study area and in specific along the final route alignment should be removed prior to construction-related soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation.

- All alien seedlings and saplings must be removed as they become evident for the duration of construction.
- Manual / mechanical removal is preferred to chemical control.
- All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction areas. This should be verified by the ECO.
- Compile and implement an alien invasive monitoring plan to remove alien invasive plant species along the chosen route alignments, prior to construction.
- Rehabilitate all areas cleared of invasive plants as soon as practically possible, utilising specified methods and species.
- Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge. Monitoring should continue for at least two years after construction is complete.
- Follow manufacturer's instruction when using chemical methods, especially in terms of quantities, time of application etc.
- Ensure that only properly trained people handle and make use of chemicals.
- Dispose of the eradicated plant material at an approved solid waste disposal site.
- Only indigenous plant species naturally occurring in the area should be used during the rehabilitation of the areas affected by the construction activities.
- After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land must be left in a condition as close as possible to that prior to construction.
- Ensure that maintenance work does not take place haphazardly, but according to a fixed plan.
- Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access.
- Delay the re-introduction of livestock (where applicable) to all rehabilitation areas until an acceptable level of re-vegetation has been reached.
- Maintenance workers may not trample natural vegetation and work should be restricted to previously disturbed footprint. In addition, mitigation measures as set out for the construction phase should be adhered to.

13.6.1.2 Impacts on Fauna

The following impacts were identified as potentially influencing ecological processes and functioning of the study area itself as well as on regional and provincial scale:

- Loss of primary upland and rocky grassland;
- Loss of conservation important faunal species;
- Disturbances caused during the construction phase;
- Disruption of functional ecological habitat types (rocky grassland and wetlands);
- Disturbances associated with maintenance procedures;
- Maintenance of the vegetation on the power line servitude; and
- Increased hunting, poaching and removal of fire wood.

Table 92: Fauna Impact Assessment

Impact	Stage	Alternative	Management Measures	Magnitude	Scale	Duration	Probability	Significance
Loss of important habitat (riparian vegetation, pan and wetland habitat & rocky or untransformed grassland)	Construction	Corridor 1	Without Management	8	2	3	4	52
			With Management	6	2	3	2	22
	Construction	Corridor 2a	Without Management	8	2	4	4	56
			With Management	6	2	3	4	44
Loss of threatened/near-threatened/protected taxa (including birds)	Construction	Corridor 1	Without Management	8	2	5	4	60
			With Management	6	1	4	2	22
		Corridor 2a	Without Management	8	2	5	5	75
			With Management	8	1	4	4	52

Impact	Stage	Alternative	Management Measures	Magnitude	Scale	Duration	Probability	Significance
Disturbances (excluding birds)	Construction	Corridor 1	Without Management	8	1	3	4	48
			With Management	6	1	3	4	40
		Corridor 2a	Without Management	8	1	3	4	48
			With Management	6	1	3	4	40
Loss of ecological function/dispersal corridors	Construction	Corridor 1	Without Management	8	3	4	4	60
			With Management	6	2	4	2	24
		Corridor 2a	Without Management	8	3	4	5	75
			With Management	6	2	4	4	48

Impact	Stage	Alternative	Management Measures	Magnitude	Scale	Duration	Probability	Significance
Hunting/snaring/poaching	Construction	Corridor 1	Without Management	6	1	4	2	22
			With Management	6	1	3	2	20
		Corridor 2a	Without Management	6	1	4	2	22
			With Management	6	1	3	2	20

Impact	Stage	Alternative	Management Measures	Magnitude	Scale	Duration	Probability	Significance
Disturbances	Operational	Corridor 1	Without Management	8	2	3	4	52
			With Management	6	1	1	4	32
		Corridor 2a	Without Management	8	2	3	4	52
			With Management	6	1	3	4	40

Impact	Stage	Alternative	Management Measures	Magnitude	Scale	Duration	Probability	Significance
Maintenance of servitude (fire/composition shifts)	Operational	Corridor 1	Without Management	8	2	4	4	56
			With Management	6	2	4	2	24
		Corridor 2a	Without Management	8	2	4	4	56
			With Management	6	2	4	2	24
Hunting/snaring/poaching	Operational	Corridor 1	Without Management	6	1	4	2	22
			With Management	6	1	3	2	20
		Corridor 2a	Without Management	6	1	4	2	22
			With Management	6	1	3	2	20

13.6.1.1 Mitigation Measures and Recommendations

Mandatory measures to be implemented during the construction and operational phases:

- The sensitivity map should be used as a decision tool to guide the layout design of the proposed development - all wetland areas (including man-made areas, pans, rivers and streams), tall woodland with eminent canopy constituents, ridges and rocky grassland (irrespective of their surface area) are regarded as sensitive habitat units.
- The construction of “new” access roads should be limited, and existing roads are encouraged for use during the construction phase.
- Unnecessary loss (or destruction) of termitaria should be avoided.
- The extent of the construction sites and access roads should be demarcated on site layout plans and should be restricted to disturbed areas or those identified with low conservation importance. Therefore, no construction personnel or vehicle may leave the demarcated area except those authorised to do so. Those areas surrounding the construction site that are not part of the demarcated development area should be considered as “no-go” areas for employees, machinery or even visitors.
- Checks must be carried out at regular intervals to identify areas where erosion is occurring. Appropriate remedial action, including the rehabilitation of eroded areas should be undertaken.
- Open fires is strictly prohibited and only allowed at designated areas.
- Harvesting of firewood or any plant material (for medicinal or cultural purpose) during the construction phase is strictly prohibited. Labour or personnel shall only assist with the removal of plant matter if requested to do so by the ECO.
- Hunting/snaring is strictly prohibited. Any person found hunting or in the possession of any indigenous animal (including invertebrate taxa) should face disciplinary measures, following the possible dismissal from the site.
- Intentional killing of any faunal species (in particular invertebrates and snakes) should be avoided by means of awareness programs presented to the labour force. The labour force should be made aware of the conservation issues pertaining to the taxa occurring on the study area. Any person found deliberately harassing any animal in any way should face disciplinary measures, following the possible dismissal from the site.
- If any subterranean/fossorial reptile, scorpion, amphibian or mammal species is recovered during the construction phase, this species must be relocated to the nearest area or natural open space with suitable habitat for the particular species to continue its life history. If accidentally killed, then this species should be adequately preserved as a “voucher” specimen (with the assistance and knowledge of the ECO). These specimens may

contribute towards a better understanding of biogeography and animal systematics.

- All construction activities must be limited to daylight hours.
- It recommended that the proposed substation be positioned as close as possible to the N18 where a variety of human-induced activities are anticipated (e.g. vehicle traffic and human pedestrians).
- It is recommended that the proposed substation be located on recently cleared land or land currently used for agricultural purposes.
- Where possible, the substation (in combination of the aforementioned recommendations) should be positioned in such a way that proposed powerlines will be at least 200-300m away from any pan or depression.

13.6.1.3 Impacts on Wetlands

13.6.1.3.1 Impacts on wetlands

The following impacts were identified as potentially influencing processes and functioning of the study area itself as well as on regional and provincial scale:

- Loss of watercourse habitat:

Direct loss of watercourse habitat, such as wetlands, riparian habitat and drainage lines, will occur at locations where project-related infrastructure footprints are present within these features. Project-related infrastructure features that can be constructed within watercourses include pylons, access tracks and the proposed Mahikeng Main Transmission Substation.

The significance of pre-mitigated impacts are High for both Alternative corridor 1 and 2a, while the impact significance post-mitigation remains High for Alternative corridor 1, but is reduced to Moderate for Alternative corridor 2a. The impact significance remains High for Alternative corridor 1 as mitigation can and should be made to avoid the impact, it would still be less effective compared to Alternative 2a. This is due to the presence of long and broad linear watercourse crossings that are located in the centre and along the length of Alternative corridor 1. The combined wetland surface area is also distinctly larger in Alternative corridor 1 (2654.60 ha) compared to Alternative corridor 2a (740.21 ha). Pylon positioning in pan/depression and flat wetlands that have a larger combined surface area in Alternative 2a compared to Alternative corridor 1 (1161.94 ha versus 392.17 ha), can be avoided more easily as these wetlands typically form isolated landscape features that are not connected to the drainage network

- Changes to the hydrological regime due to infrastructure construction in watercourses:

This impact refers to changes in water flow patterns caused by construction activities within watercourses. It is also associated with watercourse habitat loss, but focusses more on habitat modification, specifically regarding changes in water movement. Water flow changes can also occur as a result of heavy motorised vehicles driving through watercourse and the need for access tracks in watercourses that have channels. Vehicle track entrenchment commonly occur due to vehicles driving in wetlands with temporary, seasonal or permanent zones of wetness.

The significance of pre-mitigated impacts are High for both Alternative corridor 1 and 2a, while the impact significance post-mitigation remains High for Alternative corridor 1, but is reduced to Moderate for Alternative corridor 2a. The impact significance remains High for Alternative corridor 1 due to a longer combined surface area of wetland habitat and larger linear watercourse crossings along the centre of the corridor. Another important consideration why the impact significance is lower in Alternative corridor 2a is the fact that it contains longer sections of existing powerlines and associated access routes. These access routes could potentially also be used in areas where the new powerline route is located close to existing alignments, which will reduce the need to create new access tracks in watercourses.

- Decrease in surface water quality:

Pertains to potential hydrocarbon spills within watercourses due to refueling, stockpiling of hydrocarbons and soil stockpiles within or in close proximity to watercourses. Also included is sedimentation and other pollutants transported with runoff from construction activites into watercourses.The significance of pre-mitigated impacts are High for both Alternative corridor 1 and 2a, while the impact significance post-mitigation can be reduced to Low for both corridor alternatives

- Watercourse erosion:

Refers to erosion at new vehicle tracks during construction that may incorporate culverts and pipes, as well as the formation of new erosion features due to construction works. The significance of pre-mitigated impacts are Moderate for both Alternative corridor 1 and Alternative corridor 2a, while the impact significance post-mitigation change to Low and Negligible respectively (Table 93). The post-mitigation watercourse erosion impacts are assessed to be higher in Alternative corridor 1 compared to Alternative corridor 2a as the former contains more river and other large linear watercourse crossings. Erosion is more likely in watercourses that contain channels and a steeper topography as is the case in Alternative corridor 1.

- Encroachment of alien plant species into watercourses:

Alien species are expected to encroach into watercourses following soil and natural vegetation disturbances caused by construction activities. Several listed Alien and Invasive Species (AIS), in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2014), published in Government Gazette No. 37885, Notice 598 of 1 August 2014 (as amended), are specifically adapted or have a higher affinity for wetlands and other watercourses types Alien and Invasive Species are likely to persist in watercourse once they have become established. Ruderal and agrestral weeds that are not listed as Alien and Invasive Species can also persists in watercourses after construction activities and will require land use management or other forms of intervention to control. The risk of alien plant encroachment decreases once significant re-vegetation of indigenous watercourse vegetation occurred during rehabilitation. The significance of pre-mitigated impacts are Moderate for both Alternative corridor 1 and Alternative corridor 2a, while the impact significance post-mitigation can be reduced to Low for both corridor alternatives (Table 93).

13.6.1.3.2 Wetland Impact Assessment

Table 93: Wetland Impact Assessment

Impact	Corridor alternative	With or without mitigation	Probability	Duration	Scale	Magnitude/ Severity	Significance
Loss of watercourse habitat	Alternative corridor 1	Without mitigation	5	4	2	8	70
		With mitigation	4	4	1	8	70
	Alternative corridor 2a	Without mitigation	5	4	2	8	70
		With mitigation	4	4	1	6	44
Changes to the hydrological regime due to infrastructure construction in watercourses	Alternative corridor 1	Without mitigation	5	4	2	8	70
		With mitigation	4	4	1	8	70
	Alternative corridor 2a	Without mitigation	5	4	2	8	70
		With mitigation	4	4	1	6	44
Decrease in surface water quality	Alternative corridor 1	Without mitigation	5	3	2	8	65
		With mitigation	1	1	11	6	8
	Alternative corridor 2a	Without mitigation	5	3	2	8	65

Impact	Corridor alternative	With or without mitigation	Probability	Duration	Scale	Magnitude/ Severity	Significance
		With mitigation	1	1	1	6	8
Watercourse erosion	Alternative corridor 1	Without mitigation	4	4	1	8	52
		With mitigation	2	3	1	8	24
	Alternative corridor 2a	Without mitigation	4	4	1	6	44
		With mitigation	2	3	1	6	20
Encroachment of alien plant species into watercourses	Alternative corridor 1	Without mitigation	4	4	2	8	56
		With mitigation	2	3	1	8	24
	Alternative corridor 2a	Without mitigation	4	4	2	8	56
		With mitigation	2	3	1	8	24

13.6.1.3.3 Mitigation measures and Recommendations

- Pylon footprints, construction camps, access tracks or quarries should not be constructed within 30 m of delineated watercourses, specifically delineated natural watercourses as far as possible.
- The proposed Mahikeng Main Transmission Substation should not be located within a 100 m of delineated watercourses.
- An EMP Walk Down should be undertaken by a wetland specialist once the final route has been selected. The boundaries and types of wetland and other watercourse should be verified and refined during the walk down to help ensure that impacts can be avoided in as many of these features as possible.
- The smallest possible footprint should be utilized and positioned as close to the boundary of the affected watercourse as possible, in cases where pylon construction in a watercourse is unavoidable (e.g. in the event of unavoidable long watercourse crossings).
- Pylon construction activities in these areas should be completed in the shortest possible time and preferably during the dry season.
- Pylons should under no circumstance be located within channels, such as river channels, channels in valley bottom and floodplain wetlands, and drainage lines with clearly defined channels.

- New access tracks should not be constructed in watercourses as far as possible. Existing access tracks and roads should rather be used where available.
- Pylon and access track construction recommendations in watercourses are the last resort and all other attempts to avoid this impact should first have been exhausted in order to prevent these infrastructure features in watercourses.
- Restrict the construction of infrastructure in watercourses as far as possible.
- Pylon construction in watercourses and their surrounding 0 or 100 m buffer zones should only be allowed in exceptional circumstances where these areas cannot be spanned.
- The proposed Mahikeng Main Transmission Substation should not be located within a 100 m of delineated watercourses.
- Watercourses and their buffers affected by unavoidable construction activities should be rehabilitated soon after construction. Emphasis should be placed on the reinstatement of the topography to a similar profile as was present pre-construction.
- No furrows or drains should be made to channel water from infrastructure. Where this is unavoidable, these furrows and drains need to be closed and revegetated as soon as possible.
- Construction and access tracks roads should be located outside of watercourses as far as practically possible.
- Avoid driving in watercourses during construction phase to prevent vehicle track incision and the potential for channel initiation. Where this is unavoidable in watercourses with channels or wetlands with temporary seasonal or permanent zones of wetness, crossing structures should be in place within affected wetlands and other watercourses. These crossing structures can include the following:
    - A wearing course (wear surface) should be added as a surface layer on top of geotextile fabrics, which forms base for surface capping of watercourse that are deemed to require a formal crossing structure.
    - A wearing course (surface cap) of good quality clastic or gravel material also has the potential to reduce surface scour by creating a mix that will easily bind together and minimise detachment of particles.
    - It may be best not to introduce new material for track creation into certain watercourses, such as indistinct watercourses that lack an entrenched channel or wetlands with only a marginal temporary wetness zone. Site specific recommendations should be made as part of the EMP Walk

Down phase, which would also be used to verify the presence and extend of wetlands along the final selected powerline route and the proposed substation footprint.

  - Geotextiles provide four important functions in temporary road and trail surface construction that includes separation, drainage, reinforcement, and stabilisation.
  - Geotextiles work as separation fabrics when they are placed between gravel caps and underlying soils to prevent the materials from mixing.
- Additional benefits of using a formal crossing structure that has received engineering input to mitigate watercourse impacts based on site conditions, include the following:
  - It defines a single route alignment for vehicle travel.
  - Provides a ‘wear and carry’ surface over unsuitable and easily compactable wetland soils.
  - This results in a stable, durable crossing surface for vehicle access, including heavy motor vehicle traffic.
  - Halts the widening and the development of braided crossing sections, while formerly used track alignments are allowed to naturally stabilise and revegetate.
- No refuelling of construction vehicles should occur within 50 m of delineated watercourses.
- Hydrocarbons should not be stored within 50 m of delineated watercourses.
- Use stormwater control measures around construction works where areas have been cleared within watercourses or their buffers, as well as around stockpiles. Sediment traps, such as hay bales or silt traps can be used, but require maintenance throughout the construction phase.
- Construction phase stormwater control measures should be applied to pylon construction, vehicle access tracks and the proposed powerline and the substation.
- New headcut and channel features that have resulted during construction should be stabilised once observed.
- The implementation of erosion protection measures, such as energy dissipaters, at new formalised vehicle tracks the contain pipes or culverts.
- New access tracks should be designed and implemented

- During rehabilitation at the end of the construction phase emphasis should be placed on the reinstatement of the topography to a similar profile as was present pre-construction and to create stable and well vegetated surfaces. The separate removal and storage of top soils, as well as the correct reintroduction of top soil (after subsoil has been reintroduced) is also important to help create stable surfaces in areas affected by construction.
- Proposed powerline infrastructure (e.g. pylons and the Mahikeng Main Transmission Substation) should be located outside of delineated watercourses and their respective buffers to avoid edge effects and opportunity for the encroachment of invasive alien plant species.
- Restrict the clearing of watercourse vegetation as far as possible. Areas that have been cleared should be revegetated with indigenous species after construction.
- Compile and implement an alien plant control program during the operational phase of the project.

13.6.1.4 Impacts on Avifauna

Birds are impacted in three ways by means of transmission lines. It is however a common rule that large and heavy-bodied terrestrial bird species are more at risk of being affected in a negative way when interacting with transmission lines. These include the following:

- Electrocution:

Electrocution happens when a bird bridges the gap between the live components or a combination of a live and earth component of a power line, thereby creating a short circuit. This happens when a bird, mainly a species with a fairly large wingspan attempts to perch on a tower or attempts to fly-off a tower. Many of these species include vultures (of the genera *Gyps, Torgos* and *Trigonoceps*) as well as other large birds of prey such as the Martial Eagle (*Polemaetus bellicosus*) (Ledger & Annegarn, 1981; Kruger, 1999; Van Rooyen, 2000). These species will attempt to roost and even breed on the tower structures if available nesting platforms are a scarce commodity. Other types of electrocutions happen by means of so-called “bird- streamers”. This happens when a bird, especially when taking off, excretes and thereby causing a short circuit through the fluidity excreta (Van Rooyen & Taylor, 1999). This method of electrocution is however a rare phenomena. Most of these species are uncommon to rare in the study area and the impact more likely to occur to other species that are prone towards roosting on pylons such as the Black Stork (*Ciconia nigra*), Black-headed Heron (*Ardea cinerea*) and Egyptian Goose (*Alopochen aegyptiacus*).

- Physical disturbances and habitat destruction caused during construction and maintenance:

It is anticipated that a number of access roads and laydown camps need to be constructed, including the clearing of vegetation as part of the power line servitude. Therefore, intensive clearing and removal of vegetation is likely to take place underneath the power line when corresponding to the sandstone or dolerite hills and riparian thicket.

The placement of access roads and laydown camps next to habitat features with a high probability of sustaining congregations of bird species (e.g. impoundments and pans) or along drainage lines and rivers is likely to disrupt the natural movement of bird species or it could result in the abandoning of these areas. Therefore, special care should be taken near drainage lines, rivers, pans and dams as not to disturb the bird community or the vegetation structure. In addition, construction activities go hand in hand with high ambient noise levels. Although construction is considered temporary, many species will vacate the study area during the construction phase and will become temporarily displaced.

The reservoirs and cattle drinking troughs also deserve special consideration, especially when located in close proximity to game and nature reserves since these features are often overlooked or neglected during the construction of transmission lines as they often attract large scavenging birds of prey (e.g. vultures) which could easily become electrocuted or may collide with the overhead lines when taking flight.

- Bird species likely to be impacted:

In general, the study area supports a high richness of birds species (mean of 220.7 spp, n=18 QDSs). It is evident that increased richness values correspond to the open dolomite and highveld grasslands on the eastern parts of the study area as well as in the Lichtenburg area and the area west of Mahikeng – both areas earmarked by a high spatial habitat heterogeneity consisting of open bushveld (Figure 24). Poor richness values occur on the northern section along Corridor 1 – an area with low spatial heterogeneity (Figure 24). The number of bird species recorded for each quarter degree square range from 165 species at Gerdau (2626AC) to as many as 291 species at Carletonville (2627AD).

Table 94: Avifauna Impact Assessment

Impact	Stage	Alternative	Management Measures	Magnitude	Scale	Duration	Probability	Significance
Collision	Operational	Alternative Corridor 1	Without Management	8	3	5	5	80
			With Management	8	3	4	4	60
		Alternative Corridor 2a	Without Management	8	3	5	5	80
			With Management	8	3	5	4	64
Loss of habitat and disturbance	Construction and Operational	Alternative Corridor 1	Without Management	8	3	4	4	60
			With Management	6	3	4	2	26
		Alternative Corridor 2a	Without Management	8	3	4	5	75
			With Management	6	3	4	4	52

13.6.1.4.1 Mitigation Measures and Recommendations

There are many ways to ameliorate or mitigate bird impacts imposed by power line interactions. Probably the best way is to proactively avoid areas where the potential for bird interaction is evident by means of subsequent route deviations or modifications. However, route deviations are not always financially plausible unless significant bird mortalities or habitat destruction is inevitable. An option to overcome bird collisions is to replace overhead lines with underground cables. This method does come at a huge expense, and construction activities could irreparably damage sensitive habitat types. It is also more time-consuming to repair faults on underground versus overhead cables.

The following obligatory recommendations are applicable to the project area:

- A “walk-through” of the selected route must be conducted prior to the construction phase, the”walk-through” will aim to identify areas where marking of lines by means of “bird flight deterrent devices” is considered to be beneficial or compulsory.
- All intact grassland, river/stream and drainage line crossings should by default be marked (the spanning of pans should be avoided).
- Where the line crosses a wetland/river the actual crossover span as well as one span on either side of the wetland/river/ should be marked.
- At least two consecutive spans of the alignment should be marked by means of appropriate "deterrent devices" (including the nocturnal LED solar-charged devices such as the ‘overhead warning light’) where the alignment is in close proximity to any dam or pan.
- Default marking devices to be used should include large Double Loop Bird Flight Diverters and the nocturnal LED solar-charged devices such as the ‘overhead warning light’.
- Double Loop Bird Flight Diverters should be applied in a staggered fashion to the phase while alternating between black and white diverters. The maximum distance between the diverters should not exceed 5 m.
- All construction sites must be confined to disturbed areas or those identified with low conservation importance. All construction sites must be demarcated on site layout plans (preferably), and no construction personnel or vehicles may leave the demarcated area except those authorised to do so. Those areas surrounding the construction sites that are not part of the demarcated development area should be considered as “no-go” areas for employees, machinery or even visitors.
- A natural buffer zone (to be announced by the wetland specialist) should be allowed between the line servitude and any wetland/river/stream.

- All road networks must be planned with care to minimize dissection or fragmentation of important avifaunal habitat type. Where possible, the use of existing roads is encouraged. Access must be determined during the “walk- through” process.
- The breeding and roosting status of threatened and near threatened species corresponding to the servitude, in particular birds of prey, vultures, bustards, African Grass-owl and White-bellied Korhaan, should be evaluated prior to construction/decommissioning. If breeding is confirmed, the nest site must be barricaded and appropriately buffered (by at least 200 m or as proposed by the specialist). Construction/decommissioning activities shall only commence once the fledglings are successfully reared and has left the nesting site.
- It is recommended that the “cross-rope suspension” type tower be used for the proposed transmission line.
- Open fires is strictly prohibited and only allowed at designated areas; and
- Killing or poaching of any bird species should be avoided by means of awareness programs presented to the labour force. The labour force should be made aware of the conservation issues pertaining to the bird taxa occurring on the study area. Any person found deliberately harassing any bird species in any way should face disciplinary measures, following the possible dismissal from the site.

13.6.1.5 Impacts on Soil and Agriculture

13.6.1.5.1. Potential Impacts

The type of impact associated with transmission lines is limited to a small footprint along transects and with a relatively small area sterilised per pylon. In the case of agricultural potential and within the context of the specific land and climatic conditions experience in the survey area these impacts are expected to be small to negligible. In cases where irrigated agriculture is to be practiced (should enough water be available) the placement of the pylon footprints can be coordinated with the irrigation field layout so as to ensure a minimal impact. In this regard existing alignments are preferred as the initial impacts have already been incurred and new impacts will be negligible if managed.

13.6.1.4.2 Soil and Agriculture Impact Assessment

Table 95: Soil and Agriculture Impact Assessment

Nature of Impact	Stage	Management Measures	Duration	Scale	Severity	Probability	Significance Rating
Construction of pylons / power lines	Construction	With mitigation	1	1	2	3	12
		Without mitigation	1	1	2	3	12
Vehicle operation on site	Operation	With mitigation	1	1	2	3	12
		Without mitigation	1	1	2	3	12
Dust generation	Construction	With mitigation	1	2	2	3	12
		Without mitigation	1	1	2	3	12
Loss of agricultural land	Construction	With mitigation	5	2	2	3	27

		Without mitigation	5	2	2	3	27

13.6.1.5.3 Mitigation Measures and Recommendations

- The survey area is dominated by grazing agricultural land uses in the northern sections and predominantly dryland agricultural land uses in the south.
- Corridor 1 will have the largest potential impact due to the large areas of agriculture land uses (dryland, irrigated, orchards, subsistence agriculture) it traverses.
- Corridor 2a will have the smallest potential impact due to the limited areas of agriculture land uses (dryland, irrigated, orchards, subsistence agriculture) it traverses.
- The impacts are rated as low with the assumption that any obvious large impact placement of a pylon would have been avoided through proper planning beforehand. This planning should take into account the presence of irrigation areas and infrastructure.
- The development footprint of a transmission line is such that only small areas of land surface are sterilised and it is therefore practically feasible to limit the impacts through proper pylon placement.

13.6.1.6 Impacts on Visual Environment

13.6.1.6.1 Visual Impacts

The construction and operation phase of the proposed Mahikeng Substation and Powerlines related activities and its associated infrastructure will have a medium visual impact on the natural scenic resources and the topography. However, with the correct mitigation measures the impact might decrease to a point where the visual impact can be seen as less significant although still medium. The moderating factors of the visual impact of the proposed infrastructure in the close range are the following:

- Number of human inhabitants located in the area;
- Natural topography and vegetation;

- Mitigation measures that will be implemented such as the establishment of barriers or screens;
- The size of the operation; and
- Absorption capacity of the landscape.

In light of the above-mentioned factors that reduce the impact of the facility, the visual impact is assessed as medium visual impact after mitigation measures have been implemented.

13.6.1.6.2 Visual Impact Asessment

Table 96: Visual Impact Assessment

Nature of Impact	Stage	Management Measures	Duration	Scale	Severity	Probability	Significance Rating
Construction Camps	Construction	With mitigation	1	1	4	3	18
		Without mitigation	1	2	6	3	27
Construction of the Substation	Construction and Operational	With mitigation	5	2	6	4	52
		Without mitigation	5	3	8	4	64
Construction of the Powerline	Construction and Operational	With mitigation	5	3	6	4	56
		Without mitigation	5	4	8	5	85
Construction of access roads	Construction and Operational	With mitigation	4	3	3	3	39
		Without mitigation	4	3	4	4	52

13.6.1.6.3 Mitigation Measures and Recommendations

The Visual Impact due to the construction activities and associated project infrastructure can be seen as having a medium impact on the surrounding environment and inhabitants before mitigation measures are implemented. After mitigation, the visual impact can be seen as lowered although still classified as medium. Thus, mitigation measures are very important and two of the most significant mitigation measures are the rehabilitation of the area after construction has been concluded and reducing the visibility of the powerlines as much as possible. If the mitigation of the impact is not done correctly then the visual impact will become a concern. However, with correct mitigation, the impact will be of minimal visual intrusion for the type of proposed structures.

Mitigation measures may be considered in two categories:

- Primary measures that intrinsically comprise part of the development design through an iterative process. Mitigation measures are more effective if they are implemented from project inception when alternatives are being considered.
- Secondary measures designed to specifically address the remaining negative effects of the final development proposals.

Primary measures that will be implemented will mainly be measures that will minimise the visual impact by softening the visibility of the structures by "blending" with the surrounding areas. Such measures will include;

- Rehabilitation of the construction areas by re-vegetation of the sites and surrounding area.
- Painting/coating of the pylons to a darker colour than Galvanized steel.
- Building the powerlines and pylons next to existing linear structures as far as possible.
- Clear vegetation only by cutting and not earth moving equipment.
- Use of existing roads for access roads.
- Plant some indigenous trees and vegetation to create a barrier between the substation and neighbours and roads
- The visual impact can be minimized by the creation of a visual barrier. The construction area will be cleared as soon as construction of the infrastructure is finished.

- The visual impact can be minimized by the creation of a visual barrier during construction. The steel of the pylons can be painted a darker colour than galvanized steel to reduce the visual impact. Placing powerlines next to existing linear feature as far as possible. Clearing of vegetation should only be done by cutting and not earth moving equipment to reduce the visual impact of the vegetation scars.

13.6.1.7 Impacts on Social Environment

13.1.6.7.1 Social Impacts

There are similar social impacts in terms of quality of life and community impacts between corridor 1 and corridor 2a. These are related to the construction camp and its impact on communities and those in relation to the impact on communities would be Goedgevonden and Miga in the construction phase of the project. The impacts can be reduced to low anticipated impacts with mitigation measures in place. This indicates a trend in the social concerns that would display a likeness between the two corridors. The following impacts could potentially occur within the study area:

- The substation is positioned in the surrounds of the Miga community. There is a population of children located in this community and a substation in the area can pose a challenge to safety from this perspective.
- A study from the World Health Organisation (WHO) by the author Background (2007) found that the levels of electromagnetic fields the public is exposed to poses no direct risk to society. The article speaks to the impacts that may be experienced over shorter and longer periods of time. The shorter time impacts are linked to “exposure at high levels” as well “at very high field strengths” as the conditions to which are needed for the potential effects of alterations in “nerve cell excitability in the central nervous system”. (Background, 2007). The potential impacts from the longer-term spectrum indicated investigations into childhood leukemia where the conditions of the electromagnetic fields were that which only 1-4% of children are indicated to live in. The article also indicates a possible “selection bias”. The conclusion of the article is that the “evidence related to childhood leukemia is not strong enough to be considered casual” (Background, 2007).

  These findings from Empetus CC in 2006 that was done in the South African environment suggests that the alterations of cells may take place in a laboratory setting where there are controlled variables that are different to the real circumstances that people face in settings. It also suggests that the possible evidence linked to leukemia in children has not been verified in a laboratory and are associated with epidemiological research and is also not deemed to be thought of as a "causal" relationship (Empetus, 2006: 12). It also suggests that if there were links made to these elements in previous epidemiological studies "if it existed, was small" as well as "the number of cases in some of these studies were small".

Although there are numerous studies, and these are merely two on the topic, it cannot be fully determined by a Social Impact Assessment specialist as it would require a fully qualified Health Impact Assessment Practicioner to investigate the topic in isolation. However, it does need acknowledgment in this assessment and in light of the study findings.

- The presence of the substation would be a long-lasting feature in the area once it is performing its role. It is positioned on a site that would be able to be seen from the road and communities in some of the outer parts of the Miga community. The duration of the impact is permanent, the scale is the site, and the severity is low whilst the probability is definite. This leads to a moderate significance rating without mitigation.

13.6.1.7.2. Social Environment Impact Assessment

Table 97: Social Impact Assessment

Nature of Impact	Stage	Management Measures	Duration	Scale	Severity	Probability	Significance Rating
Existing residential area and estates	Construction and Operational	With mitigation	3	1	2	4	12
		Without mitigation	3	1	6	4	28
Towns and dense settements	Construction and Operational	With mitigation	1	1	1	2	4
		Without mitigation	3	1	2	2	8
Schools and Colleges	Construction and Operational	With mitigation	3	1	2	4	12

		Without mitigation	3	2	6	4	29
Land Value	Construction and Operational	With mitigation	3	1	2	4	12
		Without mitigation	3	2	6	4	29

13.6.1.7.3 Mitigation Measures and Recommendations

- Engagement with respective owners especially those who have the game farms. This would be to gain their requirements and recommendations that may be specific to the site with regard to the management of the area in the construction phase. This should address:
  - Knowing where the existing access areas are to the farm, and how they correspond with where construction of the powerline would need to take place on the farm. This would give insight as to which entrances can be intended for use during this period and if there would be a need for the establishment of new access roads.
  - A list of game that is usually found in the area where the intended construction of the corridor would take place. This would be to potentially identify if any dangerous game is usually positioned in that vicinity, to be able to be moved to another camp for the duration of the construction phase.
  - To inquire about specific monitoring requirements that the farmer may need to be carried out to ensure the safety of the game during the construction period.
- Identification of any unskilled job opportunities that could be advertised in the local settings to benefit people who live in the area.
- The formation of an intended time table of which area would undergo construction with respective dates so that could be shared with directly affected stakeholders ahead of the construction phase.
- Drafting a Code of Conduct for the Behaviour of employees that would be living in the construction camp for the period of the construction phase. It could address elements of having no guests staying over in the construction camp at any point in time; the effective waste management within the camp, for example.
- Employment opportunities should be prioritized for local people in the area in the respective skill category where it is available.

- A database list of people to contact at which sites should be compiled so if there is a component of the powerline that would need to be repaired, there is knowledge of the respective stakeholder that would need to be engaged with.
- An awareness program that could take the form of posters or a meeting could be run in the Miga community educating the adults about the dangers of the substation even if it is enclosed with fencing, as to make the community aware of it. The message could be passed down onto the children by the parents.
- The medium used to close in the substation site could be checked that no small bodied person could get through it and that it ensures the protection of the site.
- A workable arrangement where construction workers are designated to a certain area where they can perform the construction work and the enterprise can continue without interruption.
- Game count remains the same as before construction phase.

13.6.1.8 Impact on Heritage and Paleontological Resources

13.6.1.8.1 Heritage and Paleontological Impacts

The studies did not find any permanent barriers to the proposed powerline and substation developments although heritage resources of varying significances occur within proposed pwerline routes. The proposed powerline routes were designed to avoid known heritage sites. The potential impacts of the proposed powerline and substation developments on all ranges of heritage resources generally range from low to moderate.

Although stromatolites are considered to be fossils, there are hundreds of square kilometres of stromatolites in South Africa and it is not considered to be so scarce that every stromatolite has to be preserved. In the event of the discovery of an exceptional stromatolite formation it is advised that it should on principle not be destroyed if an alternative position for the placing of a specific pylon can be found.

Fossils are of no use to science if they remain undiscovered and the development will create an opportunity to discover new fossils and fossil sites just like road works led to the discovery of new fish and amphibian fossil species in the Eastern Cape and the limestone mining in Gauteng and North West Provinces was directly responsible for the discovery of our world famous hominin sites.

There is a low likelihood that the Quaternary alluvium and aeolian sand and Tertiary calcrete may contain fossils. Elsewhere rare fossils of ostrich egg shells, mollusc shells, isolated bones, root casts, burrows and termitaria were found in Quaternary deposits (Almond & Pether 2008) and the possibility of finding similar fossils in the area cannot be excluded. In the unlikely event of fossils being discovered in the sands, soils, calcrete or dolomite formations in the study area, the recommendatins and mitigation measures below should be followed. Although disturbed fossils should be collected and stored safely until it can be inspected by a palaeontologist, no attempt should be made to remove such accidentally discovered fossils from the rock by an unqualified person.

13.6.1.8.2 Impact Assessment on heritage and Paleontological Resources

Table 98: Impact Assessment for the Substation Site alternatives

Nature of Impact	Management Measures	Duration	Scale	Severity	Probability	Significance rate
Site Alternative 1						
Archaeological remains	Without management	2	3	1	4	9
	With management	2	2	1	2	6
Graves and Burial Grounds	Without management	2	3	1	2	7
	With management	2	3	1	1	6
Historical Buildings and Structures	Without management	2	3	1	1	6
	With management	2	3	1	1	6
Monuments and Memorials	Without management	2	3	2	1	7
	With management	2	3	2	1	7
Site Alternative 2						
Nature of Impact	**Management Measures**	**Duration**	**Scale**	**Severity**	**Probability**	**Significance**
Archaeological remains	Without management	3	2	2	4	13
	With management	3	2	2	2	9

Graves and Burial Grounds	Without management	3	2	2	1	7
	With management	3	2	2	1	7
Historical Buildings and structures	Without management	3	2	2	1	7
	With management	3	2	2	1	7
Monuments and memorials	Without management	3	2	2	1	7
	With management	3	2	2	1	7

Table 99: Impact Assessment for the Alternative corridor 1

Nature of Impact	Management Measures	Duration	Scale	Severity	Probability	Significance
Archaeological Remains	Without management	3	3	6	2	18
	With management	3	2	2	2	9
Graves and Burial Grounds	Without management	3	3	1	4	10
	With management	3	3	1	2	8
Historical buildings and structures	Without management	3	3	6	3	24
	With management	3	3	2	2	10
Mining Heritage	Without management	3	3	1	4	10
	With management	3	2	1	2	7
Monuments and memorials	Without management	3	3	1	1	7
	With management	1	3	1	1	5

Table 100: Impact Assessment for the Alternative corridor 2

Nature of Impact	Management Measures	Duration	Scale	Severity	Probability	Significance
Archaeological remains	Without management	3	2	1	4	9
	With management	3	2	1	2	9
Graves and Burial Grounds	Without management	3	2	1	4	9
	With management	3	2	1	2	7
Historical Buildings and structures	Without management	3	2	6	3	23
	With management	3	2	2	2	9
Monuments and memorials	Without management	1	2	2	1	5

	With management	1	2	2	1	5
Mining Heritage	Without management	3	2	1	4	9
	With management	3	2	1	2	7

13.6.1.8.3 Mitigation Measures and Recommendations

The following mitigation measures and recommendation should be considered:

- From a heritage perspective supported by the findings of this study, the proposed Alternative Corridor 1 and Alternative Corridor 2a powerline routes are both feasible, however Alternative Corridor 2a has a slight advantage because of it is relatively shorter and also runs along existing powerline from Pluto Substation to Watershed Substation.
- A walk down survey must be conducted once the final route selection is concluded.
- Both Alternative Corridor 1 and Alternative Corridor 2a Substation sites are equally viable.
- Eskom should bear in mind that limestone deposits may contain fossilised remains of animals, plants or early hominids. The skeleton of the Taung child, which is related to Australopithecine family, was found in limestone deposits at Taung in the North-West Province whilst limestone deposits near Makapans Cave in Mokopane revealed remains of Homo Erectus and other extinct animal species.
- The foot print impact of the proposed development and associated infrastructure should be kept to minimal to limit the possibility of encountering chance finds.
- Should any unmarked graves be exposed during construction affected families must be trekked and consulted and relevant rescue/ relocation permits must be obtained from SAHRA before any grave relocation can take place. Furthermore, a professional archaeologist must be retained to oversee the relocation process in accordance with the National Heritage Resources Act 25 of 1999.
- The Project Public Participation Process should ensure that any cultural heritage related matters for this project are given due attention whenever they arise and are communicated to the Provincial Heritage Resources authority throughout the proposed powerline and substation development. This form of extended community involvement would pre-empty any potential disruptions that may arise from previously unknown cultural heritage matter that may have escaped the attention of this study.

- As a result of restricted access to some farms along the proposed powerline routes, the Public consultation practitioner must request farmers to declare all heritage resources within their farms. The practitioner must persuade farmers to respond to the questionnaire in respect of potential heritage resources in their farms.
- Should chance archaeological materials or human remains be exposed during subsurface construction work on any section of the proposed development laydown sites, work should cease on the affected area and the discovery must be reported to the heritage authorities immediately so that an investigation and evaluation of the finds can be made. The overriding objective, where remedial action is warranted, is to minimize disruption in construction scheduling while recovering archaeological and any affected cultural heritage data as stipulated by the National Heritage Resources regulations.
- Subject to the recommendations herein made and the implementation of the mitigation measures and adoption of the project EMP, there are no significant cultural heritage resources barriers to the proposed development. The Heritage authority may approve the proposed development to proceed as planned with special commendations to implement the recommendations here in made.
- Surface excavations should continuously be monitored by the ECO and any fossil material be unearthed the excavation must be halted.
- If fossiliferous material has been disturbed during the excavation process it should be put aside to prevent it from being destroyed.
- The ECO then has to take a GPS reading of the site and take digital pictures of the fossil material and the site from which it came.
- The ECO then should contact a palaeontologist and supply the palaeontologist with the information (locality and pictures) so that the palaeontologist can assess the importance of the find and make recommendations.
- If the palaeontologist is convinced that this is a major find an inspection of the site must be scheduled as soon as possible in order to minimise delays to the development.
- From the photographs and/or the site visit the palaeontologist will make one of the following recommendations:

  a. The material is of no value so development can proceed, or:

  b. Fossil material is of some interest and a representative sample should be collected and put aside for further study and to be incorporated into a recognised fossil repository after a permit was obtained from SAHRA for the removal of the fossils, after which the development may proceed, or

c. The fossils are scientifically important and the palaeontologist must obtain a SAHRA permit to excavate the fossils and take them to a recognised fossil repository, after which the development may proceed.

- If any fossils are found then a schedule of monitoring will be set up between the developer and palaeontologist in case of further discoveries

13.6.1.9 Economic Impacts

13.6.1.9.1 Economic Impacts

The identified activities per economic zone were subjected to the “Plomp” Risk Matrix method to determine the impact of a specific activity in a specific zone by applying a Delphi technique in which four members of the Mosaka staff participated per activity. Once an impact per activity was determined a second Delphi was applied to weigh the different activities per zone to arrive at a mathematical weighted average providing an estimated economic impact per zone. Once the possible impact was determined mitigation measures were considered and these are included in the text. The positive impact associated with the construction phase of the power line will, in the local area, be very limited as the construction material will procured from outside the area and, due to the work being very technical, it is accepted that the construction company will mostly use experienced workers. Some locals might be employed in non-technical positions.

The contribution of a stable supply of electricity to a region always contributes to economic development in a specific area. This proposed powerline and substation will contribute to ensure a stable electricity supply to the region, but also provide power for possible new economic growth in the region. Currently the total employed labour force (2017) in the province is estimated at 990 000, depending on which source is used, with an estimated unemployment rate of 27.4%. This represents 373 000 from a total employable people of 1.36 million. It is accepted that the electricity power supply will be such as to encourage growth. It must, however, be accepted that this is based on the assumption that future economic growth will develop in the area resulting of governmental initiatives. The theoretical estimated economic contribution of the power line and the substation is estimated at a 100% utilisation to be around:

- Gross Domestic Product = R260 billion (2017 prices)
- Projected employment created by the available electricity = 950 000.

Table 101: Impact Assessment of Economic Resources

Nature of Impact	Management Measures	Duration	Scale	Severity	Probability	Significance
Re-allocation of settlements/farmers	Without management	1	3	2	4	24
	With management	1	1	2	2	8
Restricted road access	Without management	1	3	2	4	24

	With management	1	1	2	2	8
Safety and Security effect	Without management	1	3	2	2	12
	With management	1	1	2	2	8
Employment effect	Without management	1	3	2	2	12
	With management	1	1	2	2	8
Economic growth effect	Without management	1	3	2	2	12
	With management	1	1	2	2	8

13.6.1.9.2 Mitigation Measures and Recommendations

Alternative corridor 1 is preferred. Despite settlements such as Sheila and others on the green corridor will have some difficulty with mitigation, the purple line with its orchards and large irrigation infrastructure will probably require more mitigation and a negative economic impact. The most preferred substation from an economic activity point of view is Site B with no mitigation required. There are no cumulative effects for either of the powerlines. The three proposed substations have the same positive and negative effects. To conclude alternative corridor 1 and substation site B is proposed for constructing a powerline and substation in the North-West and Gauteng provinces.

14. ENVIRONMENTAL IMPACT STATEMENT

14.1 Introduction

The Environmental Impact Assessment study conducted for the proposed 400kV powerl line and the proposed substation is believed to fulfil the NEMA EIA regulations (2014 as amended on the 07th of April 2017). The necessary steps have been taken to provide Interested and Affected Parties to participate in the identification of project impacts, alternatives and other issues that are regarded for further investigation during the EIA process.

The specialist studies were required to address key issues identified during the scoping process. The specialist studies covered the biophysical, social, cultural and economic environment and assessed issues concerning the project alternatives as well as potential impacts. Mitigation measures were recommended for significant impacts.

14.2 General Findings

14.2.1 Biodiversity Component

It was found that the study area is rich in biodiversity in terms of flora, fauna, and avi-fauna and that no Red Data, endemic or protected species were identified across the study area. Two listed species (regarded as *Declining*) have been recorded, *i.e. Hypoxis hemerocallidea* and *Boophane disticha.* Power lines generally do not have a significant impact on vegetation as they can span over habitats and only big trees that interfere with the power lines are cleared. In principle, power lines have negligible impacts on grassland ecosystems. The primary ecological impacts will be on large bodied avifauna and the recommended measures to reduce these collisions should be implemented. There is one dominating nationally protected tree identified within the study area and permits to remove them will be required should they be affected by final routing of the power line.

14.2.2 Socio-Economic Component

The aspect of socio-economic profile of the study area was based on the current land use and other infrastructure that might be impact and lead to social and economic implications. The following are expected socio economic impacts (positive and negative):

- Impacts on Existing Residential area
- Impacts on Agricultural Land
- Impacts on Tourism
- Disruption in daily living and movement patterns and proximity of homestead
- Inflow of workers
- Employment opportunities

- Local Economic contribution
- Impacts on existing small Holdings

14.2.3 Aesthetic Component

Visually the power lines will change the sense of place and cause issues in areas of high eco-tourism although in this case, the anticipated impacts are likely to be insignificant due to the study area being predominantly agricultural activities, which by their own rights cause visual impacts.

14.2.4 Technical Component

From the Specialist assessments, Route 2a was selected as the preferred alternative corridor, this makes viable technical sense when the key findings are interpreted and substation site alternative A was preferred (refer to Table 102 below).

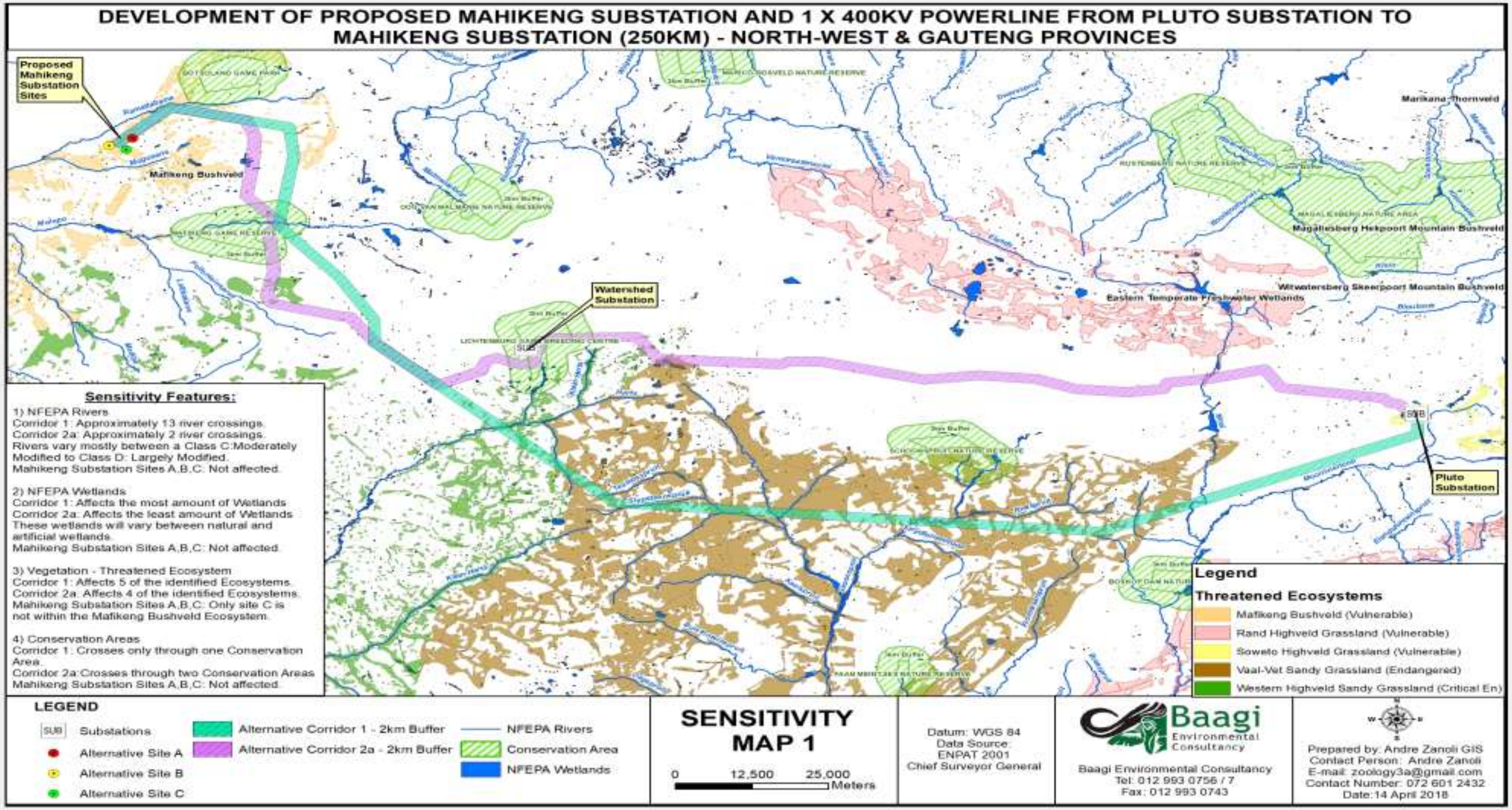


Figure 117: Sensitivity Map showing sensitivity features within the proposed study area

14.3 Alternatives

14.3.1. Alignment Alternatives

The detail description of these alternative Corridors is well documented under the alternative chapter of this report (refer to chapter 4). The two alternative Corridors and three site alternative corridors have been investigated in detail and on these possible corridors and sites; one alternative corridor and site alternative will be used for establishing the 400kV line and the Substation. It must be indicated that from socio-economic and environmental aspects all the alternatives possess more or less the same impact and there is no clear cut favourable alternatives based on those aspects. This is due to the nature of the study area which is based on the land use activities as well the existing infrastructure within the area.

After careful consideration of the key aspects of environment (i.e. biophysical, social and economic aspects), the preferred corridor is Corridor 2a (Purple Alternative corridor). There is minimal differentiation in terms of socio-economic and environment between the two alternative corridors, however, the technical viability of the area to establish the proposed power line and substation was considered as an aspect to arrive at the decision for selecting the preferred alternative.

14.3.2. No-Go Alternatives

The no-go alternative would maintain the existing status quo whereby the current network is under the strain to provide power to customers within the customer networks for transport of goods and services. Implementation of the no-go alternative would mean that the potential benefits of the proposed project would not transpire which involve the following;

- Strengthening of the Gauteng, North West and Botswana region which will ensure steady supply of electricity
- To support economic development within the area
- To be able to support the current and future developments within the area
- Direct economic benefits of the development proceeding, including the creation of employment

Therefore, this no-go alternative was considered to be counter productive.

15. CONCLUSION

During the scoping process every attempt was made to identify possible key issues and changes to the receving environment of the proposed project. Various possible alternatives were identified on a broad and small scale through consideration of both specialist inputs and issues raised during the public participation process.

The Final Scoping Report (FSR) was submitted to the competent authority (DEA) for consideration and acceptance. The compilation of the FSR adhered to the relevant regulations that regulated the compilation of the Scoping Report, the Impact Assessment Phase will now commence.

The purpose of the EIA process is to investigate the Biophysical and Socio-economic environments by means of Specialist studies to identify issues or impacts of the proposed project on these environments. Further, to provide mitigation measures for adverse impacts and to assess the significance of these impacts over the short and long term. In this specific case the proposed powerline and substation will traverse areas that incorporate sensitive vegetation species, but the need for the powerline as well the substation in the North West area is regarded as equally important. Below is an Alternatives Risk Matrix conducted during the Specialist Integration meeting which summarises the proposed preferred alternatives by the Specialists. According to Table 102 below, the most preferred and feasible Alternative Corridor is Alternative Corridor 2a rating 11x. The most preferred and feasible Alternative substation site is substation site 1 rating 11x.

Table 102: Proposed alternatives Risk Matrix

Specialist Study	Alternative corridor 1	Alternative corridor 2a	Alternative substation site 1	Alternative substation site 2	Alternative substation site 3
Flora	o	x	x		
Technical		x	x		
Fauna	x	x	x		
Avi-Fauna	o	x	x		
Watercourse	o	x	x		
Soil & Agricultural Potential	o	x	x	x	x
Visual (VIA)	o	x	x	x	x
Social (SIA)	o	x	x	x	x
Economic	x	x	x	x	x
Heritage (HIA)	o	x	x	x	x
Paleontology	x	o	x	x	x
Total	**3x**	**10x**	**11x**	**6x**	**6x**

O – Represents least preferred

X – Represents preferred

16. REFERENCES

1. EIA for Venus Sigma Hector Transmission Lines. ACER-Africa Environmental Consultants, 2009
2. Final Scoping Report for the proposed construction of the Ariadne - Venus 400kV Transmission line, as well as the extension, upgrade and refurbishment of the Ariadne and Venus Substations, Kwa-zulu Natal. Baagi Environmental Consultancy, 2011.
3. Local Government. 2017. *Municipalities of South Africa*. [ONLINE] Available at: https://municipalities.co.za/provinces/view/8/north-west. [Accessed 3 November 2017]
4. Mucina, L. & Rutherford, M.C. (eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
5. Ramotshere Moiloa Local Municipality. 2014. *Ramotshere Moiloa Local Municipality*. [ONLINE] Available at: https://www.ramotshere.gov.za/. [Accessed 3 November 2017]
6. Scoping Report: The proposed Beta – Harvard - Merapi 400 kV Transmission Line. Baagi Environmental Consultancy, 2015.
7. Climate Data [ONLINE] Available at: https://en.climate-data.org/info/sources/. [Accessed 29 October 2017]