APPENDIX D

SPECIALIST REPORTS

APPENDIX D1

AVIFAUNAL IMPACT ASSESSMENT

MBUMBU TO PROPOSED TSAKANI SUBSTATION 132KV POWER LINE

AVIFAUNAL IMPACT ASSESSMENT

OCTOBER 2014

EXECUTIVE SUMMARY

Eskom Distribution (Northern Region) has appointed Royal Haskoning DHV (RHDHV) (previously SSI Engineers and Environmental Consultants (Pty) Ltd), to undertake the Basic Assessment process for the proposed new Tsakani Substation and the proposed Mbumbu switching station to Tsakani Substation 132kV power line project ('proposed project'). Subsequently, the Endangered Wildlife Trust (EWT) was appointed to conduct an avifaunal specialist study (October, 2011). The report was updated and finalised, following changes to the corridor alternatives, by Arcus Consultancy Services Ltd (Arcus) in October 2014.

In general terms, the impacts that could be associated with a project of this nature include: collision of birds with the overhead cables; electrocution; destruction of habitat; and disturbance of birds. In general, large, heavy flying birds are more vulnerable to collision with over-head powerlines, while perching Raptors are more vulnerable to electrocution. Red Data species of both these groups occur in the area. The focal species for the study were determined, and are as follows**:** Saddle-billed Stork, White-backed Vulture, Martial Eagle, Tawny Eagle, Southern Ground Hornbill, Secretarybird, Marabou Stork, Kori Bustard, Red-crested Korhaan and Grey-headed Parrot. By examining these focal species which could occur in the area, as well as assessing the availability of bird micro habitats, the possible impacts of the proposed project were then assessed. Sensitive avifaunal areas of the site were mapped, and were found to be associated with rivers, wetlands and undisturbed woodland. Certain spans within these areas will require collision mitigation in the form of anti-collision marking devices. To determine the exact spans requiring mitigation, an avifaunal walkthrough as a component of the Environmental Management Programme (EMPR) for the proposed project is recommended. Only "Bird Friendly" monopole structures, approved by the EWT, can be used as tower structures for this project.

Two line options were considered, Line 1 and Line 3, as well as two substation alternatives for the proposed Tsakani Substation, Sub A and Sub B. It was concluded that the proposed project can be built, on either of the two power line options and utilising either substation alternative, provided that the various mitigation measures recommended in this report are implemented. From an avifaunal perspective, however, the Line 3 option is preferred.

OCTOBER 2014 UPDATE TO ORIGINAL EWT REPORT

The Avifaunal Impact Assessment Report, dated October 2011 was compiled by the specialist, Andrew Pearson, whilst in the employment of the Endangered Wildlife Trust (EWT). In August 2014, Arcus Consultancy Services Ltd. (Arcus) was appointed by Royal Haskoning DHV (RHDHV) to amend the October 2011 Avifaunal report, as the original author (Andrew Pearson) was no longer employed by the EWT but was now an employee with Arcus. The amendments to the original report are required due to a change in routing of the Line 3 option, as well as the discontinuation of Line 2 as an option. This report shows the necessary amendments based on the changes described above. Arcus made no changes to the reporting template or methods used by EWT. Updates to GIS mapping (Figures 1 and 10) were made by the EWT and reviewed by Arcus.

Signed: ANDREW PEARSON in his capacity as Avifaunal Specialist with Arcus Consultancy Services Ltd.

Date: 31st October 2014

DECLARATION OF INDEPENDANCE

Specialist Investigator

The Natural Scientific Professions Act of 2003 aims to "Provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP) and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith."

"Only a registered person may practice in a consulting capacity" – Natural Scientific Professions Act of 2003 (20(1)-pg 14)

Investigator:	Andrew Pearson (Pri.Sci.Nat)
Qualification:	BSc (Hons) Conservation Ecology
Affiliation:	South African Council for Natural Scientific Professions
Registration number:	400423/11
Fields of Expertise:	Ecological Science
Registration:	Professional Member

Andrew Pearson is employed by Arcus Consultancy Services Ltd, as a specialist investigator for conducting avifaunal specific specialist reports. Andrew has a Four Year BSc in Conservation Ecology, certificates in Environmental Law, as well as six years' experience in the environmental management field. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information.

Declaration of Independence

All specialist investigators specified above declare that:

- We act as independent specialists for this project.
- We consider ourselves bound by the rules and ethics of the South African Council for Natural Scientific Professions.
- We do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2010.
- We will not be affected by the outcome of the environmental process, of which this report forms part of.
- We do not have any influence over the decisions made by the governing authorities.
- We do not object to or endorse the proposed developments, but aim to present facts and our best scientific and professional opinion with regard to the impacts of the development.
- We undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2010.
- Should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party.

Terms and Liabilities

- This report is based on a short term investigation using the available information and data related to the site to be affected. No long term investigation or monitoring was conducted.
- The Precautionary Principle has been applied throughout this investigation.
- The specialist investigator, and Arcus/Endangered Wildlife Trust, for whom he/she works/worked, does not accept any responsibility for the conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from these assessments or requests made to them for the purposes of this assessment.
- Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this report.
- The specialist investigator withholds the right to amend this report, recommendations and conclusions at any stage should additional information become available.
- Information, recommendations and conclusions in this report cannot be applied to any other area without proper investigation.
- This report and all of the information contained herein remains the intellectual property of the Arcus.
- This report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist investigator as specified above.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed on the 31st October 2014 by Andrew Pearson.

ANDREW PEARSON

INTRODUCTION

Background

Eskom Holdings Ltd is proposing to construct the new Tsakani substation as well as a new 132kV power line from Mbumbu switching station to the proposed Tsakani substation, in the Mpumalanga Province. This is referred to as the 'proposed project'. Two route options are being considered for the power line, Line 1 and Line 3 (Figure 1), and two locations for the substation, substation A located at 24°39'20.10"S and 31°19'38.60"E and substation B at 24°39'20.10"S and 31°20'4.00"E.

Eskom Distribution (Northern Region) has appointed Royal Haskoning DHV (RHDHV) (previously SSI Engineers and Environmental Consultants (Pty) Ltd), to undertake the Basic Assessment process for the proposed project. Subsequently, the Endangered Wildlife Trust (EWT) was appointed to conduct an avifaunal specialist study, and a site visit was conducted on the 22nd of September 2011. The avifaunal specialist re-visited the site in September 2014 and the report was updated and finalised, following changes to the power line routings, by Arcus Consultancy Services Ltd (Arcus) in October 2014.

For the purposes of reporting, the 'site' is defined as the area enclosed by the two power line options (Line 1 and Line 3 (Figure 1)) and buffered by 500 m, and encompassing the proposed project. The 'broader study area' refers to the site as well as all areas within 10 km of the site.

The focal species for the study were determined by looking at the avifauna species which could occur in the broader study area, as well as assessing the available bird micro habitats on site. The potential impacts of the proposed project were then assessed against these focal species. In general terms, the impacts that could be associated with a project of this nature include: collision of birds with the overhead cables; electrocution; destruction of habitat; and disturbance of birds.

Terms of Reference

The following terms of reference were utilized for this study:

- Provide an assessment of the potential impact on avifauna associated with the proposed project.
- Describe the current state of avifauna in the broader study area, outlining important characteristics which may be influenced by the proposed infrastructure.
- Identify Red Data species potentially affected by the proposed project.

- Identify potential impacts of the proposed project on avifauna during construction and operation.
- Rate the significance of the impacts as per a standard set of criteria.
- Give a comparative assessment of the alternatives proposed.
- Give recommendations and identify mitigation measures to minimise identified impacts during all phases of the project.
- Identify and address any other aspects related to avifauna in the broader study area that should be incorporated into the reports.

Methodology

Generally when predicting the impacts of a proposed power line and substation on birds, a combination of science, field experience and knowledge of the specialist is required. More specifically the methodology used to predict impacts of the proposed project was as follows:

- The various data sets discussed below under "sources of information" were collected and examined with the aim of determining the focal species for this study.
- The data was examined to determine the location and abundance of species which may be susceptible to impacts from the proposed project including both Red Data and non Red Data.
- The broader study area was visited, and the site was thoroughly traversed, to obtain a first-hand perspective of the proposed project and birdlife, and to determine which bird micro habitats are present and relevant to the study. This involved driving around in the broader study area, taking photographs, and walking certain accessible areas, to see as much as possible of the proposed substation sites and route options for the power line.
- A desk top examination of the site, using Google Earth imagery was done to compare the power line route options and substation site alternatives.
- The impacts of the proposed project on birds were predicted on the basis of experience in gathering and analysing data on wildlife impacts with power lines and associated substation infrastructure throughout southern Africa since 1996 (see van Rooyen & Ledger 1999 for an overview of methodology), supplemented with first hand data.
- The impacts were assessed in a table, using pre-determined assessment criteria.
- Recommended mitigation measures for significant impacts were proposed.

Sources of Information

The study made use of the following data sources:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP-1 – Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997) obtained from the Avian Demography Unit of the University of Cape Town, in order to ascertain which species may occur in the broader study area and on the site.
- The conservation status of all bird species identified in the relevant SABAP-1 data was then determined with the use of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes, 2000).
- The Southern African Bird Atlas Project 2 (SABAP-2) data for certain pentads, with sufficient data, in the broader study area was examined.
- Data from the Co-ordinated Waterbird Count (CWAC) project was also consulted to determine whether any CWAC sites exist in the broader study area (Taylor, Navarro, Wren-Sargent, Harrison & Kieswetter, 1999).
- The Important Bird Areas of southern Africa (IBA) project data (Barnes 1998) was consulted to determine if any sites were within the broader study area.
- A classification of the vegetation types in the broader study area was obtained from Mucina and Rutherford (2006).
- Information on the micro habitat level was obtained through visiting the broader study area and obtaining a first-hand perspective.
- Electronic 1:50 000 maps covering the broader study area were obtained from the Surveyor General.
- Satellite Imagery of the broader study area was studied using Google Earth ©2010.

Limitations & Assumptions

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

- The SABAP-1 data is old and covers the period 1986-1997. (For a full discussion of potential inaccuracies in ASAB data, see Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997).
- The site visits (2011 and 2014) were both conducted in spring, over which time various species may not have been present in the broader study area.
- During the site visit, it was not possible to access the entire length and all sections of the proposed power line options.
- Google Earth Imagery may not always reflect the true situation on the ground, as some images may be outdated.

- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can't be reduced to formulas that will hold true under all circumstances. However, power line and substation impacts can be predicted with a fair amount of certainty, based on the specialist's experience and information from the EWT's investigations of bird interactions with power lines in southern Africa since 1996.
- Nest searches were not conducted.

DESCRIPTION OF AFFECTED ENVIRONMENT

Study Area Vegetation and Land Use

Vegetation type influences micro habitats and is therefore useful in determining avifaunal abundance and likelihood of occurrence. Figure 1 shows the vegetation classification (Mucina & Rutherford, 2006) of the broader study area and beyond. The site consists entirely of "Granite Lowveld" vegetation type, which is also dominant in the broader study area. Elements of "Legogote Sour Bushveld" are present beyond the broader study area. Both of these vegetation types form part of the Lowveld Bioregion, and represent elements of the greater Savanna Biome.

"Granite Lowveld" is found mainly in Limpopo and Mpumalanga Provinces and Swaziland. It forms a north-south belt on the plains east of the escarpment from Thohoyandou in the north, interrupted in the Bolobedu area, continued in the Bitavi area, with an eastward extension on the plains around the Murchison Range and southwards to Abel Erasmus Pass, Mica and Hoedspruit areas to the area east of Bushbuckridge. Substantial parts are found in the Kruger National Park spanning areas east of Orpen Camp southwards through Skukuza and Mkuhlu. It is found at altitudes of 250 – 700 m. "Legogote Sour Bushveld" occurs in Mpumalanga and Limpopo Provinces on the lower eastern slopes and hills of the northeastern escarpment from Mariepskop in the north through White River to the Nelspruit area extending westwards up the valleys of the Crocodile, Elands and Houtbosloop Rivers and terminating in the south in the Barberton area. It is predominantly found at higher altitudes ranging from 600 m to 1100 m.

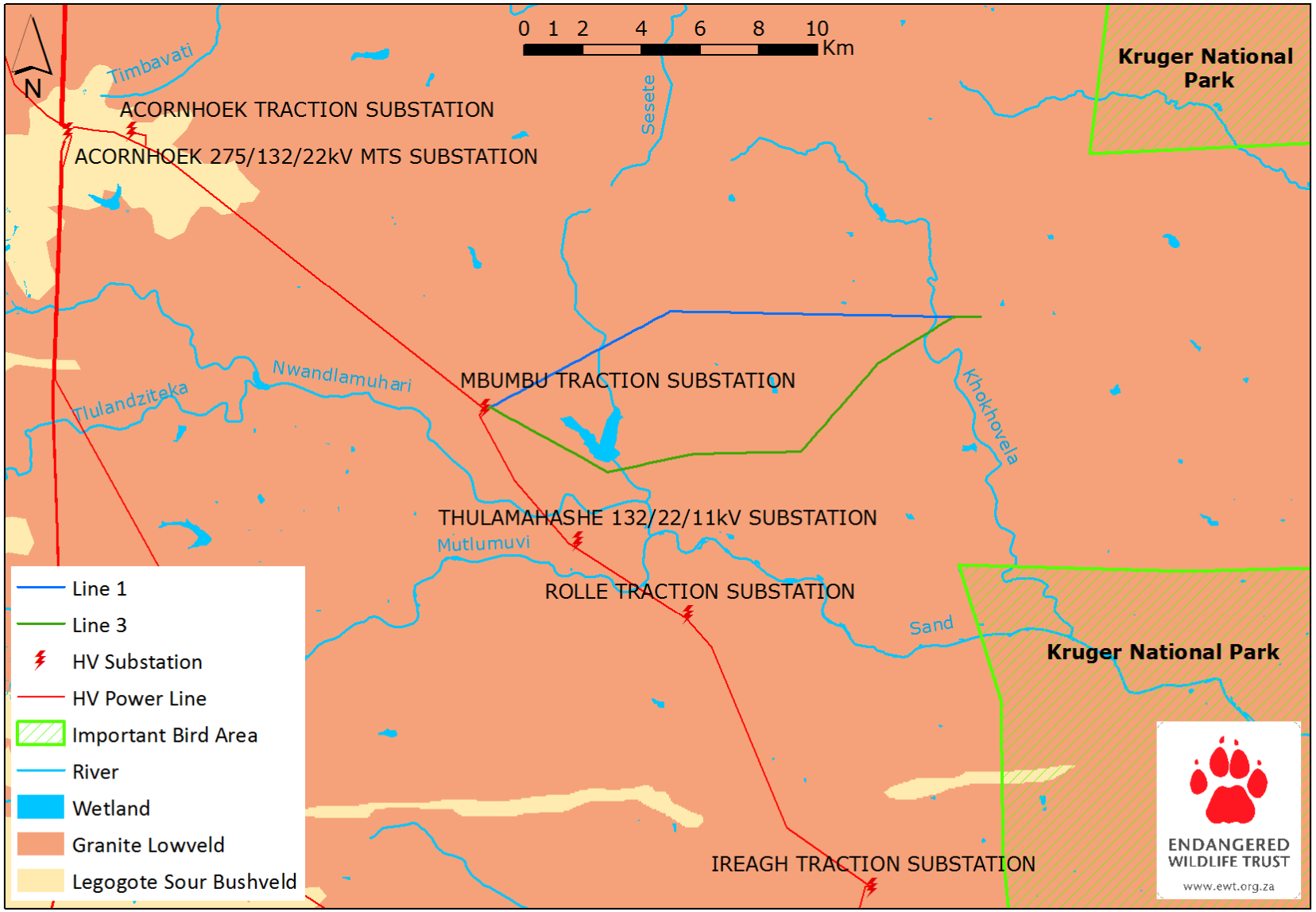

Figure 1: Map indicating the proposed project power line route options, existing high voltage electrical infrastructure, IBA's, rivers and the vegetation classification for the broader study area according to Mucina & Rutherford, 2006.

Bird Micro Habitats

Micro habitats occur at a smaller spatial scale and are shaped by factors including vegetation, topography, land use, food sources and man-made factors. Investigation of the broader study area revealed the following bird micro habitats.

Cultivated Lands and Pastures

Cultivated lands can represent feeding areas for many bird species. Through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources readily accessible to birds and other predators. The crop or pasture plants cultivated are often eaten by birds, or attract insects which are in turn eaten by birds, and during the dry season arable lands often represent the only green or attractive food sources in an otherwise dry landscape. Although there are no large areas of cultivated lands on the site, there are a few small areas of rural subsistence agriculture (Figure 2). Other areas have been cleared of woody vegetation and pasture planted, for grazing by livestock. Relevant bird species that may be attracted to cultivated lands and pastures in the broader study area, and possibly also to the small subsistence agricultural lands on the site, include Red-crested Korhaan, Yellow-billed Kite, Abdim's Stork and White Stork. More common species such as Francolins, Egrets, Herons and Ibises, will also frequent these areas.

Figure 2: Small scale arable lands and pastures in the study area.

Grasslands and Open Areas

Grasslands represent a significant foraging and/or hunting area for many bird species. However, as the site is not within the Grassland Biome, no extensive areas of true "grasslands" exist. Patches of "grassy" or "open" areas are present though, especially in cleared areas and areas of over-grazing (Figures 3 and 4). Important bird species that may be found in these open grassland patches of the site are: Secretarybird, Southern Ground Hornbill, Red-crested Korhaan, Kori Bustard and Black-bellied Bustard. The open grassland patches may also be a favorite foraging area for game birds such as francolins and Helmeted Guineafowl, as well as being hunting habitat for raptors such as Black-chested Snake-Eagle, Martial Eagle, African Marsh Harrier, and Black-shouldered kite.

Figure 3: The patchy landscape is visible showing woodland areas as well as grassland patches, in areas that appear to have been cleared for agriculture and/or grazing.

Figure 4: "Grassy" open area on the study site, being grazed by livestock.

Dams

Dams have become important attractions for various bird species in the South African landscape. Various waterfowl, such as Spur-winged geese, Egyptian geese, and numerous duck species, may frequent these areas and are vulnerable to collision with power lines. Various Storks may also frequent these water bodies, as well as fish eating raptors such as the Osprey and African Fish Eagle. A large dam is located within the site between the two power line options, approximately 3.5 km south east of Mbumbu switching station (Figure 1). Figure 5 shows a photograph of this dam which is the largest open water body on the site. In addition to this large dam, very few dams are located in the broader study area.

Figure 5: A large dam observed on site.

Rivers and Drainage Lines

Rivers represent important habitat for many species, including Black Stork, Yellow-billed Stork, Saddle-billed Stork, Ducks, Geese and a variety of other water birds. The wooded riparian habitat, as well as reed beds, alongside a river may provide habitat for various species such as the Hamerkop, African Darter, various cormorants, kingfishers (Figure 7), bee-eaters, robin-chats and numerous smaller species. Slow flowing sections of a river with overhanging vegetation supply habitat for African Finfoot, while rivers also represent feeding areas for fish eating raptors such as the African Fish Eagle. Sandbanks associated with large rivers provide habitat for various wading species including, Lapwings, Plovers, Stilts, and Sandpipers. Rivers and drainage lines also represent important flight paths for many species. The rivers on the site itself are the Mphyanyana River (Figure 6) in the west of the site and the Khokhovela River in the east. The two proposed power line options will both traverse each of these two rivers. On the site there are also smaller streams and drainage lines, such as those leading to and from the large dam discussed above. These may not always carry water; however these drainage lines may still serve as flight paths for several bird species. Other larger rivers in the broader study area are the Nwandlamuhari River and the Sand River (see the map in Figure 10 for the location of these).

Figure 6: The Mphyanyana River on site showing reed bed habitat.

Figure 7: A Malachite Kingfisher observed in the same reeds as the figure above.

Woodland Savannah

This is the most prevalent micro habitat type (Figure 8) on the site, and is consistent with the "Granite Lowveld" vegetation type. It is present in the broader study area in varying levels of disturbance, including more woody areas and some savannah (woody and grassy components present) areas. There are also riverine woodland areas, with large trees, associated with the rivers, streams and drainage lines. Various species may occur in these micro habitats, but the most likely species from Table 1 below are: White-backed Vulture, Martial Eagle (Figure 9), Tawny Eagle and Southern Ground Hornbill. This micro habitat type will also be important to physically smaller bird species, which are less likely to interact, in terms of collision and electrocution, directly with the proposed power lines, such as Doves, Cuckoos, Drongo's, Wood-peckers, Barbets, Fly-catchers, Wattle Eyes, Robin-chats, and Shrikes.

Figure 8: Relatively undisturbed woodland on site.

Figure 9: A Martial Eagle, such as the one pictured above (with a Pied Crow to the right), will favour tall trees (and possibly any tall structure such as a pylon) for perching in Woodland Savannah.

Relevant Bird Populations

Southern African Bird Atlas Project 1

The primary data source used to determine the distribution and abundance of bird species in the broader study area was the SABAP-1 data (Harrison *et al*, 1997). This data was collected over an 11 year period between 1986 and 1997. Although it is now quite old, it remains the best long term data set on bird distribution and abundance available at present. This data was collected on the basis of quarter degree squares, which is also a relatively large spatial scale. The species recorded in the relevant quarter degree squares could have been recorded anywhere within these squares and not necessarily on the site. It does however provide a good indication of what could be found in the broader study area.

The proposed project is situated in two quarter degree squares (QDGS's), 2431CA and 2431CB. Relevant Red Data (Barnes, 2000) bird species (i.e. those vulnerable to either collision or electrocution such as raptors and large flying birds), are shown in the table below, as well as their relative abundance (i.e. report rate) in each QDGS. This bird list has been considered in combination with the micro habitats identified previously in this report (and indicated in bold in Table 1 below).

Table 1: Relevant Red Data and Bonn Convention* species recorded in the quarter degree squares covering the proposed project by the SABAP-1 (Harrison *et al* 1997)

Species	Cons. status	Report rate (%)		Preferred micro habitat	Likelihood of occurrence
		2431CA	**2431CB**		
Number of cards submitted		*42*	*74*		
Saddle-billed Stork	EN	4	51	**Rivers**, **Dams,** Lakes, Wetlands	Possible
Cape Vulture	VU	19	12	**Grassland**, **Woodland Savannah**, Hills and Ridges	Possible
White-backed Vulture	VU	29	76	**Woodland Savannah**, Bushveld	Highly Likely
Lappet-faced Vulture	VU	5	64	**Woodland Savannah**	Possible
White-headed Vulture	VU	5	32	Broad-leaved woodland	Possible
Hooded Vulture	VU	-	32	**Woodland Savannah**	Likely
Martial Eagle	VU	5	66	**Woodland Savannah**, semi-arid shrubland	Likely
Tawny Eagle	VU	14	73	**Woodland Savannah**	Likely
African Marsh-Harrier	VU	2	-	Wetlands, **Grasslands**	Unlikely
Southern Ground-Hornbill	VU	5	59	**Woodland Savannah**, **Grassland**	Possible
Kori Bustard	VU	-	21	Open **Woodland Savannah**	Unlikely
Black Stork	NT	3	11	**Rivers** and Kloofs	Possible
Woolly-necked Stork	NT	5	32	**Rivers**, Wetlands, Coastal mudflats	Possible
African Openbill	NT	-	20	**Rivers**, **Dams,** Wetlands, Floodplains	Possible
Marabou Stork	NT	2	37	**Woodland Savannah**, **Grassland**	Possible
Yellow-billed Stork	NT	8	1	**Rivers**, **Dams**, Lakes, Estuaries	Possible
Greater Flamingo	NT	-	4	Shallow lakes, Salt Pans, Estuaries	Unlikely
Secretarybird	NT	7	74	**Grassland**, Open **Woodland Savannah**,	Possible
African Pygmy-Goose	NT	-	8	Permanent waters with water-lilies, **Dams**	Possible
Black-bellied Bustard	NT	21	51	**Grassland**	Likely
White Stork	Bonn	1	15	**Grassland**, **Cultivated Lands**, wetland, dams	Possible
Abdim's Stork	Bonn	1	3	**Grassland**, **Woodland Savannah**	Possible

CR = Critically Endangered; EN = Endangered; V = Vulnerable; NT = Near-threatened; *Bonn = Protected Internationally under the Bonn Convention on Migratory Species. Report rates are essentially percentages of the number of times a species was recorded in the square, divided by the number of times that square was counted. It is important to note that these species were recorded in the entire quarter degree square in each case and may not actually have been recorded on the site for this study.

Across both squares a total of 20 relevant Red Data species were recorded, comprising 1 Endangered, 10 Vulnerable and 9 Near-threatened. The White and Abdim's Storks, which are Red Data species, but are protected internationally through the Bonn Convention on Migratory species, were also recorded in both squares. The most important of these species for this study are the Saddle-billed Stork, Cape Vulture, White-backed Vulture, Lappet-faced Vulture, Martial Eagle, Tawny Eagle, Southern Ground Hornbill, Secretarybird, Marabou Stork and Black-bellied Bustard. These species are all reasonably abundant in the area and/or are vulnerable to collision with overhead power lines in South Africa, or electrocution.

Table 1 above shows the preferred micro habitats that each identified Red Data bird species typically frequents both in the broader study area and throughout their ranges. Those micro habitats identified on the site are shown in bold. It must be stressed that birds can and will, by virtue of their mobility, utilise almost any areas in a landscape from time to time. However, the analysis in Table 1 represents each species' most preferred or normal micro habitats. These locations are where most of the birds of that species will spend most of their time – so logically that is where impacts on those species will be most significant.

Southern African Bird Atlas Project 2

Both line options begin at Mbumbu switching station within pentad 2440_3110, and both traverse pentad 2435_3115. The Line 1 option also traverses pentad 2435_3110, while the Line 3 option also traverses pentad 2440_3115. The proposed Tsakani Substation falls just within pentad 2435_3120, while data from 2440_3120 was also considered due to its close proximity (and because it had been counted on three occasions). Pentad 2445_3120, approximately 8 km south east of the site was considered as it had been well counted (14 cards)

Table 2: Report Rates, as of 15:00hrs on 29th September 2014, from SABAP-2, for relevant species.

	Pentad Report Rate						
Pentad	**2445_3120**	**2440_3110**	**2440_3115**	**2435_3110**	**2435_3115**	**2435_3120**	**2440_3120**
No. Cards	14	1	1	1	1	1	3
Total Species	250	61	63	60	41	41	107
Saddle-billed Stork	14.29	-	-	-	-	-	-
Cape Vulture	7.14	-	-	-	-	-	-
White-backed Vulture	92.86	-	-	-	-	-	-
White-headed Vulture	14.29	-	-	-	-	Incidental	-
Hooded Vulture	64.29	-	-	-	-	-	-
Martial Eagle	14.29	-	-	-	-	-	-
Bateleur	92.86	-	-	-	-	100	66.7
Tawny Eagle	28.57	-	-	-	-	-	-
Southern Ground-Hornbill	Incidental	-	-	-	-	Incidental	-
Black Stork	7.14	-	-	-	-	-	-
Woolly-necked Stork	14.29	-	-	-	-	-	-
Yellow-billed Stork	7.14	-	-	-	-	-	-
Black-bellied Bustard	42.86	-	-	-	-	-	-
Red-billed Oxpecker	92.86	-	-	-	-	-	66.7
Brown Snake-Eagle	71.43	-	-	100	-	-	33.3
African Fish-Eagle	57.14	-	-	-	-	-	-
Wahlberg's Eagle	42.86	-	-	-	-	-	-
African Hawk-Eagle	35.71	-	-	-	-	-	-
Verreaux's Eagle Owl	35.71	-	-	-	-	-	-
Red-crested Korhaan	42.86	-	-	-	-	-	-
African Black Duck	35.71	-	-	-	-	-	-
White-faced Duck	14.29	-	-	100	-	-	-
Bronze-winged Courser	21.43	-	-	-	-	-	-
African Spoonbill	-	100	-	-	-	-	-

8 of the relevant species identified in the SABAP-1 data (i.e. Table 1), have not been recorded in the SABAP-2 data for the pentads examined. This however, does not necessarily mean that these species do not occur here, or that they have moved from the area, post SABAP-1, but may merely be due to the low counting effort of the pentads, or selective micro habitat counting by the SABAP-2 field counters. It must be noted though, that pentad 2445_3120 covers part of the Ulusaba Game Reserve within the Greater Kruger Park, and species such as Hooded Vulture, Bateleur, Tawny Eagle, and Red-billed Oxpecker, with a high report rate, may be scarcer outside of the protected area, in the vicinity of the site.

Coordinated Avifaunal Road-count (CAR) data

There are no CAR sites within the site or broader study area.

Coordinated Waterbird count (CWAC) data

There are no CWAC sites within the site or broader study area.

Important Bird Areas (IBA's)

The selection of Important Bird Areas (IBAs) is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations (BirdLife International, 2011). The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations, and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels.

The site does not encompass any IBA's however, the Kruger National Park IBA is present within the broader study area. This IBA is situated to the north, east and south of the site, with its closest point being approximately 7 km from the site, while the Blyde River Canyon IBA is >20km from the site, and hence is not considered further in this study. The Kruger National Park IBA is discussed in more detail below due to potential connectivity between the site and the IBA.

Kruger National Park (ZA001)

Kruger National Park (KNP) is situated on the southern portion of the Mozambique coastal plain in the Lowveld of the Northern Province and Mpumalanga. The park is roughly rectangular in shape, stretching 320 km from north to south and 65 km from east to west. The park is known to support more than 490 bird species, about 55% of the species found in the southern African sub region. The diversity of birds can be attributed to the variety of habitats present and the eco-tonal nature of the area. The park supports the healthiest populations of scavenging bird species (e.g. Vultures) in South Africa. The rivers, flood-plains, pans, dams and vleis are important for many wetland-dependent and associated birds, such as Black Stork, which breed in the gorges of the nearby Lebombo Mountains. Several wide-ranging species, which are now rare outside South Africa's large national parks, are locally common in KNP, including the country's largest populations of Marabou Stork, Hooded Vulture, White-backed Vulture, Lappet-faced Vulture, White-headed Vulture, Martial Eagle, Bateleur, Tawny Eagle, Kori Bustard and Southern Ground Hornbill. Cape Vulture regularly forage within the park (BirdLife International, 2011).

Specialist's Observations

Observations by the specialist of bird species in the broader study area made during the September 2011 and September 2014 site visits are provided in Appendix 1. These lists are merely for indicative purposes, representing incidental observations (which could be positively identified).

Data from this table needs to be used with caution, as observations over short periods, in one season (spring in this case), and in fairly similar weather conditions cannot be taken as a true indication of the presence of bird species in the area. In particular, the target species for this study are threatened, rare species, so the likelihood of seeing one during a two day period is limited. This study has therefore attached far more weight to the secondary data sources such as the bird atlas projects (SABAP-1 and SABAP-2) which collected data over a far longer period, and across more diverse conditions.

Focal Species List

Determining the focal species for this study, i.e. the most important species to be considered, is a four step process. Firstly, the micro habitats available on site were identified. An analysis of the above existing avifaunal data represents the second step, i.e. which species may occur in the broader study area at significant abundances. The third step is to identify those species (which may be present based on the above two steps), and are more likely to be impacted upon by the proposed project. This step called on the vast experience of the EWT in evaluating and investigating electrical infrastructure impacts on birds, as well as the Arcus specialist's experience in assessing electrical infrastructure projects (these impacts are discussed in more detail below). In general, large, heavy flying birds are more vulnerable to collision with over-head powerlines, while perching Raptors are more vulnerable to electrocution. Smaller passerines are more likely to be impacted upon through habitat destruction and disturbance. The fourth and final step was to consider the species conservation status or other reasons for protecting the species. This involved primarily consulting the Red Data bird species (Barnes 2000) as in Table 1.

The resultant list of 'focal species' for this study is as follows:

- Saddle-billed Stork;
- White-backed Vulture;
- Martial Eagle, Tawny Eagle;
- Southern Ground Hornbill;
- Secretarybird;
- Marabou Stork;
- Kori Bustard;
- Red-crested Korhaan; and
- Grey-headed Parrot.

In some cases, these species serve as surrogates for other similar species (as mitigation will be effective for both), examples being Saddle-billed Stork for Black and Abdim's Storks, Red-crested Korhaan for Black-bellied Bustard, White-backed Vulture for Lappet-faced Vulture and Martial Eagle for Bateleur. Assorted more common species will also be relevant

to this study, but it is believed that the above target species will to a large extent serve as surrogates for these in terms of impact assessment and management. It must be noted that many "non Red Data" bird species also occur on site and could be impacted on by proposed project. Although this impact assessment focuses on Red Data species, the impact on non Red Data species is also assessed. Furthermore, much of the mitigation recommended for Red Data species will also protect non Red Data species.

IDENTIFICATION OF IMPACTS

This section identifies the potential impacts on avifauna from the proposed project. The impacts are then assessed in tables 3 and 4, according to a fixed set of criteria as supplied by RHDHV (Appendix 3).

General Description of Impacts on Birds

Because of its size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger 1983; Verdoorn 1996; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

Construction Phase Impacts

Habitat Destruction

During the construction phase and maintenance of substations and power lines some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes, as well as clearing vegetation at the substation site. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat. Habitat destruction by the proposed project is anticipated to be of moderate significance following the implementation of mitigation.

Disturbance

Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during bird breeding activities. Disturbance of birds by the proposed project is anticipated to be of low significance after mitigation.

Operational Phase Impacts

Electrocutions

Electrocution of birds on overhead power lines is an important cause of unnatural mortality of raptors and storks and has been reported in Europe, USA and South Africa (APLIC 1994; van Rooyen & Ledger 1999). Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Electrocution is possible on 132kV lines, depending on the exact pole structure used.

The impact assessment found the impact of electrocution to be of high significance, and low significance after the application of mitigation in the form of bird friendly structures. Further information on the mitigation technique is provided below in this report.

Collisions

Collisions are the biggest single threat posed by transmission power lines to birds in Southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, and therefore, consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term.

Potential collision impacts with the proposed power line of certain focal species such Secretarybird, Kori Bustard, various Stork species, and Southern Ground Hornbill, are possible. The impact assessment has found these impacts to be of low significance after the application of mitigation as described below in this report.

Table 3: Assessment of Construction Phase Impacts

AVIFAUNA IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE AFTER MITIGATION
Disturbance	Localised	Short term	Moderately severe	Moderate	Strict control should be maintained over all activities during construction, in line with an approved Construction EMP. **During Construction, if any of the "Focal Species" identified in this report are observed to be roosting and/or breeding in the vicinity, Arcus is to be contacted for further instruction.**	Low
Habitat Destruction	Localised	Long term	Moderately severe	Moderate	Strict control should be maintained over all activities during construction in line with an approved Construction EMP, in particular heavy machinery and vehicle movements, and staff. It is difficult to mitigate properly for this as some habitat destruction is inevitable.	Moderate

Table 4: Assessment of Operational Phase Impacts

AVIFAUNA IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE AFTER MITIGATION
Electrocution	Localised	Long term	Moderately severe	High	A "Bird Friendly" monopole structure, with a bird perch (as per standard Eskom guidelines) should be used for the tower structures.	Low
Collision	Localised	Long term	Moderately severe	Moderate	Mark sections of line in high sensitivity areas with anti-collision marking devices on the earth wire to increase the visibility of the power line and reduce likelihood of collisions. Marking devices should be spaced 10 m apart. High sensitivity areas should be finalised in a site "walkthrough" by an avifaunal specialist once the final route is decided and towers/pylons pegged as a condition of the EMPR.	Low

IDENTIFICATION OF SENSITIVE AREAS WITHIN THE SITE TO INFORM MITIGATION

The impact assessment has identified mitigation in the form of:

- The use of bird friendly monopole structures for the power line – required throughout the proposed project;
- The use of anti-collision marking devices – to be applied in areas of High Sensitivity;
- Strict control over construction techniques to be implemented through the EMPR.

With regard to the anti-collision marking devices the high sensitivity areas with regard to avifauna must be determined.

Figure 10 below shows the major rivers, which have been buffered by 500 m, as well as the various wetlands and/or dams in the site, which have been buffered by 200 m. These wetland/dams buffer zones, as well as the buffer zones around the Rivers, are all regarded as ***High Sensitivity*** areas, and collision mitigation (as detailed in Table 4), is required for

all these areas. As discussed above, the northerly Line 1 option appears to pass through relatively undisturbed woodlands, as demarcated by the dotted red line in Figure 10. This area is also regarded as a ***High Sensitivity*** zone, requiring both collision (exact spans to be finalised in an avifaunal walkthrough) mitigation.

Unknown Sensitivity: These are all the remaining areas, where no obvious avifaunal features or patterns were identified during the study. It is likely that the majority of these areas could be designated as Low- Medium sensitivity and hence will not require collision mitigation on lines passing through them. However a walk through survey of the final power line route is required to confirm this as a condition of the EMPR and any spans of power line found to be located in an area of High Sensitivity must be fitted with collision mitigation.

COMPARISON OF ALTERNATIVES

Two power line options have been proposed for consideration and can be seen in Figure 10 below.

Line 1:

- This is the most northerly option, and is approximately 16.2 km in length.
- Does not follow existing infrastructure, and avoids human settlement for the majority of its length.
- Line option that passes through the greatest area of relatively undisturbed woodland (see area demarcated by the dotted red lines in Figure 10).

Line 3:

- This is the most southerly route option, and is approximately 17.5 km in length.
- From Mbumbu, it heads south east, passing on the southern shore of a large dam.
- Does not appear to follow any existing infrastructure.
- Passes near large areas of human habitation, as well as over-grazed and disturbed lands.

Two substation sites have been proposed for the new Tsakani Substation.

Substation A:

- This is the western substation site located at 24°39'20.10"S and 31°19'38.60"E
- Situated in old pasture lands used for grazing and in close proximity to human development.
- Situated in an *Unknown Sensitivity* Zone, that is likely to be low to moderately sensitive in terms of avifauna.

Substation B:

- This is the eastern substation site located at 24°39'20.10"S and 31°20'4.00"E, approximately 700 m east of Sub A.
- Situated close to human development on the outskirts of Hluvukani.
- Situated in an *Unknown Sensitivity* Zone, that is likely to be low to moderately sensitive in terms of avifauna.

The Line 3 option is preferred for the power line routing. From a avifauna perspective these is no preference between substation A and substation B

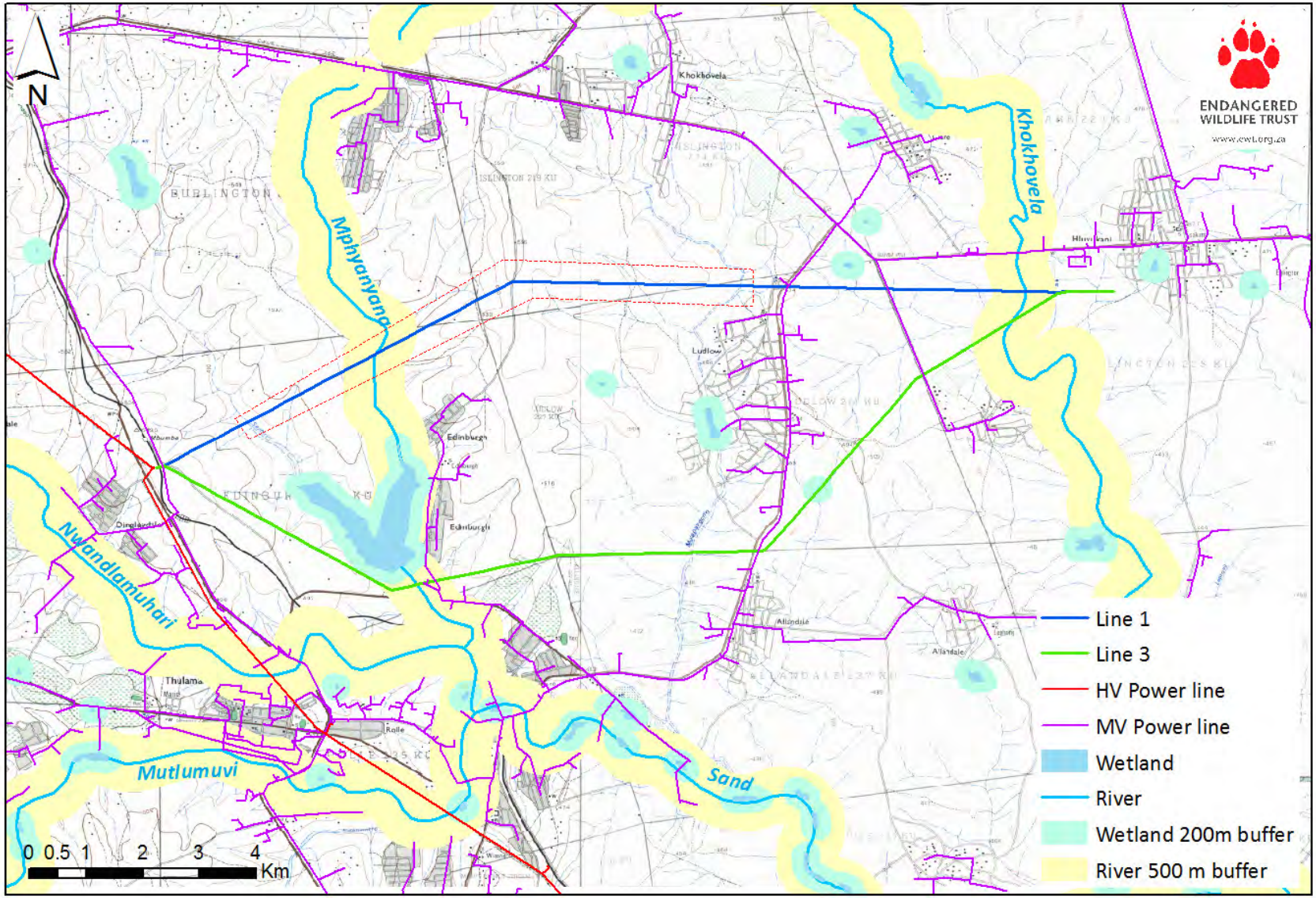

Figure 10: Map showing the Line Options as well as sensitive areas of the study site, associated with natural woodland, wetlands and rivers.

IMPACT STATEMENT

In conclusion, the proposed project can be built provided that the various mitigation measures recommended in this report are implemented. From an avifaunal perspective, the southern power line option, Line 3, which passes through disturbed areas and near to numerous human settlements, is more preferred than the northern option, Line 1, which is acceptable but is the least preferred. From an avifauna perspective there is no preference over substation A or B.

Electrocutions of large raptors (which are abundant in the broader study area) has the potential to be the most significant impact of the proposed project if mitigation (i.e. a bird friendly monopole structure) is not applied. Therefore, in terms of avifauna, the project should not proceed unless safe pylon structures, approved by the EWT (Arcus Consulting can facilitate this approval), is used. An example of a possible bird friendly structure is shown in Appendix 2 and if an alternate structure is considered, it should be approved by the EWT.

Collisions are also expected to be an important impact of this project and thorough marking of identified spans of power line with bird flight diverters is required to mitigate for this. High sensitivity areas (i.e. in the vicinity of Rivers, Dams, Wetlands and pristine Woodland) have been mapped, within which the above-mentioned collision mitigation must be implemented. An avifaunal walk through is recommended in order to confirm the high sensitivity areas to identify the exact spans of the power line to which the mitigation for bird collisions is required. Provided that the high risk sections of the power line are mitigated in the form of marking, the impact should be reduced to an acceptable level. Arcus, as well as the EWT, through their partnership with Eskom and ongoing international networking, are well aware of the room for improvement on the effectiveness of power line marking devices. However, it is the view of the specialist that currently available devices, although not 100% effective, would provide an acceptable level of mitigation for the proposed project.

Habitat destruction and disturbance are expected to be the most important impacts of the proposed substation site on avifauna and mitigation through controls over construction practices should be implemented through the EMPR. Electrocutions are also possible in the substation, but are less likely here than on the power line pylon structures and therefore no additional mitigation is recommended at this time. However, the substation site should be monitored for signs of bird mortality or nesting and the Arcus avifaunal specialist should be contacted for further instruction should such instances arise.

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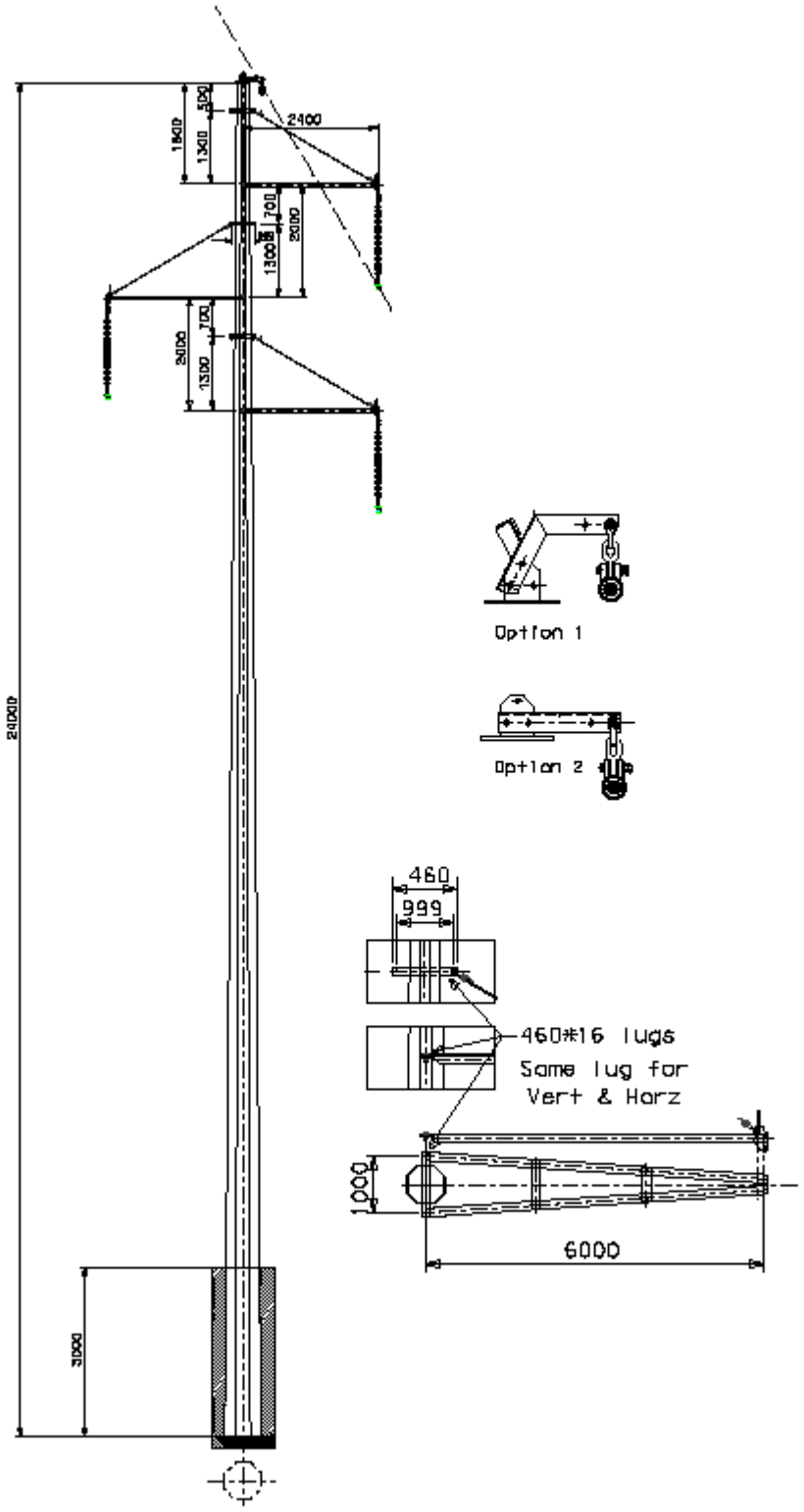
APPENDIX 1: List of species observed during the two site visits (September 2011 and September 2014).

Roberts VII	Alphabetical Name	Scientific Name	Sep-11	Sep-14
496	Barbet, Black-collared	*Lybius torquatus*	x	x
494	Batis, Chinspot	*Batis molitor*	x	x
493	Bulbul, Dark-capped	*Pycnonotus tricolor*	x	x
492	Bunting, Golden-breasted	*Emberiza flaviventris*	x	x
495	Crow, Pied	*Corvus albus*	x	x
497	Dove, Emerald-spotted Wood	*Turtur chalcospilos*	x	x
489	Drongo, Fork-tailed	*Dicrurus adsimilis*	x	x
499	Egret, Western Cattle	*Bubulcus ibis*	x	x
488	Go-away-bird, Grey	*Corythaixoides concolor*	x	x
491	Goose, Egyptian	*Alopochen aegyptiaca*	x	x
490	Guineafowl, Helmeted	*Numida meleagris*	x	x
498	Helmet-shrike, White-crested	*Prionops plumatus*	x	x
487	Heron, Grey	*Ardea cinerea*	x	x
486	Hoopoe, African	*Upupa africana*	x	x
485	Hornbill, African Grey	*Tockus nasutus*	x	x
699	Hornbill, Southern Yellow-billed	*Tockus leucomelas*	x	x
701	Ibis, Hadeda	*Bostrychia hagedash*	x	x
700	Kingfisher, Brown-hooded	*Halcyon albiventris*	x	x
276	Kingfisher, Malachite	*Alcedo cristata*	x	x
661	Kite, Yellow-billed	*Milvus aegyptius*	x	x
660	Lapwing, Blacksmith	*Vanellus armatus*	x	x
67	Oriole, Black-headed	*Oriolus larvatus*	x	x
68	Puffback, Black-backed	*Dryoscopus cubla*	x	x
69	Pytilia, Green-winged	*Pytilia melba*	x	x
62	Robin, White-browed Scrub	*Erythropygia leucophrys*	x	x
60	Roller, Lilac-breasted	*Coracias caudatus*	x	x
364	Vulture, White-backed	*Gyps africanus*	x	x
563	Waxbill, Blue	*Uraeginthus angolensis*	x	x
565	Waxbill, Common	*Estrilda astrild*	x	x
567	Apalis, Yellow-breasted	*Apalis flavida*	x	
564	Bee-eater, Little	*Merops pusillus*	x	
105	Camaroptera, Green-backed	*Camaroptera brachyura*	x	
107	Dove, Laughing	*Streptopelia senegalensis*	x	
101	Eagle, Martial	*Polemaetus bellicosus*	x	
106	Flycatcher, Spotted	*Muscicapa striata*	x	
108	Prinia, Tawny-flanked	*Prinia subflava*	x	
102	Shikra	*Accipiter badius*	x	
100	Starling, Burchell's	*Lamprotornis australis*	x	
103	Sunbird, White-bellied	*Cinnyris talatala*	x	
856	Swallow, Lesser Striped	*Cecropis abyssinica*	x	

Roberts VII	Alphabetical Name	Scientific Name	Sep-11	Sep-14
857	Woodpecker, Golden-tailed	*Campethera abingoni*	x	
854	Babbler, Arrow-marked	*Turdoides jardineii*		x
450	Barbet, Crested	*Trachyphonus vaillantii*		x
451	Bush-shrike, Orange-breasted	*Chlorophoneus sulfureopectus*		x
449	Canary, Yellow-fronted	*Crithagra mozambica*		x
663	Cisticola, Rattling	*Cisticola chiniana*		x
666	Dove, Cape Turtle	*Streptopelia capicola*		x
552	Eagle, Brown Snake	*Circaetus cinereus*		x
423	Eagle, Tawny	*Aquila rapax*		x
422	Firefinch, Jameson's	*Lagonosticta rhodopareia*		x
550	Fiscal, Common	*Lanius collaris*		x
548	Flycatcher, Southern Black	*Melaenornis pammelaina*		x
533	Francolin, Crested	*Dendroperdix sephaena*		x
620	Goose, Spur-winged	*Plectropterus gambensis*		x
542	Hamerkop	*Scopus umbretta*		x
615	Hornbill, Crowned	*Tockus alboterminatus*		x
616	Hornbill, Southern Red-billed	*Tockus rufirostris*		x
614	Korhaan, Red-crested	*Lophotis ruficrista*		x
948	Lapwing, Crowned	*Vanellus coronatus*		x
947	Martin, Brown-throated	*Riparia paludicola*		x
949	Mousebird, Red-faced	*Urocolius indicus*		x
946	Neddicky	*Cisticola fulvicapilla*		x
555	Nightjar, Fiery-necked	*Caprimulgus pectoralis*		x
556	Owl, African Scops	*Otus senegalensis*		x
557	Parrot, Grey-headed	*Poicephalus fuscicollis*		x
554	Pipit, Bushveld	*Anthus caffer*		x
553	Shrike, Lesser Grey	*Lanius minor*		x
204	Shrike, Magpie	*Corvinella melanoleuca*		x
194	Sparrow, House	*Passer domesticus*		x
196	Sparrow, Southern Grey-headed	*Passer diffusus*		x
195	Spurfowl, Natal	*Pternistis natalensis*		x
42	Swallow, Barn	*Hirundo rustica*		x
41	Swallow, Red-breasted	*Cecropis semirufa*		x
346	Swallow, Wire-tailed	*Hirundo smithii*		x
43	Tit, Southern Black	*Parus niger*		x
381	Wagtail, Cape	*Motacilla capensis*		x
382	White-eye, Cape	*Zosterops capensis*		x
385	Woodpecker, Bearded	*Dendropicos namaquus*		x

APPENDIX 2: Example of a "bird friendly steel monopole tower structure" as supplied by EWT.



APPENDIX 3: Significance Rating Scales as supplied by RHDHV.

APPENDIX D2

ECOLOGICAL ASSESSMENT

PRELIMINARY ECOLOGICAL ASSESSMENT FOR THE PROPOSED MBUMBU-TSAKANI 17M 132KV POWER LINE AND NEW TSAKANI SUBSTATION; NORTHERN REGION, ESKOM DISTRIBUTION DIVISION

Compiled for Royal Haskoning*DHV* (Pty) Ltd BY:
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SUBMITTED: 30th OCTOBER 2014

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1. BACKGROUND INFORMATION

Eskom Transmission is responsible for providing a high quality supply of electricity to meet the ever increasing needs of its end users. As a result, its infrastructure of power lines and substations are continuingly being established and expanded upon to support annual load growth. Eskom propose to provide sufficient capacity for the future and improve the reliability by building/constructing a new 17km 132kV loop-in and out Chikadee power line from the existing Mbumbu Switching Station to the new proposed Tsakani Substation.

Eskom Holdings Limited has, in line with the Environmental Impact Assessment Regulations, 2010, promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, appointed Royal HaskoningDHV (RHDHV) as the independent consultant to undertake the BA for the proposed Mbumbu-Tsakani power line as well as Tsakani substation located in the Acornhoek area Mpumalanga Province. Royal HaskoningDHV (RHDHV) has appointed Mr. C.L. Cook as ecological specialist to investigate the potential ecological related impacts associated with the construction and operation of the proposed new 132kV Mbumbu-Tsakani power line as well as Tsakani substation.

The preliminary ecological survey focused on the describing the basic ecological description of the current habitat integrity of the proposed alternative alignments as well as available and sensitive habitats along the alignments with special reference to the current status of threatened plant and faunal species (amphibians, reptiles and mammals) occurring; or likely to utilize the areas within and immediately surrounding the proposed 132kV Mbumbu-Tsakani power line as well as Tsakani substation. The survey was supplemented by literature investigations; personal records, historic data and previous surveys conducted in the Acornhoek-Bushbuckridge areas as well as in similar habitats.

1.1 OBJECTIVES OF THE FAUNAL SURVEY/ HABITAT ASSESSMENT

- To provide a basic description of the vegetation and fauna occurring on the proposed 132kV Mbumbu-Tsakani power line as well as new Tsakani substation.
- To provide a description of any threatened mammals, reptiles and amphibians occurring or likely to occur on the proposed 132kV Mbumbu-Tsakani power line as well as Tsakani substation.
- To describe the available habitats on the two 132kV Mbumbu-Tsakani power line alignments including areas of important conservation value or areas most likely to form important habitat for remaining threatened faunal species.
- To determine potential impacts of the development on the vegetation and fauna occurring along the proposed 132kV Mbumbu-Tsakani power line as well as Tsakani substation.
- To provide management recommendations to mitigate negative and enhance positive impacts of the proposed construction of the 132kV Mbumbu-Tsakani power line as well as Tsakani substation development.

1.2 SCOPE OF STUDY

- A preliminary mammal, bird reptile and amphibian survey recording sightings and/or evidence of existing fauna.
- An assessment of the ecological habitats, evaluating conservation importance and significance with special emphasis on the current status of threatened plant and animal species (Red Data Species), within the proposed 132kV Mbumbu-Tsakani power line as well as Tsakani substation and immediate adjacent areas.
- Literature investigations with which to augment field data were necessary.
- To rank the two alternative 132kV Mbumbu-Tsakani power line and the potential environmental impacts on associated fauna.
- Identification of potential ecological impacts that could occur as a result of the 132kV Mbumbu-Tsakani power line as well as Tsakani substation development and assess the significance of these, where possible.
- Investigate feasible and practical management recommendations that should be implemented to reduce or minimize the impacts, should the project be approved.
- Documentation of the findings of the study in a report.

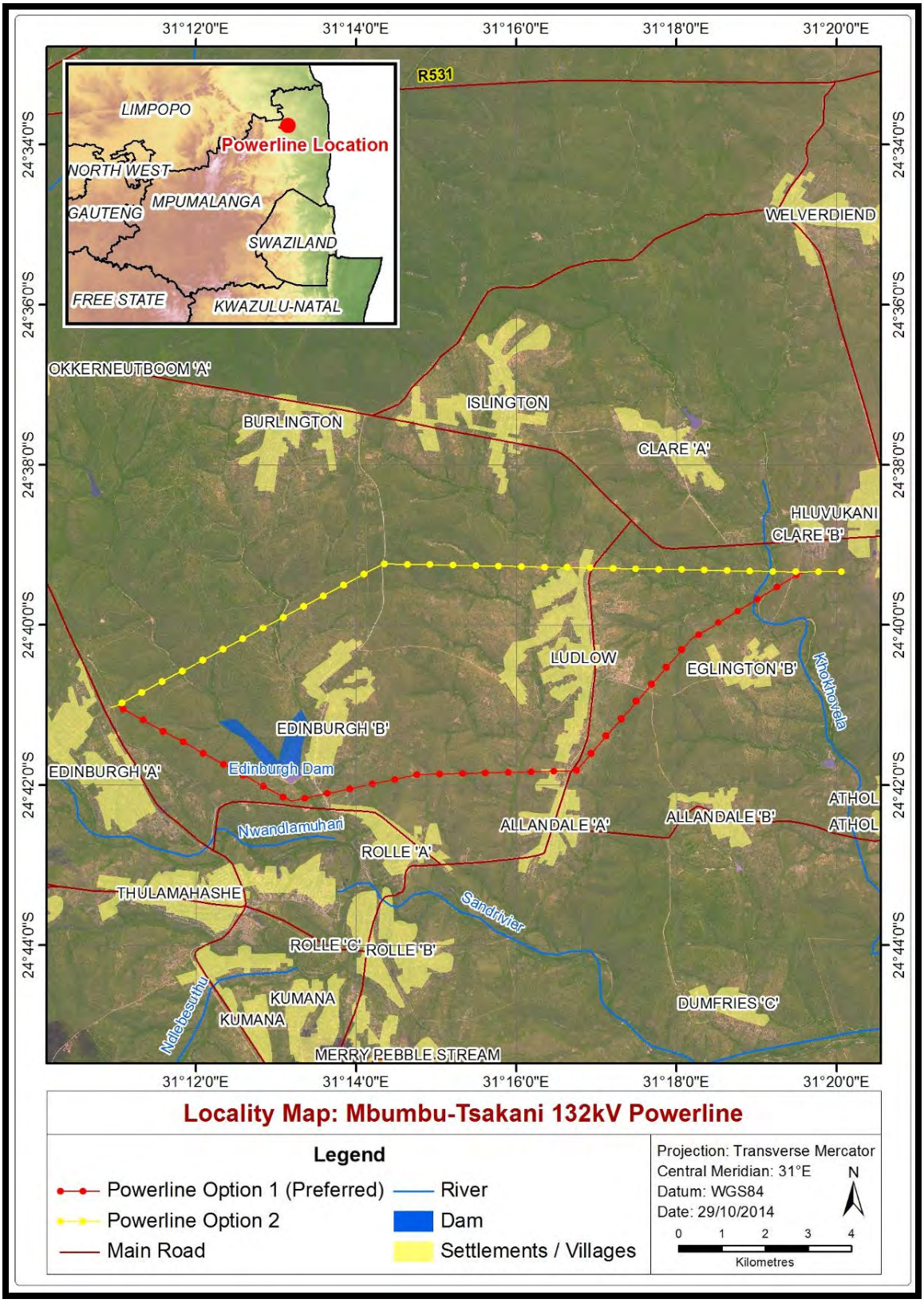

Figure 1: Locality map for the proposed Mbumbu-Tsakani alignments

2. METHODOLOGY

2.1 PREDICTIVE METHODS

A 1:50 000 map of the study area was provided showing existing infrastructure and the proposed two alternative alignments. This was used as far as possible in order to identify potential "hot-spots" along the corridors, e.g. Patches of undisturbed bushveld vegetation, river crossings, wetlands and dams (Edinburgh) and agricultural areas. Satellite imagery of the area was obtained from Google Earth was studied in order to get a three dimensional impression of the topography and land use.

2.2 LITERATURE SURVEY

A detailed literature search was undertaken to assess the current status of threatened fauna that have been historically known to occur in the 2431 CA and 2431 CB QDGC's in the Acornhoek study area within which the alignments are located. The literature search was undertaken utilising *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford 2006) for the vegetation description as well as *National Red List of Threatened Plants of South Africa* (Raimondo *et al,* 2009) as well as internet using POSA (http://posa.sanbi.org accessed on the 28th of October 2014). *The Mammals of the Southern African Subregion* (Skinner & Chimimba 2005) and *The Red Data Book of the Mammals of South Africa: A Conservation Assessment* (Friedmann and Daly (editors) 2004) as well as ADU's MammalMap (http://vmus.adu.org.za/vm_sp_list.php accessed on the 28th of October 2014) for mammals. The *Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland* (Minter *et al.* 2004) for amphibians as well as SAFAP FrogMap (http://vmus.adu.org.za accessed on the 28th of October 2014) The *Field Guide to the Snakes and other Reptiles of Southern Africa* (Branch 2001) and *South African Red Data Book-Reptiles and Amphibians* (Branch 1988) as well as SARCA ReptiMAP (http://sarca.adu.org.za accessed on the 28th of October 2014) for reptiles.

2.3 SITE INVESTIGATION METHODOLOGY

A preliminary assessment of the status, spatial requirements and habitat preferences of all priority species along the proposed Mbumbu-Tsakani power line as well as Tsakani substation site as well as potential threats was conducted. For certain species, an estimate of the expected or historical distribution for the area could be extrapolated from published information and unpublished reports, while habitat and spatial requirements were generally derived from the literature. For other species, little of this information was readily available and conservation targets remain speculative. Species assessments will be updated when additional data becomes available and where appropriate, proposed conservation targets will be revised.

Three general habitat sensitivity scans were carried out on the 3rd and 4th of October 2011 as well as a recent site visit of the re-aligned preferred power line alignments conducted between the 1st and 4th of October 2014. These site visits did not entail intensive surveying or utilisation of any sampling methods and can rather be viewed as being an opportunity to identify sensitive faunal habitats along the proposed Mbumbu-Tsakani power line as well as Tsakani substation site. It must be stressed that no comprehensive vegetation or faunal survey were conducted due to time as well as financial constraints; but merely a brief assessment of the current ecological status of the preferred (Option 1) and alternative alignment (Option 2). By surveying the proposed alignments as well as immediate habitats adjacent to the proposed alignments for specialised habitats, as well as the remaining vegetation and specific habitats, one can make an assumption of the possible presence or absence of threatened plant and animal species.

All animals (mammals (larger), reptiles and amphibians) seen or heard; were recorded. Use was also made of indirect evidence such as animal tracks (footprints, droppings) to identify animals. The data was supplemented by previous surveys conducted in similar habitats, literature investigations, personal records and historic data. Different habitats were explored to identify any sensitive or specialized species. Habitats explored included **Granite Lowveld (SVI 3)** (Mucina & Rutherford 2006) bushveld in various forms of transformation and degradation (wood harvesting, sand mining, overgrazing, frequent fires, alien vegetation invasion), loosely embedded rock material, rivers including perennial and non-perennial rivers, seasonally inundated depressions, artificially created dams, stumps, moribund termite mounds, abandoned animal burrows, trees and under lose bark material.

2.4 Uncertainties in predicting results

- Limitation to a base-line ecological survey for only 5 days (40 hours) during the early summer months (October). Heavy rain as well as hail had fallen during the site visit on the 3rd October 2011. The majority of dams had sufficient surface water and amphibians had initiated their short duration breeding activities. Certain of the non-perennial drainage lines contained no surface water as well as the larger systems around the proposed Tsakani substation.
- The majority of threatened plant and animal species are seasonal only emerging after sufficient early heavy summer rainfalls between November and December. Thus only those flowering plants that flowered at the time of the visit could be identified with high levels of confidence.
- Some of the more rare and cryptic plant species may have been overlooked due to their inconspicuous growth forms. Many of the rare and endangered succulent species can only be distinguished (in the field) from their very similar relatives on the basis of their reproductive parts. These plants flower during different times of the year. Multiple visits to any site during the different seasons of the year could therefore increase the chances to record a larger portion of the total species complex associated with the area.
- The majority of threatened faunal species are extremely seasonal only emerging after sufficient heavy early summer rainfall (November-March).
- The majority of threatened plant and animal species are extremely secretive and difficult to observe even during intensive field surveys conducted over several seasons/ years.
- Limitation of historic data and available databases for the Acornhoek area.
- The presence of threatened species on site is assessed mainly on habitat availability and suitability as well as desk research (literature, personal records) and previous surveys conducted in similar habitats between 1997-2014).
- Certain areas of the proposed alignments are situated on private lands, which are fenced with restricted access; especially during nocturnal surveys.

2.5 Gaps in the baseline data

- Little long-term, verified data of faunal species distribution on micro-habitat level along the proposed power line alignments.
- Little long-term, verified data on impacts of the extensive illegal sand mining, wood harvesting and poaching activities as well as the existing power-lines in the study area on the vegetation and fauna.

3. VEGETATION AND FAUNAL HABITAT AVAILABILITY

Vegetation structure is generally accepted to be more critical in determining faunal habitat than actual plant composition. Therefore, the description of vegetation presented in this study concentrates on factors relevant to faunal species abundance and distribution, and does not give an exhaustive list of plant and tree species which occur in the study area. No comprehensive faunal surveys were conducted and species lists provided in the Appendix are of species most likely to occur on the site using habitat as an indicator of species presence.

3.1 GRANITE LOWVELD (SVI 3)

The vegetation unit of the proposed Mbumbu-Tsakani power line as well as Tsakani substation site is situated in **Granite Lowveld (SVI 3)** (Mucina & Rutherford 2006) which was previously classified as **Arid Lowveld** (40%), **Lowveld** (38%) (Acocks 1998) or **Mixed Lowveld Bushveld** (LR 19) (Low & Rebelo 1996).

Distribution

Limpopo and Mpumalanga Provinces, Swaziland and marginally in Kwazulu-Natal. A north-south belt on the plains east of the escarpment from Thohoyandou in the north, interrupted in the Bolobedu area, continued in the Bitavi area, with an eastward extension on the plains around the Murchison Range and southwards to Abel Erasmus Pass, Mica and Hoedspruit area east of Bushbuckridge. Substantial parts are found in the Kruger National Park spanning areas east of Orpen Camp southwards through Skukuza and Mkhulu, including undulating terrain west of Skukuza to the basin of the Mbyamiti River. Altitude varies between 250-700m (Mucina & Rutherford 2006).

Vegetation & Landscape Features

Tall shrubland with few trees to moderately dense low woodland on the dense sandy uplands with *Terminalia sericea*, *Combretum zeyheri* and *Combretum apiculatum* and ground layer including *Pogonathria squarrosa*, *Tricholaena monachne* and *Eragrostis rigidior*. Dense thicket to open savanna in the bottomlands with *Acacia nigrescens*, *Dichrostachys cinerea*, *Grewia bicolor* in the woody layer. The dense herbaceous layer contains the dominant *Digitaria eriantha*, *Panicum maximum* and *Aristida congesta* on fine-textured soils, while the brackish bottomlands support *Sporobolus nitens, Urochloa mosambicensis* and *Chlors virgata*. At seep lines, where convex topography changes to concave, a dense fringe of *Terminalia sericea* occurs, with *Eragrostis gummiflua* in the undergrowth (Mucina & Rutherford 2006). According to Bredenkamp et al. (1998), the proposed site is situated within the Mixed Lowveld Bushveld vegetation type. The

landscape has been derived from gently undulating plains of sand convexities with intervening drainage lines (Tinley 1979).

General observations applicable across the vegetation of the entire site are as follows:

- The open woodland areas were defined using the occurrence of *Combretum herorense*, *Sclerocarya birrea* subsp. *caffra*, *Acacia karroo*, *Acacia caffra*, *Combretum apiculatum*, *Combretum imberbe*, *Ziziphus mucronata*, *Gymnosporia heterophylla* and *Dombeya rotundifolia*.
- Several protected tree species were observed around the alignments especially Marula, *Sclerocarya birrea* subsp. *caffra* (>50), Apple-Leaf (*Philenoptera violacea*) and Wild Teak, *Pterocarpus angolensis**
- Several protected and red listed 'Declining'* Cape Poison Bulbs (*Boophone disticha*) were observed adjacent to the alternative alignment (Option 2).
- Weed and alien invader floral species where observed on site where both medium-low in diversity and abundance.
- Basal cover was low throughout the preferred alignment which would indicate that the areas is extensively utilised for livestock grazing activities;
- Forb species diversity was moderate to low throughout the property due to utilisation of the area for cattle and goat grazing activities;
- Developed portions adjacent to the existing villages and old and current agricultural lands showed the most sign of transformation from the natural state with more weed and invaders evident.

* A taxon is 'Declining' when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population.

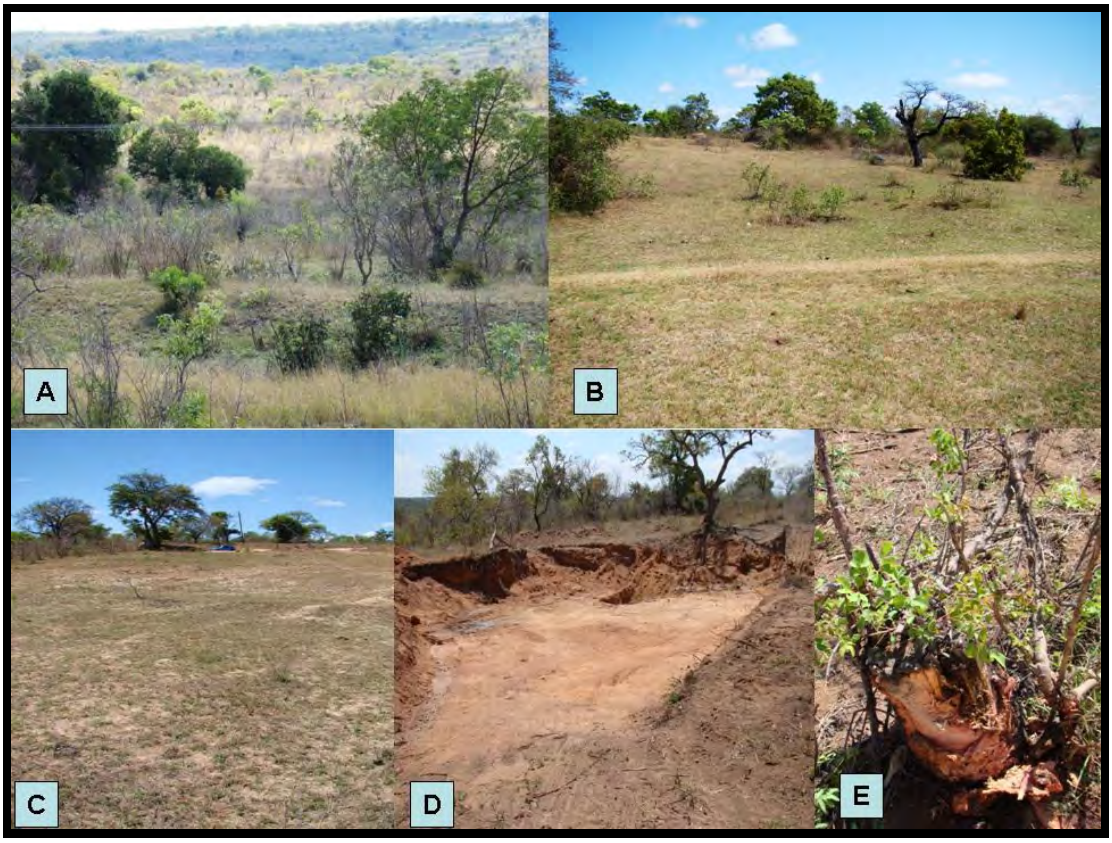

Figure 2: A conglomerate of photographs displaying the current impacts of the vegetation along the alignments

A: The proposed study area is situated within habitats that have been degraded or totally transformed by various anthropogenic impacts; **B:** Overgrazing of the grass and forb layer by livestock including cattle and goats; **C:** Small-scale agricultural activities around the rural homesteads resulting in vegetation clearance and transformation of bushveld vegetation; **D:** Several illegal informal sand mining operations were observed adjacent to the proposed alignments. The sand mining activities result in the destruction of remaining tree, shrub and forb species. Access roads to the sand mining areas result in destruction of adjacent vegetation as well as increased access for wood harvesting activities. The sand mining activities have expanded significantly since the first site visits undertaking in 2011 with increased habitat destruction visible during the 2014 site visit. **E:** Several coppicing stumps of large indigenous tree species were observed along the alignment. Only the large Marula (*Sclerocarrya birrea* subsp.*caffra*), Common Wild Fig (*Ficus thonningii*) as well as the poisonous Tamboti (*Spirostachys africana*) are not utilised for wood harvesting.

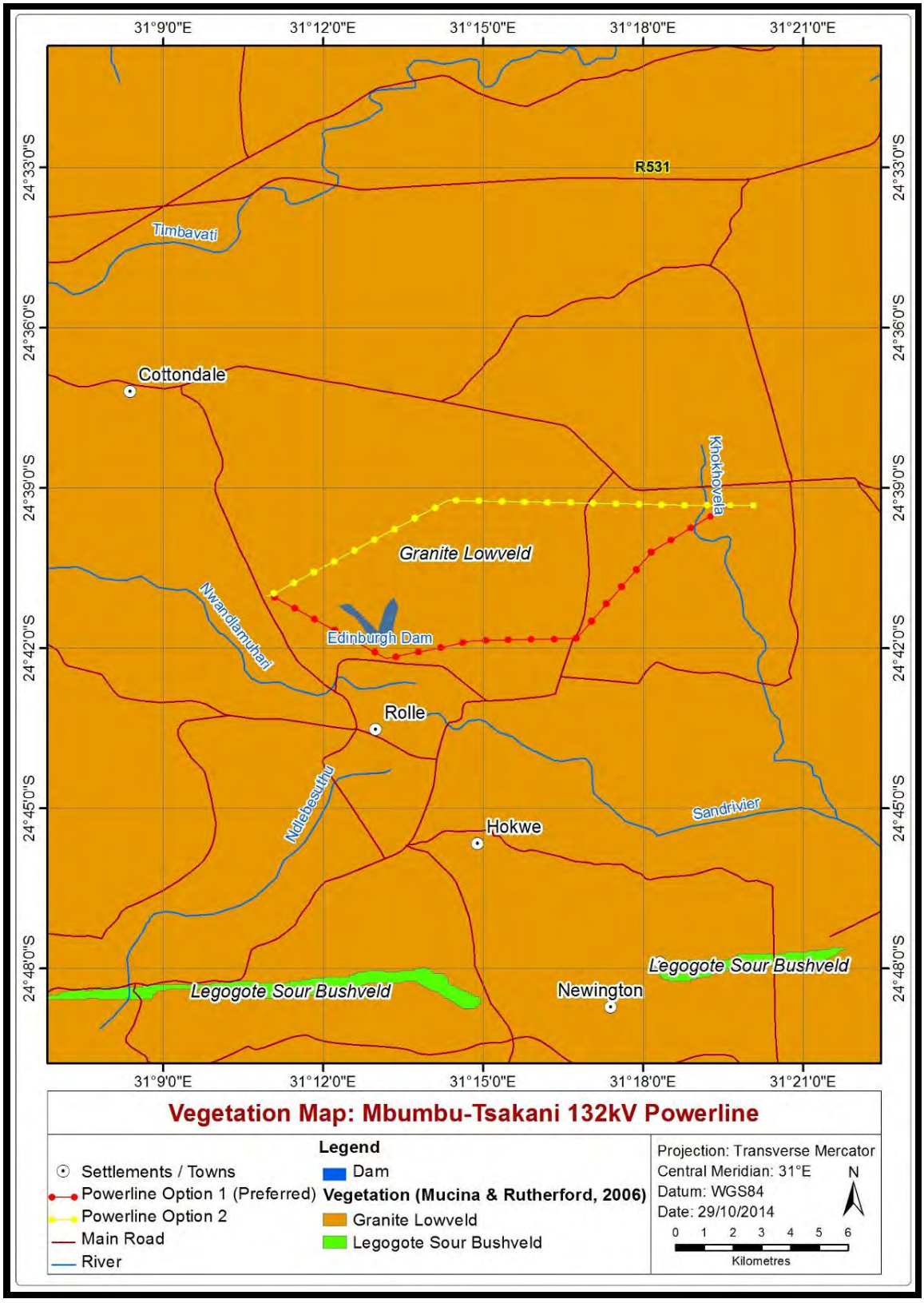

Figure 3: Vegetation map for the proposed Mbumbu-Tsakani power line

Geology and Soils

Geologically, the study area is located on granite-gneiss with volcanic, dolerite intrusions forming a grid of dykes and a large sill in the western areas. From north to south, the Swazian Goudplaats, Makhutswi Gneiss and the Nelspruit Suite (granite gneiss and migmatite), and further south the younger Mpuluzi Granite (Randian) form the major basement geology of the areas. Granitic rocks have weathered to form coarse sandy soils with a high infiltration rate and low clay forming potential (Venter et al. 2003). Clay soils with high sodium content are found in the depressions and footslopes, while nutrient-poor sandy soils are located on the crests. With these two positions at opposite ends of the landscape catena, a variety of vegetation types are described. The study site is located at the upper end of the landscape catena and includes the *Sclerocarya birrea/ Combretum herorense* sand savanna situated on the crests and hills on well-drained, granite-derived soils and dominated by broad-leafed woody species. The geology of the site comprises of granite rocks and the soil is mostly coarse, sandy and shallow, overlying granite, quartzite, sandstone or shale (Low & Rebelo, 1998).

Figure 4: The majority of the soils on the site were well-drained, coarse, light brown, sandy to sandy-gravel soils with no hydric indicators (mottles) indicating terrestrial soils. Hydric soils with clear mottles were observed in the seasonally inundated depressions (old sand mining pits) as well as seepage wetlands around the drainage lines

Topography and geology

The proposed study area is situated adjacent to habitats that have been totally transformed by various anthropogenic impacts, including residential, commercial and industrial developments. Topographically, the area in general can be described as undulating plains, with the Khokhovela River the largest feature in the area.

Climate

Summer rainfall with dry winters and generally a frost-free region. Mean annual precipitation is around 350-650 mm per annum, falling in summer.

Conservation

This vegetation type is well represented in the region and currently a great portion falls within protected environments (Kruger National Park 17%) as well as private nature reserves including Selati, Klaserie, Timbavati, Mala Mala, Sabi Sand and Manyeleti and as such, its conservation priority is considered **Vulnerable**. More than 20% is transformed mainly by cultivation and by settlement development. Erosion is low to moderate especially around the illegal sand mining activities. According to the Mpumalanga Biodiversity Sector Plan (2013) the power line alignments bisect large natural areas. The delineation of the vegetation units is outdated and inaccurate as large areas have been extensively degraded due to on-going illegal sand mining activities and wood harvesting activities. Large areas have also been cleared for small-scale agricultural lands.

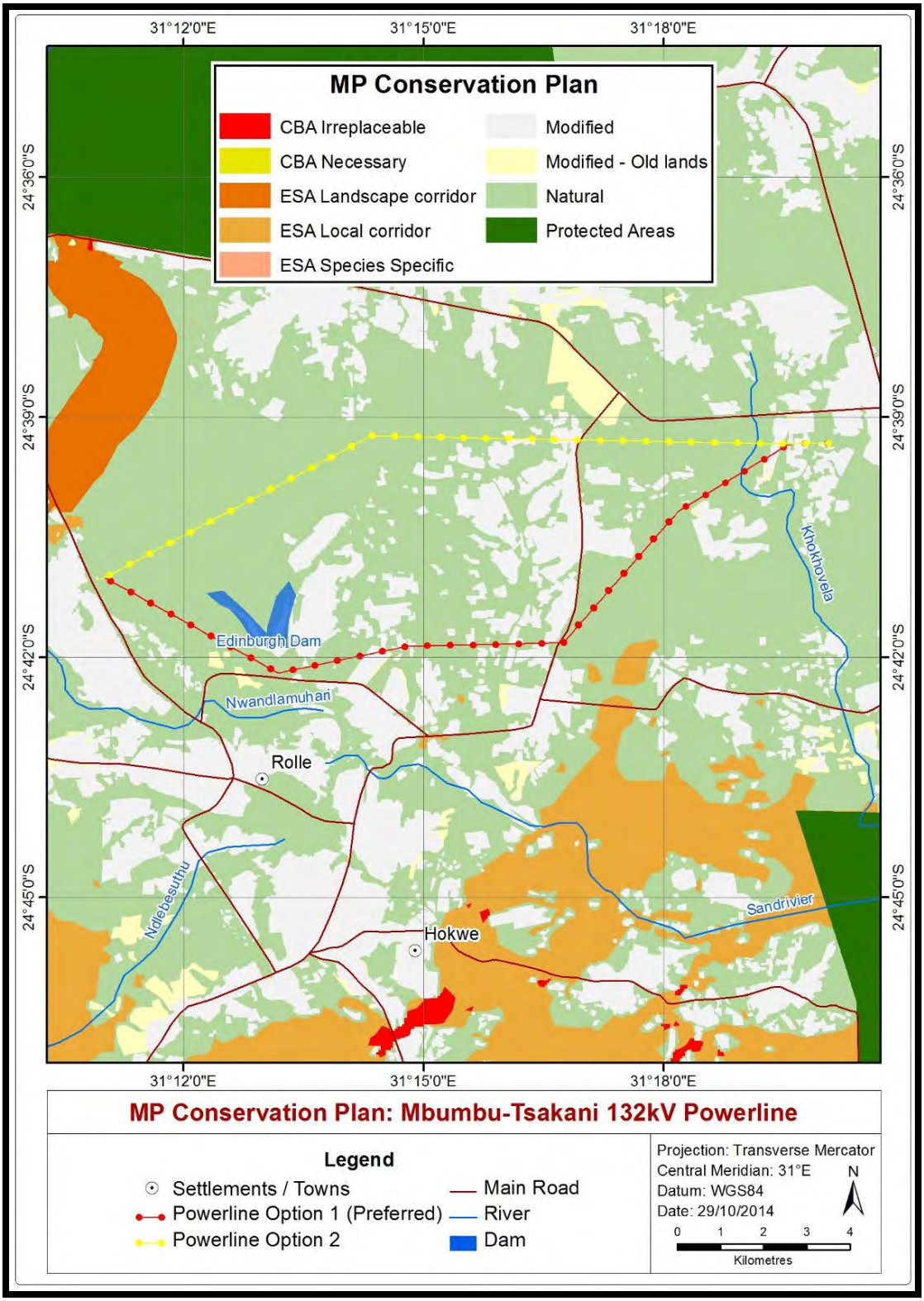

Figure 5: Mpumalanga Biodiversity Sector Plan (2013) for the proposed Mbumbu-Tsakani power line

3.2 DOMINANT VEGETATION OBSERVED ALONG PROPOSED POWER LINE ALIGNMENTS

As the two alternative alignments of the Mbumbu-Tsakani power line as well as new Tsakani substation are situated in a semi-rural/ agricultural environment the vegetation around the proposed alignments has been severely altered and transformed from its natural state. Certain sections of the proposed alternative alignment (Option 2) contain elements of natural Granite Lowveld vegetation; but the majority of the preferred alignment (Option 1) consists of Granite Lowveld vegetation in various stages of transformation and degradation. The species recorded below are by no means a comprehensive list of species present on the site.

Tree and Shrub Species

Acacia nilotica, Dichrostachys cinera, Acacia nigrescens Acacia gerrardii, Acacia exuvialis, Bolusanthus speciosa, Bauhinia galpinii, Acacia tortilis, Gymosporia buxifolia, Gymnosporia glaucophylla, Combretum apiculatum, Ziziphus mucronata, Euclea divinorum, Combretum zeyheri, Grewia occidentails, Grewia moticola, Strychnos madagascariensis, Grewia flavescens, Diospyros lycioides, ***Sclerocarya birrea*** **subsp.** ***caffra****[*], Terminalia sericea, Schotia brachypetala, Peltophorum africanum, Acacia karoo, Ficus thonningi, Ficus ingens, Combretum molle,, Ximenia caffra,* ***Pterocarpus angolensis****, Combretum hereroense,* ***Philenoptera violacea,*** *Searsia* (*Rhus*) *lancea, Searsia chirindensis, Searsia pyroides*

Forb Species

Aptosimum lineare, Aptosimum procumbens, Aloe greatheadii, Indigofera daleoides, Bidens pilosa, Heliotropium ciliatum, Solanum sisymbriofolum, Cucumis africanus, Senecio gerrardii, Pentzia pilufera, Riccinus communis, Cheilanthes hirta, Protasparagus setaceus, Hypoxis obtusa, Merremia tridentate, Dicerocaryum eriocarpum, Ceratotheca triloba, Asclepias fruticosa, Momordica balsami, Solanum panduriforme, Commelina africana, Commelina erecta, Sida cordifolia, Ipomoea sinensis, Ipomea crassipes, Hibiscus trionum, Schizoglossum cordifolium, Asclepias physocarpa, Turbina oblongata, Cassia comosa, Evolvulus alsinoides, Aptosimum procumbens, Pterodiscus speciosus, Harpagophytum procumbens, Ledebouria ovatifolia, Blepharis subvolubilis, Barleria sp., Cucumis zeyheri, Cucumis metuliferus, Berkheya radula, Senecio coronatus, Senecio venosus, Senecio isatidioides, Vernonia hirsute, Ageratum houstonianum, Helichrysum caespititium, Sonchus olaraceus,, Helichrysum umbraculigerum, Senecio latifolius, Stomatanthes africanus, Geigeria burkei, Indigofera sanguinea, Indigofera zeyheri, Tephrosia grandiflora, Pellaea viridise, Kalanchoe rotundifolia, Kalanchoe paniculata, Asparagus falcatus, Asparagus angusticladus, Bulbine abyssinica, Trachyandra saltii, Ledebouria floribunda, Anthericum

[*] Protected tree species under the National Forests Act, 1998 (Act no. 84 of 1998).

longistylum, Chlorophytum bowkeri, Oxalis obliquifolia, Ornithogalum seineri, Ammocharis coranica.

Graminoids or Grass Species

Andropogon eucomus, Andropogon huillensis, Themeda triandra, Hyparrhenia tamba, Hyparrhenia filipendula, Schizachyrium sanguineum, Hemarthria altissima, Oropetium capense, Digitari eriantha subsp. eriantha, Tragus berteronianus, Setaria sphacelata, Setaria verticillata, Tristachya leucothrix, Aristida adscensionis, Eragrostris trichopora, Eragrostris gummiflua, Sporobolus fimbriatus, Panicum schinzii, Eragrostris lehmanniana, Eragrostris biflora, Poa annua, Sporobolus ioclados, Setaria megaphylla, Sporobolus pyramidalis, Miscanthus junceus, Diplanche fusca, Echinochloa colona, Trichoneura grandiglumis, Digitaria velutina, Aristida congesta, Hyparrhenia hirta, Digitaria sp., Sporobolus panicoides, Chloris gayana, Melinus repens, Eragrostis nindensis, Eragrostis capensis, Eragrostris racemosa, Eragrostris curvula, Themeda triandra, Panicum maximum, Chloris virgata, Pogonarthia squarrosa, Urelytrum agropyroides, Kyllinga alba, Cyperus fulgens Hetrapogon contortus, Eragrostis chloromelas, Eragrostis racemosa, Brachiaria sp., Eragrostis superba, Cymbopogon excavutus, Cymbopogon plurinodis, Cymbopogon validus, Dactyloctenium aegyptium, Digitaria longiflora, Urochloa mossambicensis.

Figure 6: A conglomerate of photographs displaying the dominant tree species observed along the proposed power line alignments
A: Marula (*Sclerocarya birrea* subsp. *caffra*) was observed along the alignments as well as access roads and villages; **B:** Common Cluster Figs (*Ficus sycamorous*) was observed along the riparian zones along the streams and rivers; **C:** Red-leaved Fig (*Ficus ingens*) was observed on the rocky areas adjacent to the proposed alignment and riparian zones of the perennial and non-perennial rivers; **D:** Large-fruited Bushwillow (*Combretum zeyheri*) occurred within scattered localities along the alignments as well as **E:** Scented Thorns (*Acacia nilotica subsp. kraussiana*); **F:** Silver Cluster Leaf (*Terminalia sericea*) was observed in dense stands within the sandy soils adjacent to the alignments and **G:** Several fruiting Black Monkey-Orange (*Strychnos madagascariensis*) were observed adjacent to the alignments
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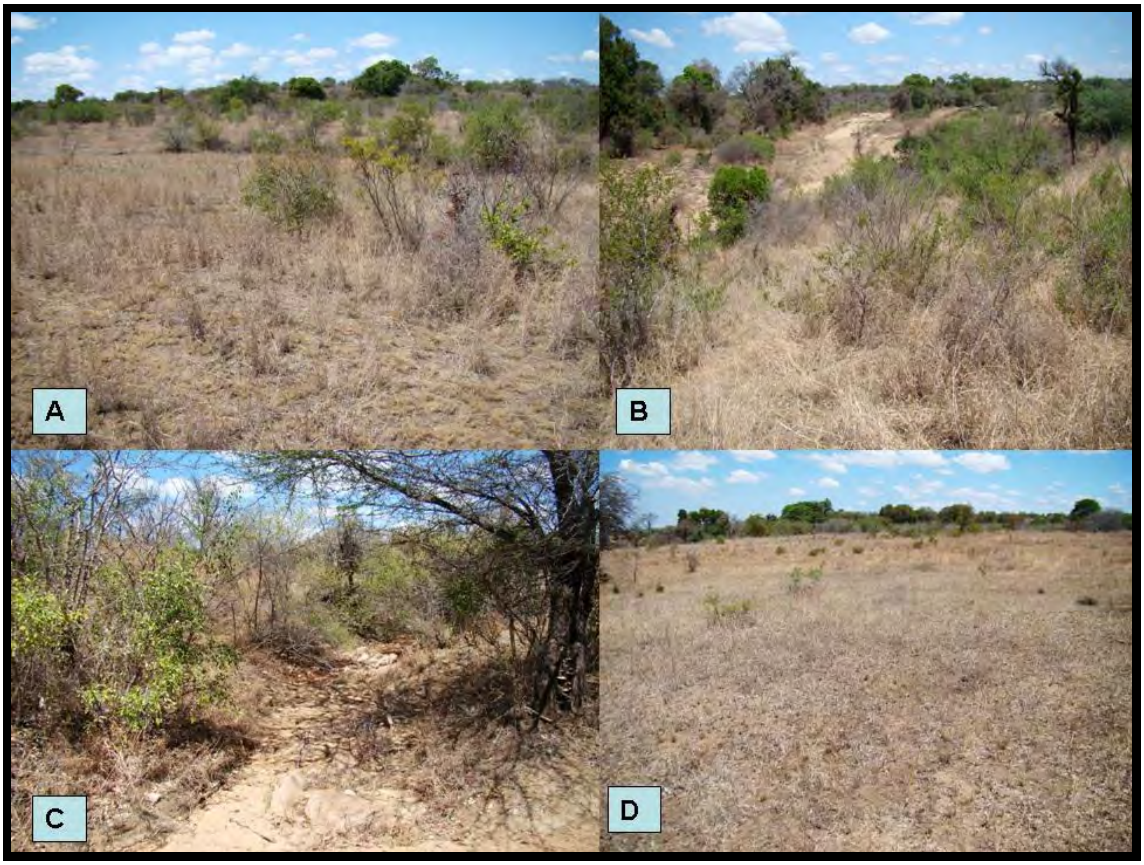

Figure 7: A collage of photographs displaying the dominant vegetation around the proposed new Tsakani Substation site

A: The areas around the Tsakani substation site is dominated by degraded as well as transformed bushveld or agricultural lands. The proposed substation site is surrounded by old and current agricultural lands, livestock enclosures (kraals). The majority of large tree species have been removed and the grass and forb layer is overgrazed. **B:** Remaining large indigenous tree species occur within the remnant patches of riparian vegetation approximately 130m to the south of the proposed substation site along the non-perennial tributary of the Khokhovela River which is a tributary of the Sand River. Riparian tree species observed included *Ficus sycomorus, Spirostachys africana, Diospyros mespiliformis, Kigelia africana, Trichilia emetica, Phoenix reclinata, Schotia brachypetala* and *Philonoptera violacea*. **C:** A small non-perennial drainage line occurs to the south of the proposed substation site. The vegetation was denser along the riparian zone of the non-perennial drainage line although evidence of wood harvesting was noted all around the site. Riparian vegetation observed along the drainage line included *Ficus ingens, Carissa bispinosa, Euclea divinorum, Acacia nilotica* as well as dense stands of *Dichrostachys cinerea.*D: The proposed Tsakani substation site

comprises transformed agricultural lands. A single large Common Wild Fig, *Ficus burkei* occurs on the site.

Large areas adjacent to the proposed substation site are old or fallow agricultural lands as well as livestock enclosures. Extensive wood harvesting as well as vegetation clearance for agricultural activities occurs around the substation site. The frequent burning of the grassland vegetation as well as overgrazing by livestock including cattle and goats has altered the natural tree, shrub, forb and grass species composition. Remaining grass and forb species are dominated by species indicative of a disturbed or degraded habitat. Evidence of wood harvesting activities were noted along the non-perennial drainage line to the south as well as riparian zone of the Khokhovela River to the east of the proposed substation site. The vegetation on the proposed substation site is dominated by small shrubby *Acacias* as well as secondary succession grasses on an old agricultural land. A single large Common Wild Fig, *Ficus burkei* occurs on the site. The vegetation becomes more natural towards the Khokhovela River. Remnant patches of large riparian tree species occur along the macro-channel banks of the river. No rare or threatened plant species were observed around the proposed substation site or are likely to occur within the transformed agricultural lands on and surrounding the site.

3.3 DOMINANT VEGETATION AROUND VILLAGES

The vegetation around the villages comprises mostly of introduced exotic tree species such as *Eucalyptus grandis, Jacaranda mimosifolia, Melia azedarach, Ficus elastica, Schinus molle, Tipuana tipu, Tecoma stans, Senna didymobotrya, Nerium oleander, Plemeria obtusa, Catharanthus roseus* and small-scale cultivated maize lands as well as mango and avocado orchards.

Figure 8: Alien invasive vegetation observed within the villages adjacent to the proposed alignments included:
A: Lantana (*Lantana camara*) Category 1 Weed (proposed Category 1b NEMBA); **B**: Oleander (*Nerium oleander*) Category 1 Weed (proposed Category 1b NEMBA); **C**: Peanut Butter Cassia (*Senna didymobotrya*) Category 3 (proposed Category 1b NEMBA); **D**: Dense-thorned Bitter Apple (*Solanum sisymbrifolium*) Category 1 Weed (proposed Category 1b NEMBA); **E:** Sisal Hemp (*Agave sisalana*) Category 2 Invader and **F:** White-flowered Mexican Poppy (*Argemone ochroleuca* subsp. *ochroleuca*) Category 1 Weed (proposed Category 1b NEMBA).

Exotic and invasive plant species were categorised according to the framework laid out by The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983). CARA defines weeds as alien plants, with no known useful economic purpose that should be eradicated. Invader plants, also considered by the Act, can also be of alien origin but may serve useful purposes as ornamentals, as sources of timber, or may have other benefits (Henderson, 2001). These plants need to be managed and prevented from spreading.

Alien and invasive plant species can be grouped three categories:

- **Category 1** plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in Regulation 15.D of the CARA.
- **Category 2** plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.
- **Category 3** plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.

Alien Invasive species

The following invasive plant and tree species should be physically removed from the proposed site if encountered.

Agave americana
Agave americana 'Marginata'
Agave sisalana
Argemone ochroleuca subsp. ochroleuca
Arundo donax
Opuntia ficus-indica
Riccinus communis
Melia azedarach
Sesbania punicea
Lantana camara
Solanum elaeagnifolium
Tecoma stans
Schinus molle
Jacaranda mimosifolia

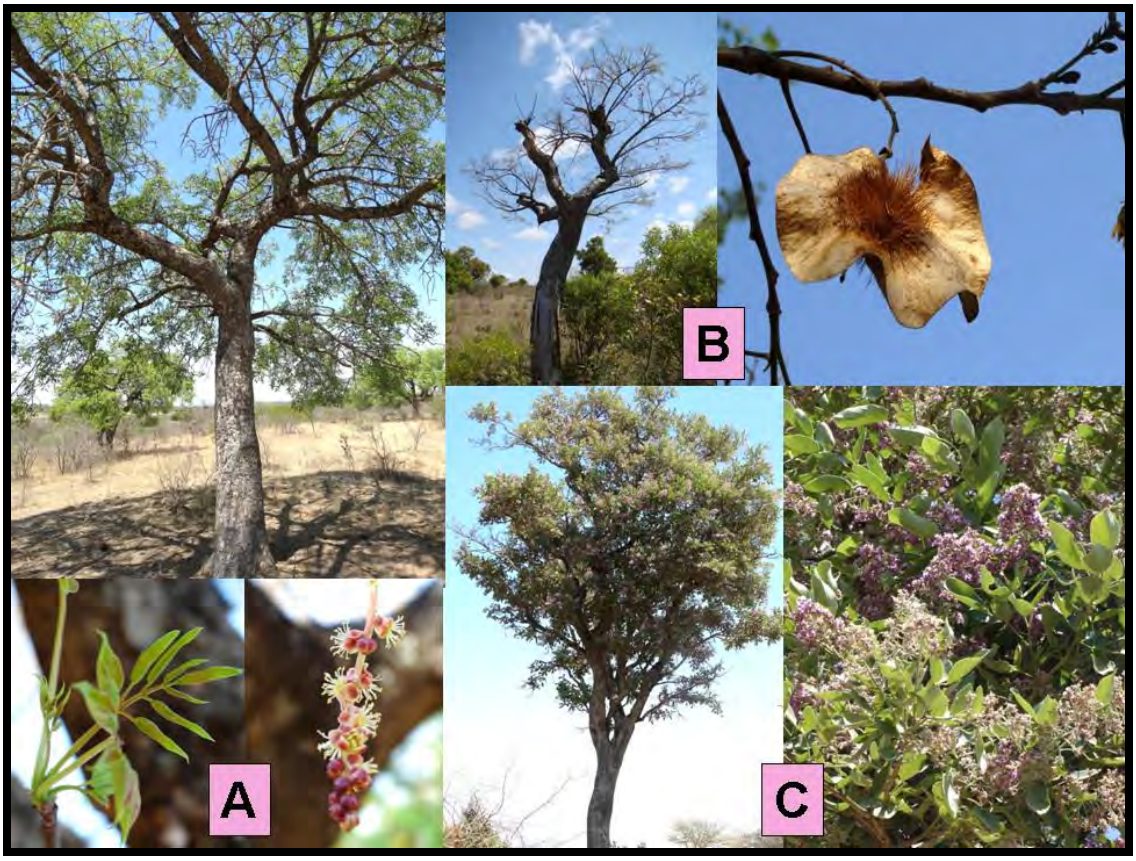

Figure 9: **Three protected tree species were observed within and surrounding the proposed power line alignments:**
A: Several (>50) large as well as emerging Marula (*Sclerocarya birrea* subsp. *caffra*) were observed along the proposed alignment and is the dominant indigenous tree remaining around the rural villages and agricultural lands. **B:** A few scattered (uncommon) large Wild Teaks (*Pterocarpus angolensis*) were observed around the proposed alignments. This large specimen was observed to the south-east of the Mbumbu Substation. The tree had all the lower-limbs removed due to wood harvesting activities. **C:** A few scattered Apple-Leaf (*Philenoptera violacea*) occur adjacent to the alignments as well as within the riparian zones of the non-perennial drainage lines and rivers. A permit will be required from the Department of Agriculture, Forestry and Fisheries (DAFF) for the removal of any protected tree species. Ideally the alignment of towers and power line should be adjusted to prevent the destruction of any remaining large (>4m) indigenous tree species including any protected tree species.

3.4 PROTECTED TREE SPECIES

In terms of the National Forests Act 1998 (Act No 84 of 1998) certain tree species can be identified and declared as protected. The Department of Agriculture (now Department of Agriculture, Forestry and Fisheries) developed a list of protected tree species. In terms of Section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization.

Two protected tree species was observed within all the proposed alignments with several (>50) large (>4m) Marula *Sclerocarya birrea* subsp. *caffra* noted. Several small emerging Marula were also observed along the alignments. A few (<10) scattered Wild Teak (*Pterocarpus angolensis*) were observed along the proposed alignments. Several large specimens were observed with the removal of the lower limbs. A few (<10) Apple-Leaf (*Philenoptera violacea*) occur adjacent to the alignments as well as within the riparian zones of the non-perennial drainage lines and rivers. All remaining Aloes (*Aloe greatheadii*), bulbous plants (geophytes) should be replanted if unearthed during the construction phase of the project. The DAFF will have to be approached to obtain the required permits for the removal of any Marula *Sclerocarya. Birrea* ssp. *caffra,* Apple-Leaf (*Philenoptera violacea*) and Kiaat (*Pterocarpus angolensis*).

Table 1: List of Protected Trees occurring within the 2431 CA and 2431CB 1/ 4 degree grid squares. (POSA and South African National Botanical Institute, 2007)

SCIENTIFIC NAME	FAMILY	COMMON NAME	RECORDED SPECIES
Breonadia salicina	Rubiaceae	Matumi	No specimens observed it's a facultative riparian (riverine) species
Elaeodendron transvaalensis	Celastraceae	Bushveld saffron	No specimens observed
Combretum Imberbe	Combretaceae	Leadwood	No specimens observed
Philenoptera violacea	Caesalpiniaceae	Apple-Leaf	Approximately 5 specimens observed
Pittosporum viridiflorum	Pittosporaceae	Cheesewood	No specimens observed
Pterocarpus angolensis	Ceasalpiniaceae	Wild teak	Confirmed adjacent to alignment approximately 5 specimens observed
Sclerocarya birrea subsp. *caffra*	Anacardiaceae	Marula	Confirmed on the site (~50)

Figure 10: *Boophone disticha*

A few scattered Cape Poison Bulbs (*Boophone disticha*) were observed within the remnant patches of Granite Lowveld open and closed woodland adjacent to the alternative alignment (Option 2). None were observed during the brief field survey adjacent to the preferred alternative (Option 1).

RED DATA PLANT SPECIES

The red listed 'Declining' Cape Poison Bulb (*Boophone disticha*) was observed within the remnant patches of Granite Lowveld open and closed woodland adjacent to the proposed alternative alignment. The extremely toxic bulb is used extensively throughout Africa for traditional medicine, and its medicinal uses have been extensively documented. It is very popular in the muthi markets and amongst urban and rural healers. The bulbs are usually very large and always present in the muthi markets. *Boophone disticha* is presently listed as 'Declining' due its loss of habitat in KwaZulu-Natal and Gauteng and because the volumes traded in the market imply that harvesting is having an impact on the population. The species is, however, long lived and widely distributed.

Figure 11: Leopard Orchids

A few epiphytic Leopard Orchids (*Anselia gigantea*) were observed within the alien invasive Jacaranda (*Jacaranda mimosifolia*) as well as old lead-wood stumps within the villages adjacent to the proposed power line alignments.

Several epiphytic orchids *Ansellia africana* were observed in alien invasive trees (*Jacaranda mimosifolia*) and old *Combretum imberbe* stumps around certain homesteads. This epiphytic orchid is widespread in the area although the commercial '*muthi*' collectors pose a major threat in the area to remaining colonies.

As a precautionary approach; prior to construction and vegetation clearance a suitably qualified Botanist or Ecologist should closely examine or walk-though the proposed servitude once pegged/demarcated and closely examine the proposed construction areas (tower supports) for the presence of any threatened or red listed plant species. A rescue and recovery programme should be initiated and the effected plant relocated in suitable habitat away from the tower or servitude. Given the disturbed nature of the area, it is unlikely that any significant populations of any Red Listed plant species occur within or in the immediate vicinity of the preferred alignment (Option 1).

4. RESULTS OF THE INITIAL FAUNAL SURVEY OR HABITAT ASSESSMENT

The preliminary faunal survey focused mainly on mammals, reptiles and amphibians of the study area. The survey focused on the current status of threatened animal species occurring, or likely to occur within the study area, describing the available and sensitive habitats, identifying potential impacts resulting from the development and providing mitigation measures for the identified impacts. Faunal data was obtained during a single site visit of the proposed alignment carried out mainly by vehicle as well as walking through sections of representative bushveld habitat and the substation site carried out on foot on the 3rd and 4th of October 2011 as well as the 1st- 4th of October 2014. All animals (mammals (larger), reptiles and amphibians) seen or heard; were recorded. A separate specialist avifauna/bird survey was conducted for the proposed alignments. Use was also made of indirect evidence such as nests, feathers and animal tracks (footprints, droppings) to identify animals. Previous surveys, literature investigations; personal records and historic data supplemented the initial survey.

The literature search was undertaken utilising *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford 2006) for the vegetation description. *The Mammals of the Southern African Subregion* (Skinner & Chimimba 2005) and *The Red Data Book of the Mammals of South Africa: A Conservation Assessment* (Friedmann and Daly (editors) 2004) for mammals. A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers 2009) and the *The Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland* (Minter et al. 2004) for amphibians. *The Field Guide to the Snakes and other Reptiles of Southern Africa* (Branch 2001) and *South African Red Data Book- Reptiles and Amphibians* (Branch 1988) for reptiles.

The majority of vegetation adjacent to the proposed power line alignments (especially Option 1) consists of completely transformed bushveld habitat with limited habitat diversity. The adjacent areas are utilised mainly for livestock grazing activities and suffers from extensive overgrazing, mostly from goats and cattle. Their grazing and trampling can encourage thicket growth by *Dichrostachys cinerea* by reducing grass cover. However, the opportunistic feeding patterns of goats can have a severe impact on both the composition and productivity of this ecoregion. In addition, goats are known to be more destructive than cattle at higher stocking densities (Skead 1988).

High livestock densities also pose considerable threat to wildlife, since high numbers of domesticated animals generally cause a displacement of game, as there is less suitable habitat available. Furthermore, wild predators and scavengers such as the Black-backed Jackal, Caracal, Leopard and the White-backed Vulture have been eradicated by

livestock farmers who see these animals as a threat to their livelihoods. Poisoned carcasses are often used for this purpose; this method is indiscriminate and therefore poses considerable threat to all predators and scavengers; especially the threatened Vulture species. Poaching and illegal hunting (dogs) are further reducing the remnant faunal populations.

Given the disturbed nature of the area, it is unlikely that the power line alignments or substation site will host a great variety of animal species or viable populations. The proposed alignments are situated between the agricultural and rural residential areas in transformed and degraded habitats and it is therefore unlikely that the area will support viable populations. Some Red Data species may occur in the area, but none were actually recorded (direct or indirect) within the power line alignments or substation site during the brief field survey.

Figure 12: A conglomerate of photographs displaying the current impacts on the vegetation as well as associated faunal species

A: The majority of vegetation adjacent to the preferred alignment (Option 1) consists of completely transformed bushveld habitat with limited habitat diversity. The adjacent areas are utilised mainly for livestock grazing activities and suffers from extensive overgrazing, mostly from goats and cattle. **B:** Their grazing and trampling can encourage thicket growth and bush-encroachment by *Dichrostachys cinerea* by reducing grass cover. This was especially prevalent adjacent to the lower-lying non-perennial drainage lines **C:** Hunting with dogs as well as feral cats around the villages has a high impact on remaining faunal species. **D:** An existing irrigation/water furrow is situated adjacent to an artificially embanked dam to the north of the preferred alignment (Option 1) and acts as a potential pit-fall trap for animal species migrating towards and away from the dam. **E:** Extensive dumping and littering occurs adjacent to the villages as well as several informal or illegal sand mining areas.

Existing Impacts on the fauna on and surrounding the site included:

- The preferred power line alignment (Option 1) is situated mainly within degraded and transformed bushveld (fallow agricultural lands) which are dominated by completely transformed vegetation with limited habitat diversity. The alternative alignment bisects areas which display a more natural species composition of Granite Lowveld.
- High levels of human disturbances associated with the existing villages and habitat degradation and transformation due to present agricultural activities occur adjacent to the alignments. This has resulted in impoverished habitats with limited faunal diversity.
- Existing villages, agricultural, sand mining as well as informal access roads and pedestrian and livestock pathways occur around the alignments.
- Previous and current agricultural activities (old lands) have transformed large areas of bushveld habitat adjacent to the alignments as well as substation site.
- Extensive overgrazing by livestock (especially cattle and goats) result in limited vegetative or grass cover or refuge habitat for remaining faunal species.
- Illegal sand mining areas have destroyed large sections adjacent to the alignment since the previous site visit in 2011. The sand mining also results in increased access and the resultant increased anthropogenic activities (wood harvesting, hunting and poaching).
- Wood harvesting results in destruction of important habitat for arboreal faunal species.
- Frequent burning of remaining patches of grasslands severely restricts vegetative cover and potential refuge habitat for remaining faunal species.
- Hunting with dogs as well as cats around the villages. Dogs and cats have a high impact on remaining faunal species.
- Introduction of exotic and alien vegetation.
- Deterioration in water quality within the surrounding rivers and streams.

Given the disturbed nature of the area, it is unlikely that the area will host a great variety of animal species or viable populations. The proposed power line alignments bisect degraded bushveld (vegetation clearance, wood harvesting, sand-mining) as well as old transformed agricultural lands; situated in a rural village environs and it is therefore unlikely that the area will support viable wildlife populations. It is highly likely that significant populations of any Red Data species remain in the vicinity of the proposed alignment; none were actually recorded (direct or indirect) on the site during the survey.

Faunal species observed during the survey reflect common species of the area associated with human settlements and habitat transformation. The faunal data in no way provides comprehensive lists for mammals, reptiles, amphibians present on the proposed site as the study was conducted with limited time constraints allocated for the study.

4.1 MAMMALS

Mpumalanga is faunally diverse with approximately 163 mammal species consisting of 98 smaller and 64 larger species. It is the objective of Mpumalanga Tourism and Parks Agency (MTPA) to conserve all of these species *in situ.* The grassland and forest biomes sustain many endemic and red data mammal species. The grassland biome is one of the biomes in which Red Data Book (RDB) insectivore richness is concentrated (Gelderblom, Bronner, Lombard & Taylor, 1995). High mammalian species richness occurs in savannahs, which could be as a result of the wide variety of habitats available. In Mpumalanga Province, savanna areas with the availability of sufficient cover, karst areas, wetlands, pans and a well-managed mosaic of short and tall grassland, are habitats that significantly contribute towards the ecological requirements of certain mammal species.

Certain species in Mpumalanga, towards which conservation efforts for habitat protection should be directed, have been identified. Priority species can be used to flag or emphasise key habitats, which are of conservation concern. These species thus contribute towards identifying priority areas of conservation importance and in determining the conservation value of land. Anthropogenic land conversion and habitat degradation and fragmentation mainly due to agricultural and mining activities are major threats to the continued existence of endemic and threatened fauna in the province. Suitable habitat remains for larger mammal species to the north and east of the proposed alignments within the provincial Andover Reserve and several private game reserves.

It must be stressed that no actual mammal survey was undertaken due to time constraints and the extreme limitations that the results from a single site survey conducted during the summer months would pose. Instead fieldwork was augmented with previous surveys in similar habitats as well as published data. Although the majority of habitats along the proposed alignments are degraded or totally transformed into agricultural lands as well as sand mining operations the remaining bushveld habitat to the north as well as east (private and government nature reserves) offers favourable habitat for several mammal species including several threatened mammal species. The

majority of larger mammals would have located suitable habitats away from the agriculture and sand mining activities, or have been destroyed by poaching and hunting.

An adult male kudu and common duiker were observed in the denser woodland vegetation around the alternative alignment (Option 2). Evidence of Cape Clawless Otters (*Aonyx capensis*) as well as Marsh Mongoose (*Atilax paludinosus*) in the form of faeces or spraints as well as quills of Cape Porcupine (*Hystrix africaeustralis*) where also observed along the riparian zone of the perennial tributary. Tree Squirrels (*Paraxerus cepapi*) were observed foraging adjacent to the Cluster Fig on the macro-channel banks of the Khokhovela River. Evidence (spoor) of several antelope species were observed along the informal dirt road around the proposed alignments including Bushbuck (*Tragelaphus scriptus*) and Common Duiker (*Sylvicarpa scrptus*). Slender Mongoose (*Galerella sanguinea*) were observed running across the roads. Several rodent burrows (most likely Bushveld Gerbils) were observed in the old agricultural areas adjacent to the alignments. No major rocky outcrops were observed along the proposed alignments hence the lack of rupicolous mammal species such as Bushveld Elephant Shrew, Namaqua Rock Mouse and Rock Hyrax.

The Conservancies and privately owned nature reserves to the north and east of the alignments provides important habitat for several larger and smaller mammal species. Larger mammal species including Giraffe, Eland, Plains Zebra, Kudu, Impala, Wildebeest, Common Duiker, Grey Rhebok, Reedbuck, Blesbok, Bushbuck, Warthogs, Red Hartebeest, African Elephant, Bushpigs, Antbears, Black-backed Jackal, Spotted Hyaena, Brown Hyaena, African Civet, Vervet Monkey, Common Warthog and Chacma Baboons. A list of mammal species observed on the site as well as species likely to occur on the site using habitat as an indicator of presence; is presented in the Appendix (see Table 9).

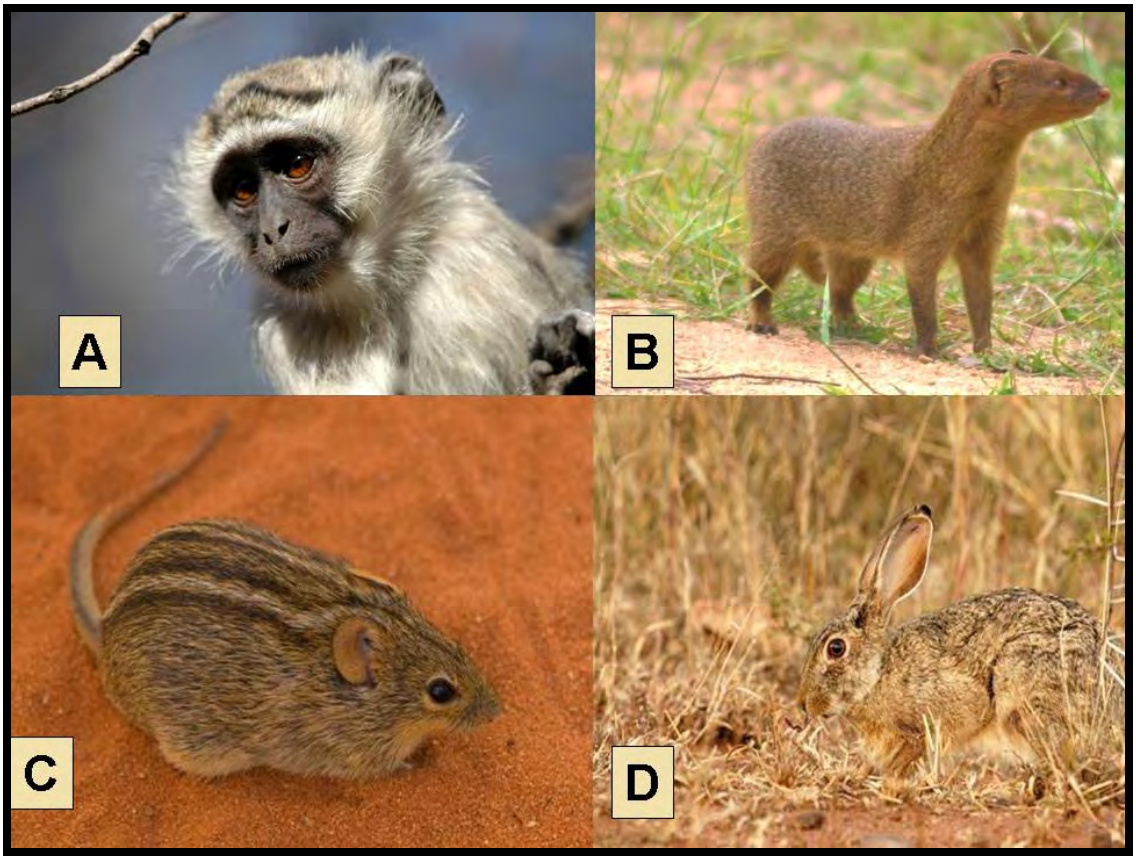

Figure 13: A collage of photographs displaying the smaller mammal species observed adjacent to the proposed power line alignments
A: Vervet Monkeys (*Cercopithecus aethiops pygerythrus*) were observed foraging along the rivers. **B:** Slender Mongooses (*Galerella sanguinea*) were observed darting across the dirt roads. **C:** Four-Striped Grass Mouse (*Rhabdomys pumilio*) were observed in the grassy areas adjacent to the alignments as well as **D:** Scrub Hare (*Lepus sextalis*).

Table 2: Mammal species recorded during initial faunal survey

COMMON NAME	SCIENTIFIC NAME
African (Common) Mole-rat	*Cryptomys hottentotus*
Four-Striped Grass Mouse	*Rhabdomys pumilio*
Scrub Hare	*Lepus saxatilis*
Slender Mongoose	*Galerella sanguinea*
Tree Squirrel	*Paraxerus cepapi*
Cape Clawless Otter	*Aonyx capensis*
Cape Porcupine	*Hystrix africaeaustralis*
Common Duiker	*Sylvicarpa grimmia*
Bushbuck	*Tragelaphus scriptus*

COMMON NAME	SCIENTIFIC NAME
Kudu	*Tragelaphus strepsiceros*

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES

According to Skinner and Chimimba (2005) six mammal species of conservation importance or concern could possibly occur on the site using current distribution records and habitat requirements as an indicator of possible presence. These included Wild Dog (*Lycaon pictus*) (Endangered), Cheetah (*Acinonyx jubatus*) (Vulnerable), Lion (*Panthera leo*) (Vulnerable), Spotted Hyaena (*Crocura crocura*) (Lower Risk- Near-threatened), Side-striped Jackal (*Canis adustus*) (Lower Risk- Near-threatened), Ground Pangolin (Lower Risk-Near-threatened), Honey Badger (*Mellivora capensis*) (Lower Risk- Near-threatened), and Serval (*Leptailurus serval*) (Lower Risk-Near-threatened). The majority of species can be excluded due to lack of suitable habitat on the site and adjacent areas. The larger carnivores including Lion, Wild Dog, Cheetah and Spotted Hyaena are restricted to the adjacent provincial and private game reserves. No actual observation or evidence of any sensitive or endangered mammals was recorded during the brief survey or are likely to occur within the power line alignments or substation site. More comprehensive surveys undertaken over extended periods will deliver a more representative species list of mammal species likely to occur within the area. It is highly unlikely that the preferred alignment (Option 1) comprises critical habitat for any of the above-mentioned threatened mammal species and that the proposed new Mbumbu-Tsakani power line will most likely have a **medium-low**, **short-long term impact** on remaining mammal species in the Acornhoek area.

4.2 AMPHIBIANS

Amphibian surveys by Jacobsen (1989), as well as recent and current surveys suggest that 51 species of amphibians currently occur in the Province of Mpumalanga. The present study concentrated mainly on Red Data species and species that are threatened or have relatively restricted distributions. Eight species are considered as important for setting conservation priorities. In Mpumalanga: *Vandijkophrynus* (*Bufo*) *gariepensis nubicolus* (Karroo toad), *Hadromophryne* (*Heleophryne*) *natalensis* (Cascade Frog/Natal Ghost Frog), *Hemisus guttatus* (Spotted shovel-nosed Frog), *Hyperolius semidiscus* (Yellow-striped Reed Frog); *Strongylopus wageri* (Plain Stream Frog), Giant Bullfrog (*Pycicephalus adspersus*), Greater Leaf-folding Frog (*Afrixalis fornasinii*) and Whistling Rain Frog (*Breviceps sopranus*).

The amphibian populations in Mpumalanga are faced with several environmental threats. Habitat destruction and alien vegetation resulting in fragmentation of populations

is probably the major threats facing all frog species. Forestry and agriculture have already resulted in the rapid destruction and fragmentation of the habitat of populations of the species discussed here. Overgrazing and severe fires in the grassland catchment areas result in extensive silting up of streams and wetlands, threatening the breeding habitat of these frogs. The biphasic life cycle of most frogs, as well as their semi-permeable skin makes them particularly vulnerable to pollutants and other environmental stresses. Consequently frogs can be used as environmental bio-monitors to indicate the quality of the environment. Chemical pollution and acidification constitute a major threat to frog populations. Heavy metals such as aluminium, cadmium, copper, zinc and iron are all toxic to amphibians. It can be inferred from studies on fish that nickel, lead and manganese will also have deleterious effects on frog populations (Bishop 1996).

Herbicides and pesticides often cause developmental abnormalities or mortalities. A recent report has shown that widely used and apparently safe herbicides containing the active ingredient glyphosphate are extremely toxic to tadpoles and frogs (Bishop 1996). These herbicides are widely used in plantations, as well as in nature reserves for alien plant control and the making of firebreaks. Another threat to the continued survival of these frog species, is the damming of rivers, streams and wetlands. In many cases this action is followed by the introduction of alien fish species, with their associated parasites, for angling purposes in these dams. The preferred breeding habitat of five of the species discussed is natural, shallow, ephemeral pools and streams in palustrine wetlands. Deeper man-made dams and weirs alter and shrink the breeding habitat of these frogs considerably. Invasive predator fish species may also be a threat to the survival of the species.

No actual survey was undertaken due to extreme time constraints for an adequate herpetological survey. The majority of species in Mpumalanga Province are classified as explosive breeders completing their short duration reproductive cycle in the early summer months between (November-January). These frog species only emerge after the first heavy summer rainfalls and are dormant during the cold winter months. Explosive breeding frogs utilise ephemeral pans or inundated grasslands for their short duration reproductive cycles.

Figure 14: Suitable breeding habitat for several frog species was observed within the seasonal pools situated within the drainage lines

No surface water was present in the larger non-perennial rivers as well as several smaller drainage lines. No natural pans/depressions were observed during the site visit although several seasonally inundated depressions or old sand mining pits were observed adjacent to the alignments (especially the alternative Option 2 alignment).

Table 3: Frog species recorded during the brief field survey.

COMMON NAME	**SCIENTIFIC NAME**
Guttural Toad	*Amietophrynus gutturalis*
Eastern Olive Toad	*Amietophrynus garmani*
Common Platanna	*Xenopus laevis*
Boettger's or Common Caco	*Cacosternum boettgeri*

COMMON NAME	SCIENTIFIC NAME
Common River Frog	*Amietia angolensis*
Dwarf Puddle Frog	*Phrynobatrachus mababiensis*
Snoring Puddle Frog	*Phrynobatrachus natalensis*
Bushveld Rain Frog	*Breviceps adspersus*

As the survey was undertaken during the day only a small proportion of species were recorded. Heavy rains occurred within 24 hours of the survey and resulted in the initiation of several explosive frog species. Comprehensive herpetological surveys can only be undertaken throughout the duration of the wet season (November-March). It is only during this period that accurate frog species lists can be compiled. The majority of amphibian species recorded calling within shallow pool situated within the perennial tributary or drainage line and included Common River Frog (*Amietia* (*Afrana*) *angolensis*); Common Platanna (*Xenopus laevis*) and Painted Reed Frog (*Hyperolius marmoratus taeniatus*). Several Dwarf Puddle Frogs (*Phrynobatrachus mababiensis*) were calling from the grassy banks and shallow edge of the tributary. Several road fatalities of Guttural Toad (*Amietophrynus gutturalis*) as well as Eastern Olive Toad (*Amietophrynus garmani*) were observed on the roads adjacent to the alignments.

Due to heavy precipitation during the previous 24 hours small, seasonally inundated grassland or pools were observed within old sand mining areas. Frog species recorded calling were Common Caco (*Cacosternum boettgerri*) as well as Snoring Puddle Frog (*Phrynobatrachus mababiensis*).

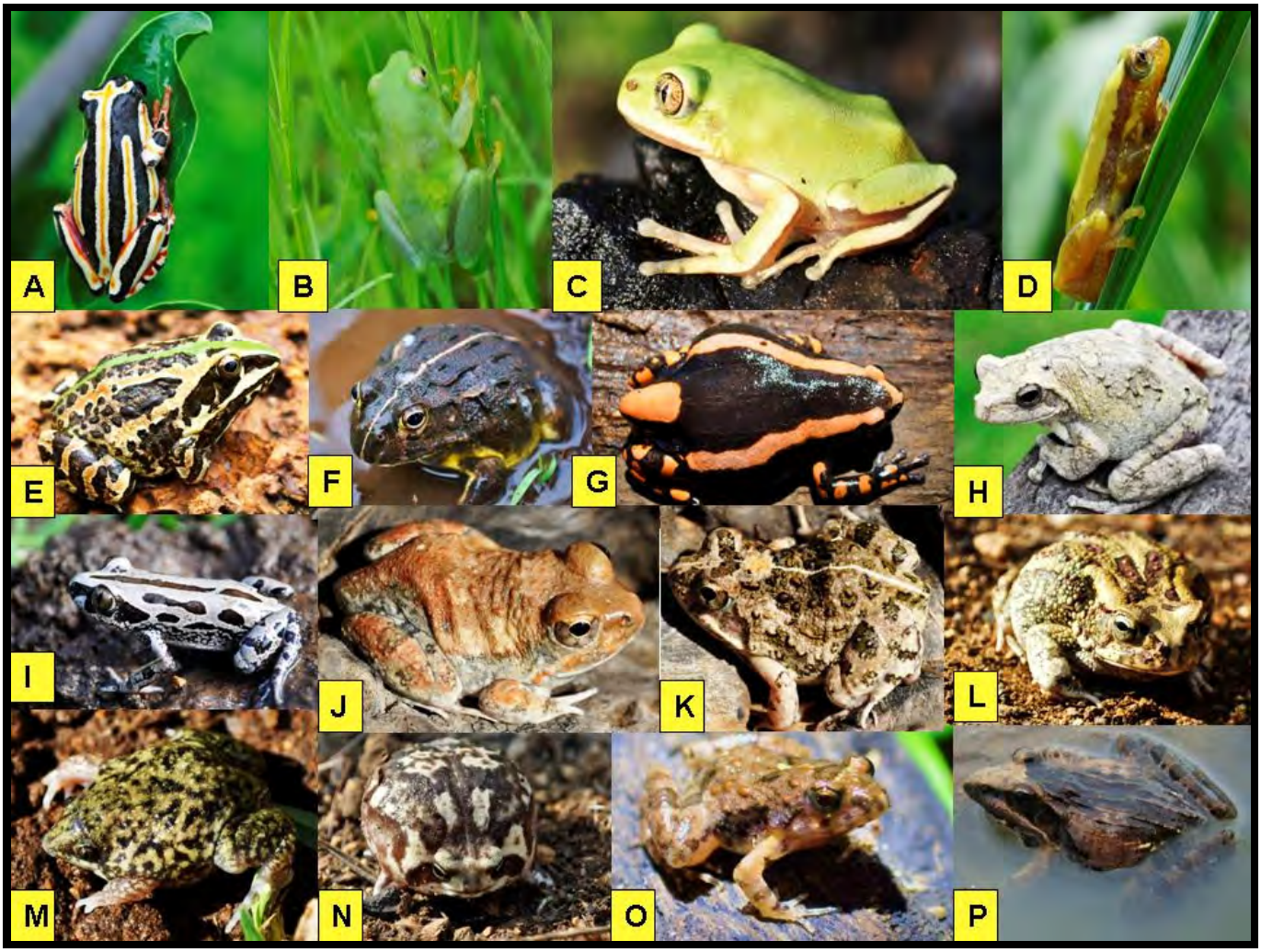

Figure 15: A conglomerate of photographs of frog species recorded from the 2431CA and 2431CB QDGC's as well as previous surveys by the consultant in the Bushbuckridge and Acornhoek areas

A: Painted Reed Frog (*Hyperolius marmoratus taeniatus*), **B:** Water Lily Frog (*Hyperolius pusillus*), **C:** Brown-Backed Tree Frog (*Leptopelis mossambicus*) juvenile colouration, **D:** Golden Leaf-Folding Frog (*Afrixalus aureus*); **E:** Southern Ornate Frog (*Hildebrandtia ornata*), **F:** African Bullfrog (*Pyxicephalus edulis*), **G:** Banded Rubber Frog (*Phrynomantis bifasciatus*), **H:** Southern Foam Nest Frog (*Chiromantis xerampelina*), **I:** Bubbling Kassina (*Kassina senegalensis*), **J:** Russet-Backed Sand Frog (*Tomopterna marmorata*), **K:** Tremelo Sand Frog (*Tomopterna cryptotis*), **L:** Eastern Olive Toad (*Amietophrynus garmani*), **M:** Mottled Shovel-nosed Frog (*Hemisus marmoratus*), **N:** Bushveld Rain Frog (*Breviceps adspersus*), **O:** Dwarf Puddle Frog (*Phrynobatrchus mababiensis*) and **P:** Plain Grass Frog (*Ptychadena anchietae*).

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES

Figure 16: The Giant Bullfrog (*Pyxicephalus adspersus*) (left) occurs within limited localities within Mpumalanga Province. No suitable habitat remains within the area for Giant Bullfrogs although favourable habitat remains for the smaller African Bullfrog (*Pyxicephalus edulis*) (right).

Giant Bullfrog *(Pyxicephalus adspersus)*

As the largest southern African frog, it spends most of the year underground encased in a transparent cocoon, emerging only after heavy thunderstorms in summer. The Bullfrog breeds in shallow, temporary rain-filled pans and small wetlands in grassland and savanna (Passmore and Carruthers 1995), as well as in the Great Karroo (SAFAP). Although the species occurs widespread in southern Africa (Lambiris 1988), the populations in Mpumalanga are threatened by habitat degradation and fragmentation.

The predicted distribution of *P. adspersus* was determined using environmental variables such as elevation (800 to 1700 m a.s.l.) and mean annual rainfall of less than 750 mm. It is absent from high lying areas with high rainfall. These habitats are estimated to be more than 40% transformed. Loskopdam Nature Reserve is the only provincial protected reserve where the Giant Bullfrog was recorded (Jacobsen et al 1986). For this reason the species is considered **Vulnerable** in the Mpumalanga Province.

The Giant Bullfrog is currently assigned as a **Near-threatened** species (IUCN Red List category) *Minter et al.* 2004. Giant Bullfrogs have been recorded from the 2431CA and 2431CB QDGC's. The records of Giant Bullfrogs are most likely an incorrect identification of juvenile African Bullfrogs (*Pyxicephalus edulis*). The preferred alignments (Option 1) does not provide any suitable breeding habitat for Giant Bullfrogs and limited suitable habitat for the protected African Bullfrog in the form of the seasonally

inundated depressions or old sand mining excavations to the north and south of the alignment.

4.3 REPTILES

Most current knowledge of the reptiles of Mpumalanga is based on a survey done by N.H.G. Jacobsen (1989) providing a detailed account of all reptiles in the then Transvaal province. This survey resulted in descriptions of life histories, habitat requirements and conservation status and maps of the known distributions. Jacobsen's (1989) survey revealed that 154 reptiles occur in the Mpumalanga Province and of these, 86 species are threatened. However, many of these threatened reptiles have relatively wide distributions and thus this study was restricted to Red Data species and species that are largely restricted to Mpumalanga.

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe during field surveys. The majority reptile species are sensitive to severe habitat alteration and fragmentation. Due to human presence in the area coupled with increased habitat destruction and disturbances around the alternative sites are all causal factors in the alteration of reptile species occurring on the site and surrounding areas. No major rock outcrops were observed on the site. Rock outcrops provide favourable refuges for certain snake and lizard species (rupicolous species). Trees including stumps; bark and holes in trees are vital habitats for numerous arboreal reptiles (chameleons, snakes, tree agamas, geckos and monitors).Several large termite mounds were observed along and around the proposed alignments. Termite mounds offer important refuges for numerous frog, lizard and snake species. Large number of species of mammal, birds, reptiles and amphibians feed on the emerging alates (winged termites). These mass emergences coincide with the first heavy summer rains and the emergence of the majority of herpetofauna. Termite mounds also provide nesting site for numerous snakes, lizards (varanids) and refuge habitats for several smaller mammals (shrews) and frogs. Trees including stumps, bark and holes are vital habitats for numerous arboreal reptiles (chameleons, snakes, agamas, geckos and monitors).

The indiscriminate killing of all snake species around the existing villages reduces reptile populations especially snake populations drastically. The frequent burning of the site will have a high impact on remaining reptiles. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

Table 4: List of reptile species recorded during brief field survey

COMMON NAME	SCIENTIFIC NAME
Distant's Ground Agama	*Pelomedusa subrufa*
Striped Skink	*Trachylepis punctatissima*
Rainbow Skink	*Trachylepis margaritifer*
Flap-neck Chameleon	*Chamaeleo dilepis*
Delalande's Sandveld Lizard	*Nucras lalandii*
Yellow-throated Plated Lizard	*Gerrhosaurus flavigularis*
Nile Monitor	*Varanus niloticus*
Southern Tree Agama	*Acanthocerus atricolis*

Eight reptile species were recorded during the survey: Striped Skinks (*Trachylepis punctatissima*) and Rainbow Skink (*Trachylepis margaritifer*) were observed around the sheds as well as homestead. Spotted Sand Lizard (*Pedioplanis lineoocellata*), Flap-necked Chameleon (*Chamaeleo dilepis*), Yellow-throated Plated Lizard (*Gerrhosaurus flavigularis*) as well as Southern Tree Agama *Acanthocercus atricollis* and Distant's Ground Agama (*Agama aculeate distanti*) were observed within the riparian zone of the perennial tributary. A Nile Monitor (*Varanus niloticus*) was flushed from the reed beds below the dam (Option 1) situated on the perennial tributary. No snake species were observed during field survey and populations are expected to be low due to high levels of human disturbance. A list of reptile species observed on the site as well as species likely to occur on the site using habitat as an indicator of presence; is presented in the Appendix see Table 8.

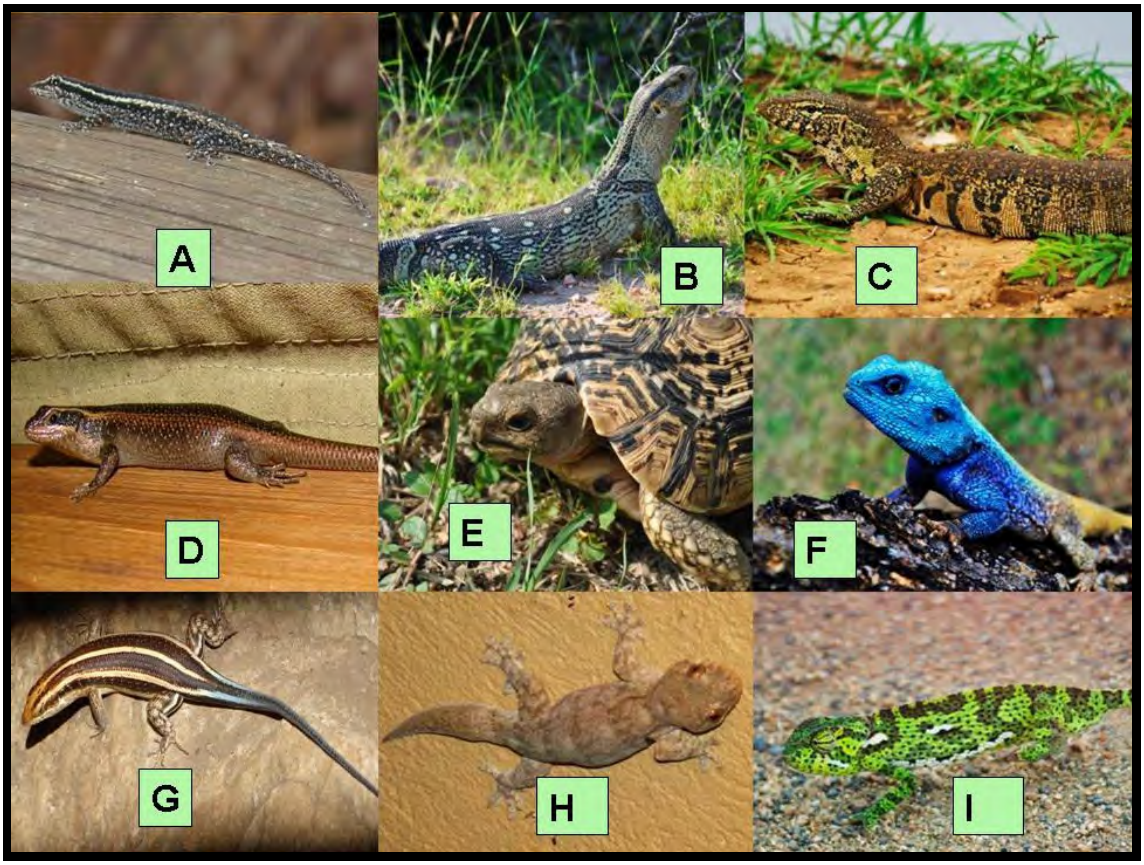

Figure 17: A conglomerate of photographs displaying the reptile species likely to occur along the alignments

A: Common Dwarf Gecko (*Lygodactylus capensis*), **B:** Rock Monitor (*Varanus albigularis*); **C:** Nile Monitor (*Varanus niloticus*), **D:** Striped Skink (*Trachylepis striata*) **E:** Leopard Tortoise (*Stigmochelis pardalis*), **F:** Male Southern Tree Agama (*Acanthocercus atricolis*), **G:** Rainbow Skink (*Trachylepis margaritifer*) **H:** Turners Gecko (*Chondrodactylus* turneri) and **I:** Flap-necked Chameleon (*Chamaeleo dilepis*).

4.3 HABITAT FOR SENSITIVE OR ENDANGERED SPECIES

One red listed or threatened reptile species has been recorded namely the Large-scaled Grass Lizard (*Chamaesaura macrolepis*) has been recorded from the 2431 CA and 2431 CB QDGC's according to ReptiMAP (SARCA virtual museum).

Large-scaled Grass Lizard (*Chamaesaura macrolepis*)

The large-scaled grass lizard lacks forelimbs altogether and the hind limbs have only one digit each. The legs are spike-like and may be held perpendicular to the body and play no part in locomotion. Grass lizards do not appear to use holes in the ground as refuge habitats, although they do occasionally shelter under rocks is there is easy access. Grass fires are important conservation threat to Grass Lizard populations in several respects. Fires kill lizards that become trapped in pockets of grassland from which they cannot escape. Transformation of land by humans has exacerbated the negative effects of fire due to the increase in fire frequency, fragmentation of the grasslands and installation of barriers such as roads, walls and channels, over which the lizards cannot easily pass to escape the flames. Fires also change the structure of the grassland habitat making it more difficult for Grass Lizards to locomote. The removal of the grass cover is also likely to increase predation and reduce the abundance of food. After fires, Grass Lizards typically move into any unburned patches that remain. It is probably for this reason that populations persist better in grasslands where there are rocky areas as the rocks probably afford some protection from fire and also serve as fire breaks, causing patches of grass to remain (Alexander & Marais 2007). The Large-scaled Grass Lizard has been recorded from the 2431 CA and 2431 CB QDGC's according to ReptiMAP (SARCA virtual museum).

No endangered reptile species were recorded during the brief field survey or are likely to occur within the proposed alignments or substation site due to lack of suitable habitat. Extremely limited suitable habitat occurs within the remnant patches of riparian vegetation along the perennial and non-perennial rivers and streams for the protected Southern African Python. No Southern African Pythons or evidence of pythons was observed during the brief field survey. Remaining Python populations would have been impacted on during the previous agricultural activities. As a precautionary measure an educational programme on Southern African Pythons should be implemented for the contractors of the project. If any pythons are discovered on the site the relevant conservation authorities should be informed and the python relocated in suitable habitat away from the alignments.

5. SENSITIVE HABITATS AROUND ALIGNMENTS

Due to habitat transformation surrounding the villages the remaining natural vegetation around the villages is of vital importance. This vegetation provides critical habitats for numerous plant and animal species. Animal species utilise the strip of vegetation around these areas for breeding, foraging, refuge, exploratory and migratory movements. All remaining large tree species should be retained wherever possible as they form vital habitat for numerous insectivorous predators, which control deleterious insect (grasshoppers), bird (queleas) and mammal (rodents) populations. Trees and stumps are vital habitats for numerous arboreal reptiles, birds and mammals; as they are used for refuge sites as well as foraging areas. Destruction of remaining tree species will result in decreased predators and increased populations of detrimental pest species, which could affect surrounding croplands. The majority of the site has little remaining agricultural potential because of the poor soil quality as well as limited water supply. Abundant pest animal species were also observed in the altered habitats.

Figure 18: All remaining large indigenous tree species (>4m) and shrubs (>2m) should be retained wherever possible and the towers and power line alignment should be shifted to avoid remaining large tree species. Trees form vital habitats for numerous faunal species adapted to their arboreal habitat as well as playing a vital role in erosion stabilisation.

Impacts on the sloping areas such as the macro-channel banks of the Khokhovela River must be strictly regulated preventing possible further deterioration of the environment. The soils of the site are highly erodable; extensive erosion could result without a protective vegetative layer. Habitats such as the remaining Granite Lowveld bushveld, scattered low-lying rock outcrops, trees, stumps, termitaria and leaf litter are all vital habitats for numerous animal species. The alignment should ideally avoid these sensitive micro-habitats for remaining faunal species.

5.1 KHOKHOVELA RIVER; PERENNIAL AND NON-PERENNIAL DRAINAGE LINES

Figure 19: The Khokovela River and associated open and closed woodland riparian zone are considered as sensitive habitats due to an ecological as well as hydrological functioning.

Rivers are longitudinal ecosystems, and their condition at any point is a reflection of not only upstream activities, but also of those within adjacent and upstream parts of the catchment (O'Keefe 1986). Any impact on the riverine area within the study area is therefore also likely to impact on upstream and downstream areas.

The riparian zone comprises plant communities contiguous to and affected by surface and subsurface hydrological features of perennial or intermittent water bodies (rivers and streams). Riparian areas have one or both of the following characteristics: 1) distinctly different vegetative species than adjacent areas, and 2) species similar to adjacent areas but exhibiting more rigorous or robust growth form. The vegetation is dependant on the river for a number of functions including growth, temperature control, seed dispersal and germination and nutrient enrichment (Kemper, 2000). The vegetation comprises a distinct composition of species, often different from that of the surrounding terrestrial vegetation. Tree species are positioned according to their dependence or affinity for water, with the more water loving (mesic species) being located closest to the river channel, often with their roots in the water, and the less water loving terrestrial species further away from the river (Kemper, 2000).

Certain sections along the Khokhovela River as well as surrounding perennial and non-perennial drainage lines are more typical of the natural riparian vegetation, whilst others especially around existing villages have been severely altered due to riparian zone degradation. Impacts include the change in species composition due to:

- Reed encroachment
- Exotic species encroachment (*Melia azedarach, Lantana camara*)
- Encroachment of terrestrial species
- Loss of indigenous trees and shrubs
- Flooding of terrestrial and riparian vegetation.

Change in age structure of trees and shrubs due to loss of different size classes of shrubs and trees. There have been changes in the physical character of certain sections of the riparian zone mainly due to physical scars due to vegetation clearances, wood harvesting, erosion and restriction of riparian zone. Changes in the flow regime of the rivers will further impact the sensitive riparian zone upstream and downstream.

The riparian zone, of which vegetation is a major component, has a number of important functions including:

- Enhancing water quality in the river by the interception and breakdown of pollutants
- Interception and deposition of nutrients and sediments
- Stabilisation of riverbanks and macro-channel floor
- Flood attenuation
- Provision of habitat and migration routes for fauna and flora
- Provision of fuels, building materials and medicines for communities (if done on a sustainable basis!!)
- Recreational areas {fishing (rod and line not shade or gill nets); birdwatching; picnic areas etc.}

The entire riparian strips and its associated flora are sensitive and important habitats for numerous animal species. Trees are vital habitats for numerous arboreal animal species. Large numbers of birds were recorded in these woody habitats. The riparian vegetation plays a vital role in the re-colonization of aquatic macro-invertebrates. The majority of macro-invertebrates are only aquatic during their larval period and are terrestrial for their adult stages. Trees and shrubs provide vital refuge, foraging and migratory passages for species migrating to and away from the river. Fringing vegetation including trees, shrubs, reeds and forbs are vital habitats for numerous aquatic macro-invertebrates and fish species as well as for numerous animal species (reptiles, amphibians, birds and mammals).

All rivers and their associated riparian vegetation are sensitive habitats and disturbances and anthropomorphic induced impacts, activities around the Khokhovela River, perennial and seasonal tributaries should be strictly limited. Activities such as washing, uncontrolled cattle drinking areas, uncontrolled hunting and poaching, removal of riparian tree species, gill nets should be prevented as they will eventually result in the collapse of the aquatic ecosystem on which the nearby and downstream communities are dependent on for water supply.

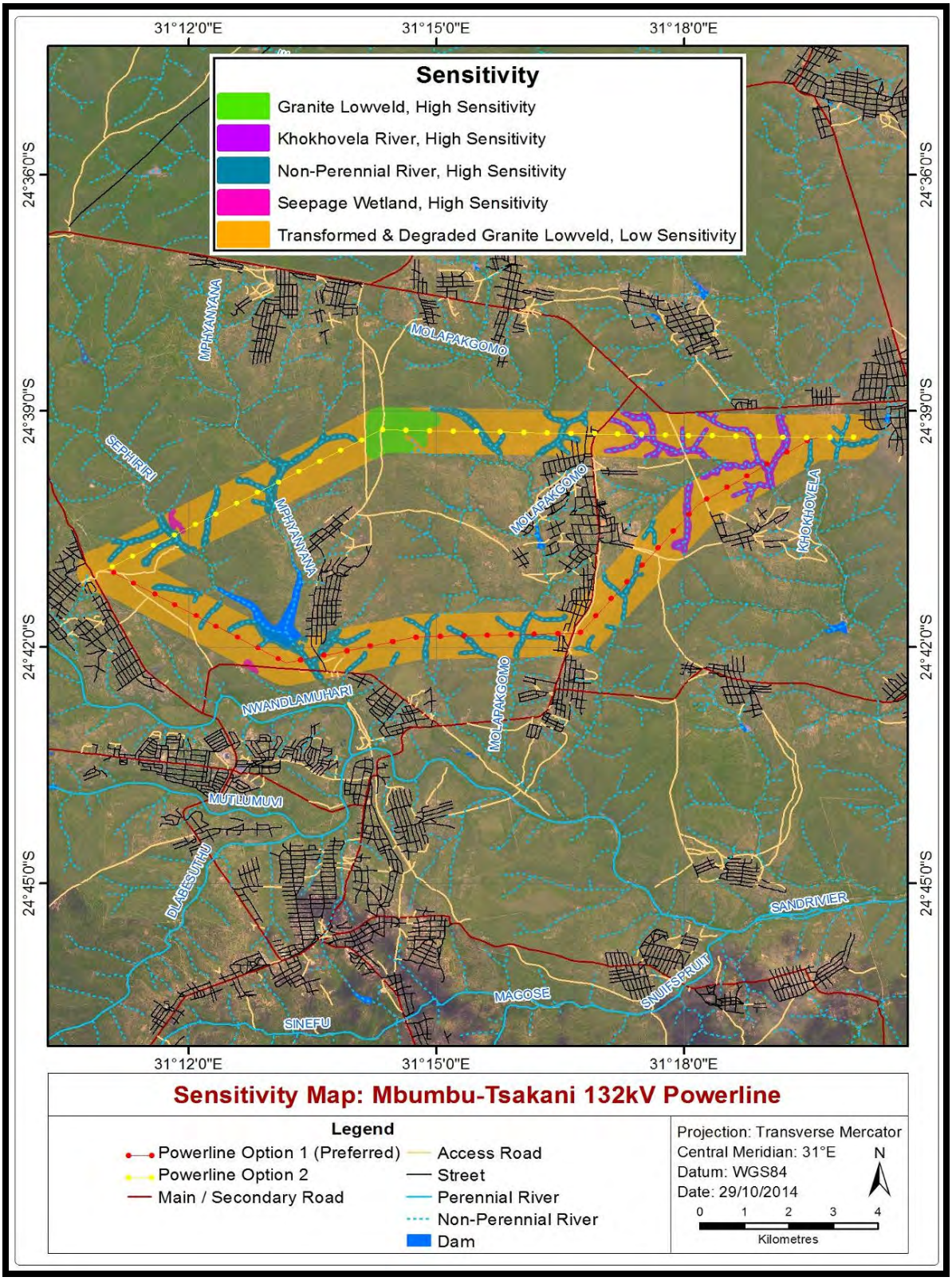

Figure 20: A sensitivity map of the Mbumbu-Tsakani power line and substation site

6. EVALUATION OF THE PREFERRED ALIGNMENTS

As mentioned previously, two potential alignments have been identified for the a new 17km 132kV loop-in and out Chikadee power line from the existing Mbumbu Switching Station. Factors considered in evaluating and determining the order of preference of the two corridors in terms of floral and faunal impacts are listed and discussed below:

6.1 OPTION 1

The majority of the alignment is situated within degraded or transformed vegetation as well as existing power line servitudes, access roads and informal tracks and livestock pathways with limited habitat diversity this significantly reduces the level of disturbance and habitat destruction. In addition, fauna in the immediate vicinity of the existing lines as well as adjacent sand mining areas would already be relatively tolerant of disturbance as a result of maintenance activities as well as sand mining activities. The alignment bisects several non-perennial drainage lines or rivers. The majority of the riparian vegetation along these seasonal rivers has already been removed for wood harvesting activities although certain sections along the Khokhovela River display a more natural species composition. All riverine areas including their associated riparian or hygrophilous vegetation along the seasonal drainage lines must be considered as sensitive habitats and activities must be strictly managed (see management recommendations). The Option 1 is the **Preferred alignment** for the vegetation as well as remaining fauna within the areas.

Figure 21: A conglomerate of photographs displaying current impacts within and around the preferred alignment (Option 1)

A: The preferred alignment exits the Mbumbu substation and heads in a south-easterly direction towards a large impoundment for approximately 5.35km. **B:** Several informal sand mining areas were observed to the east of the Mbumbu substation. Several large trucks were observed transporting sand from a large pit immediately to the east of the substation. **C:** The majority of riparian vegetation around the Edinburgh dam as well as non-perennial drainage lines has been removed and the vegetation has been degraded with only a few scattered large indigenous trees remaining. This will result in minimal vegetation clearance during construction activities as well as during the operational or maintenance phase. Ideally the final alignment of towers as well as power line should be shifted around any large (>4m) indigenous tree species. **D:** A concrete irrigation trench/furrow restricts the migratory and dispersal movements of smaller animal species between the dam and the adjacent bushveld habitat. **E:** Existing Eskom servitudes and lines as well as sand mining activities occur in the area. Several informal roads and tracks occur adjacent to the alignment especially for access to illegal sand mining operations in the area as well as wood harvesting. The vegetation has been impacted on by surrounding anthropogenic activities including extensive wood harvesting and overgrazing. Bush encroachment by *Dicrostachys cinerea*. Hunting with dogs was observed during site visitation.

6.2 OPTION 2

From the Mbumbu substation the alignment heads in a northerly direction for 6.79km. The vegetation displays a more natural species composition (more abundant large tree and shrub species) and has less anthropogenic disturbances due to limited accessibility compared to the transformed and degraded vegetation towards the south and east around the existing villages. Fewer tracks and pathways occur in the areas and limited illegal sand mining and wood harvesting activities. The proposed alignment bisects several non-perennial drainage lines towards the new Tsakani substation site. A few scattered red listed 'Declining' *Boophone disticha* were observed adjacent to the proposed alignment within the open and closed woodlands.

Figure 22: Option 2 Granite Lowveld bushveld

The alternative alignment (Option 2) bisects Granite Lowveld bushveld which displays a more natural species composition as well as containing several larger tree species. Areas to the east of the alignment are fenced off restricting anthropogenic activities. The area currently contains fewer access roads as well as informal tracks which restricts which restricts access as well as anthropogenic activities such as wood harvesting,

poaching and hunting as well as sand mining. For this reason the alternative alignment is **Not preferred** from an **ecological perspective**.

7. GENERIC DESCRIPTION OF POTENTIAL IMPACTS OF POWER LINES ON ASSOCIATED FAUNA

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in Southern Africa are electrocution of birds (and other animals) and disturbance and habitat destruction during construction and maintenance activities.

7.1 Habitat destruction and disturbance

During the construction phase and maintenance of power lines, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on fauna breeding, foraging and roosting in or in close proximity of the servitude, both through modification of habitat and disturbance caused by human activity.

Mitigation and Recommendations

The following general recommendations are made to minimise the impacts of power line construction on **threatened fauna**:

- Close site supervision must be maintained during construction.
- During the **CONSTRUCTION** phase workers must be limited to areas under construction and access to the undeveloped areas, especially the surrounding open areas must be strictly regulated (“no-go” areas during construction activities).
- Provision of adequate toilet facilities must be implemented to prevent the possible contamination of ground (borehole) water in the area. Mobile toilets must be provided in order to minimise unauthorised traffic of construction workers outside of the designated areas.

- All temporary stockpile areas including litter and dumped material and rubble must be removed on completion of construction. All alien invasive plant should be removed from the site to prevent further invasion.
- Access to the power line servitude must be restricted. Access to the power line servitude should ideally be fenced off and gated along the main access roads. No quad-bikes, motorcycles or off road vehicles and illegal hunting as well as illegal sand mining should be permitted in the adjacent properties.
- Firearms or any other hunting weapons must be prohibited on site.
- Contract employees must be educated about the value of wild animals and the importance of their conservation.
- Educational programmes for the contractor's staff must be implemented to ensure that project workers are alerted to the possibility of snakes being found during vegetation clearance. The construction team must be briefed about the management of snakes in such instances. In particular, construction workers are to go through ongoing refresher courses to ensure that protected frog species such as the African Bullfrog and snake species, such as African Rock Pythons, are not killed or persecuted when found.
- Severe contractual fines must be imposed and immediate dismissal on any contract employee who is found attempting to snare or otherwise harm wild animals.
- No animals should be intentionally killed or destroyed and poaching and hunting should not be permitted on the site.
- No specific recommendations are made for the protection of burrowing red data mammals. Consideration could be given to rescuing the animals where there burrows are found in advance of construction. This is not recommended as a general prescription since the chances of digging out live Aardwolf or Antbears are small. Aardwolves are likely to vacate their burrows in the face of the advancing construction. There is also a risk associated with capturing animals dug out of burrows, and holding them in captivity. If a section of many active burrows is found then mitigation could be considered (minor deviation to the power line alignment or rescue operation for the animals).
- Prior to construction and vegetation clearance a suitably qualified Zoologist/Botanist or Ecologist should closely examine the proposed construction areas (tower supports) for the presence of any protected tree and red listed plant species as well as any large animal burrows, rocky outcrops, logs, stumps and other debris and relocate any affected plants or animals to appropriate habitat away from the servitude or tower.

7.2 VEGETATION/FLORA

Protected or endangered species may occur along the line route including *Boophone disticha* and *Anselia africana*. Special care should be taken not to damage or remove any such species unless absolutely necessary. Permits for removal must be obtained from Provincial Nature Conservation should such species be affected as well as the Department of Agriculture, Forestry and Fisheries (DAFF) for the removal of protected tree species namely the Marula (*Sclerocarrya birrea* subsp. *caffra*), Apple-Leaf (*Philenoptera violacea*) as well as Wild Teak (*Pterocarpus rotundifolius*). All plants not interfering with the operation of the line shall be left undisturbed. Collection of firewood and traditional medicinal plants is strictly prohibited. No area should be cleared of trees, bushes and other vegetation for the purpose of a camping site.

Management objective

- Minimal disturbance to vegetation where such vegetation does not interfere with construction and operation of the line
- No unnecessary destruction to surrounding vegetation
- Protection of any protected or endangered plant species
- Prevention of litigation concerning removal of vegetation

Measurable targets

- Adequate protection of any endangered or threatened plant or tree species
- No litigation due to removal of vegetation without the necessary permits

Mitigation and recommendation

Remaining indigenous bulbous geophytes and Aloes should be retained or replanted wherever possible. Gardens or landscaped areas around the Tsakani Substation development should be planted with indigenous (preferably using endemic or local species from the area) grasses, forbs, shrubs and trees, which are water wise and require minimal horticultural practices. Where herbicides are used to clear vegetation, specimen-specific chemicals should be applied to individual plants only. General spraying should be prohibited.

All alien vegetation should be eradicated over a five-year period. Invasive species should be given the highest priority. No dumping of any materials in undeveloped open areas and neighbouring properties. Activities in the surrounding open undeveloped areas (especially open bushveld must be strictly regulated and managed.

The construction of the proposed Mbumbu-Tsakani 132kV power line could result in limited opening-up of the vegetal cover during the construction phase. The opening up

of existing vegetated areas, thereby creating corridors along which animals can move, may result in increased predation levels on small mammals, reptiles, amphibians, arachnids and scorpions along these corridors. The limitation of the disturbance of vegetation cover as well as rocky outcrops, logs, stumps, termite mounds within sensitive areas will ameliorate this impact. The impact will be short-long term depending on the amount of vegetation to be cleared. Excessive habitat destruction during construction could reduce the amount of habitat available. This impact is anticipated to be localised, of a long-term nature and of low significance, provided that appropriate mitigation measures are implemented (e.g. the limitation of vegetation clearance within sensitive areas especially riverine crossings).

7.3 REVEGETATION

Where necessary a suitable mixture of grass seed shall be used to re-seed damaged areas. Badly damaged areas shall be fenced in to enhance rehabilitation. Areas to be rehabilitated must be planted with a mixture of endemic pioneer grass species endemic to the area, as soon as the new growing season starts. To get the best results in a specific area, it is a good idea to consult with a vegetation specialist or the local extension officer of the DAFF. Seed distributors can also give valuable advice as to the mixtures and amount of seed necessary to seed a certain area. Re-seeding, as well as fencing in of badly damaged areas, will always be at the discretion of the Environmental Control Officer, unless specifically requested by a Landowner.

Management objective

- Minimise damage to topsoil and environment at tower positions
- Successful rehabilitation of all damaged areas
- Prevention of erosion

Measurable targets

- No loss of topsoil due to construction activities
- All disturbed areas successfully rehabilitated within three months of completion of the contract
- No visible erosion scars three months after completion of the contract

A mixture of seed can be used provided the mixture is carefully selected to ensure the following:

a) Annual and perennial plants are chosen.
b) Pioneer species are included.
c) All the plants shall not be edible.
d) Species chosen will grow in the area without many problems.
e) Root systems must have a binding effect on the soil.
f) The final product should not cause an ecological imbalance in the area.

CONSTRUCTION PHASE

- Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion.
- Re-seeding shall be done on disturbed areas as directed by the Environmental Control Officer.

7.4 SURROUNDING FARMING ACTIVITIES

Domestic Livestock

Construction activities must be planned carefully so as not to interfere with the calving and lambing season for most animal species. The Contractor's workforce will have to be very careful not to disturb the animals as this may lead to fatalities which will give rise to claims from the Landowners. Interference with any wildlife without the applicable permits shall not be allowed. The Contractor shall under no circumstances interfere with livestock without the Landowner being present. This includes the moving of livestock where they interfere with construction activities. Should the Contractors workforce obtain any livestock for eating purposes, they must be in possession of a written note from the Landowner. Speed limits must be restricted especially on farm roads (30km/hr) preventing unnecessary road fatalities of surrounding livestock.

Management objective

- Minimise disruption of surrounding farming activities
- Minimise disturbance of fauna
- Minimise interruption of breeding patterns of fauna

Measurable targets

- No hunting and poaching or intentional killing of animals (including snakes, scorpions, spiders)
- No stock losses where construction is underway
- No complaints from Landowners or Nature Conservation
- No litigation concerning stock losses and animal deaths

7.5 ACCESS ROADS

Planning of access routes must be done in conjunction between the Contractor, Eskom and the Landowner. All access to private farmland must be negotiated in advance with land-owners. All agreements reached shall be documented in writing and no verbal agreements should be made. The condition of existing access / private roads to be used shall be documented with photographs.

The Contractor shall properly mark all access roads. Markers shall show the direction of travel as well as tower numbers to which the road leads. Roads not to be used shall be marked with a "**NO ENTRY**" sign. Unnecessary traversing of agricultural and natural open land is discouraged. Where required, speed limits shall be indicated on the roads (30km). All speed limits shall be strictly adhered to at all time.

Vehicle access to the power line servitude must as far as possible be limited to existing roads. If a new access roads need to be constructed it should follow cleared areas such as cattle pathways. The following mitigation should also be undertaken:

7.6 VEGETATION CLEARANCE

Management objective

- Minimise damage to surrounding vegetation
- Minimise damage to topsoil
- Successful rehabilitation of barren areas

Measurable targets

- No damage to vegetation outside the road servitude
- No loss of topsoil
- No visible erosion three months after completion of the contract
- All disturbed areas successfully rehabilitated three months after completion of the contract

The object of vegetation clearing is to trim, cut or clear the minimum number of trees and vegetation necessary for the safe mechanical construction and electrical operation of the distribution line. Only an 8m strip may be cleared flush with the ground to allow vehicular passage during construction. No scalping shall be allowed on any part of the servitude road unless absolutely necessary. The removal of all economically valuable trees or vegetation shall be negotiated with the Landowner before such vegetation is removed.
Vegetation clearing on tower sites must be kept to a minimum. Big trees with large root systems shall be cut manually and removed, as the use of a bulldozer will cause major damage to the soil when the root systems are removed. Stumps shall be treated with herbicide. Smaller vegetation can be flattened with a machine, but the blade should be kept above ground level to prevent scalping. Any vegetation cleared on a tower site shall be removed or flattened and not be pushed to form an embankment around the tower.

No vegetation clearing in the form of de-stumping, scalping or uprooting shall be allowed on river- and stream banks (riparian zone). Vegetation shall only be cut to allow for the

passage of the pilot-cables and headboard. Trees and vegetation not interfering with the statutory clearance to the conductors can be left under the line. Dense vegetation under the line which could cause a fire hazard, particularly in the middle third of the span in the vicinity of the lowest point of the conductors, will be considered as a separate case. With permission of the landowner, the total servitude under the line and up to 5m outside the outer phases should be cleared.

Protected tree species or plants shall not be removed unless they are interfering with a structure. Where such species have to be removed due to interference with a structure, the necessary permission and permits shall be obtained from Provincial Nature Conservation as well as DAFF. The protected tree species must be identified by a suitable qualified botanist/ecologist prior to construction and vegetation clearance. All protected species not to be removed must be clearly marked and such areas fenced off if required.

Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion.

The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. Eskom's approval for the use of herbicides is mandatory. Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the supplier’s specifications.

Upon completion of the stringing operations and before handover, the servitude must be inspected and all vegetation interfering with the safe operation of the line shall be removed / cut down. All alien vegetation in the total servitude and densifiers creating a fire hazard shall be cleared and treated with herbicides.

It is recommended that a contractor for vegetation clearing should comply with the following parameters:

- the contractor must have the necessary knowledge to be able to identify protected species as well as species not interfering with the operation of the line due to their height and growth rate.
- the contractor must also be able to identify declared weeds and alien species that can be totally eradicated.
- the contractor must be in possession of a valid herbicide applicators licence.

7.7 DANGEROUS ANIMALS

Numerous dangerous wild animals and arachnids and scorpions occur around the substation site and along the proposed loop-in-line and thus safety measures must be implemented to ensure the safety of the contractors and sub-contractors.

Figure 23: Common Yellow-Banded Baboon Spider (*Harpactira tigrina*) was observed under loosely embedded rocks within the wooded areas adjacent to the alternative alignment (Option 2)

ARACHNIDS

During the construction phase care must be taken not to destroy any trap-door or baboon spider burrows. Prior to excavations a thorough inspection of the cleared areas must be undertaken to determine the presences of any baboon spider burrows, loosely embedded rocks or stumps in the proposed cleared areas. Several species of Baboon and Trapdoor species have been recorded in the area.

Conservation

Of the mygalomorphs, it is mainly the larger Baboon Spiders that are in great demand as pets and are consequently regarded as commercially threatened by the International Union for Conservation of International Trade in Endangered Species (CITES) (De Wet & Schoonbee 1991). The genera *Ceratogyrus, Harpactira* and *Pterinochilus* were added

to schedule V11 of the Transvaal Provincial Nature Conservation Ordinance of 1983 as Protected Invertebrate Animals. Eskom must ensure that no baboon spiders are illegally collected or intentionally destroyed throughout all stages of the project.

Figure 24: Several scorpion species including *Opistothalmus glabifrons* as well as the highly venomous *Parabuthus transvalicus* and *Parabuthus mossambicensis* occur within the study area

Scorpions

Several species of scorpions are recorded from the area. These scorpions construct burrows or scrapes under rocks as well as found under loose bark, wood piles and other surface debris. The majority of these scorpions possess a painful sting they are not of medical importance except*s Parabuthus transvalicus* and *Parabuthus mossambicensis.* which are amongst South Africa's most venomous scorpion species. Care should be taken when removing stumps, logs or rock material. Any scorpions encountered on the site should be left alone and allowed free access away from the activity or safely removed from the area. No scorpions should be intentionally killed. Standard precautions or safety measures includes wearing sturdy leather boots and gloves in the field and close inspection of sleeping areas and bedding, clothes, shoes etc. for any scorpions. Stings from mildly venomous scorpions cause localised pain and swelling, with little systematic reaction. The affected limb should be immobilized and an ice pack should be applied, if possible, to the site of the sting. The site of the sting should be cleaned and never cut open. Venom sprayed in the eyes (certain *Parabuthus* species

are able to spray venom) produces an intense burning sensation and may result in temporary blindness if the eyes are not washed out thoroughly with clean water or some other neutral liquid such as milk.

SNAKES

Several venomous snake species occur along the proposed route including Southern or Bibron's Burrowing Asp (*Actractaspis bibronii*), Mozambique Spitting Cobra (*Naja mossambica*), Snouted Cobra (Naja *annulifera*), Black Mamba (*Dendroaspis polylepis*), Puff Adder (*Bitis arietans*), Boomslang (*Dispholidus typus*), Common or Rhombic Night Adder (*Causus rhombeatus*). General avoidance of snakes is the best policy if encountered. Snakes should not be harmed or killed and allowed free movement away from the area. Safety precaution measure must be implemented especially during the vegetation clearance phase which could result in encounters with several venomous snake species. Appropriate foot wear (sturdy leather boots) should be worn in the field.

7.8 POISONOUS PLANTS

Figure 25: Oleander (*Nerium oleander*) (left) and the Yellow Oleander (*Thevetia peruviana*) (right)

The Oleander (*Nerium oleander)* and the Yellow Oleander (*Thevetia peruviana*) (right) are both poisonous plants and are potentially lethal to livestock as well as humans. They are common within the rural homesteads situated adjacent to the proposed alignments. Two leaves and around 4 seeds of the Yellow Oleander can be fatal to a child.

7.9 FIRE PREVENTION

The frequent burning of the vegetation will have a high impact on remaining reptile species. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

Management objective

- Minimise risk of veld fires
- Minimise damage to grazing
- Prevent runaway fires

Measurable targets

- No veld fires started by the Contractor's work force
- No claims from Landowners for damages due to veld fires
- No litigation

Mitigation and recommendations

No open fires shall be allowed on site under any circumstance. The Contractor shall have fire-fighting equipment available on all vehicles working on site, especially during the winter months.

7.10 THREATENED ANIMALS

At a local scale the study site and surrounding areas comprises little or no suitable habitat for any threatened animal species.

Mitigation and recommendations

As a precautionary mitigation measure it is recommended that the developer and construction contractor as well as an independent environmental control officer should be made aware of the possible presence of certain protected animal species (South African Python, African Bullfrog, White-throated or Rock Monitor, Water Monitor) prior to the commencement of construction activities. In the event that any of the above-mentioned species are discovered they should be allowed to move away from the construction area and not interfered with.

8. IMPACT RANKING OF POTENTIAL IMPACTS TO ASSOCIATED FLORA AND FAUNA

The activities associated with a given development project may have impacts during the construction and/or operational phases. In this report, the assessment of impacts was divided into three phases associated with a project. These are i) the *status quo* or present situation taking consideration of existing impacts not associated with the proposed development, ii) the *construction phase* including surveying and other activities associated with the planning of the project, construction and all the activities associated with construction until the contractor leaves the site and iii) the *operational phase* which includes all activities associated with the operation and maintenance of the proposed development. The criteria against which the activities were assessed are presented below.

Assessment criteria

Extent of the impact:

The spatial scale of the impacts are described as either:

- local (i.e. within the boundaries of the alignment or site),
- regional (i.e. the impact could affect the greater Acornhoek area and other nearby towns and villages, conservation areas etc.), or
- national (i.e. South Africa)

Intensity of the impact

The intensity or severity of the impacts within the context of all the activities and other impacts associated with the project and is indicated as either:

- **low** (i.e. where the impact affects the environment in such a way that physical, biological, cultural, social and economic functioning and processes are not affected),
- **medium** (i.e. where the affected environment is altered but physical, biological, cultural, social and economic functioning and processes continue albeit in a modified way), or
- **high** (where physical, biological, cultural, social and economic functioning and processes are altered to the extent that they will temporarily or permanently cease).

Probability of occurrence

The likelihood of the impact actually occurring throughout or during any stage of the life cycle of the activity, is indicated as either:

- **improbable** (the possibility of the impact materialising is very low as result of design or historic experience),

- **probable** (there is a distinct possibility that the impact will occur and mitigation measures are required),
- **highly probable** (it is most likely that the impact will occur), or
- **definite** (the impact will occur regardless of the implementation of any prevention measures and mitigatory measures are required to contain the effect).

Duration of the impact

The life span of the impact is described as either:

- short term, the impact will either disappear with mitigation or will be mitigated through natural processes (0-5 years),
- medium term (6-15 years),
- long term (where the impact will last the entire operational life of the power line, but would be mitigated by direct human action or by natural processes thereafter), or
- permanent (the impact will persist beyond the operational life of the power line).

Significance of the impact

Based on a synthesis of the information contained in points i - iv above, the potential impacts are assessed in terms of the following significance criteria:

< **low** (i.e. where the impact would not have any influence on the decision to continue with the proposed project)

< **moderate** (i.e. where the impact should influence the decision to continue with the proposed development in the area unless it is effectively mitigated to acceptable levels),

< **high** (i.e. where the impact must influence the decision to continue with the proposed development regardless of any mitigation measures).

Table 5: Summary table of ranking of potential impacts of the preferred alignment (Option 1) on vegetation and associated fauna

POTENTIAL IMPACT	INTENSITY	EXTENT	PROBABILITY OF OCCURENCE	DURATION	SIGNIFICANCE (WITHOUT MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Loss of Protected Tree species	Medium-Low	Localized along power line and access roads servitude.	Highly Probable	Short-Long Term during construction and maintenance	Medium-Low	Low
Loss of Faunal Habitat	Medium-High	Localized along power line and servitude.	Definite	Short-long term	Medium-High	Medium-low
Threatened Fauna	Medium-Low	Local	Probable	Short-Long Term during construction and maintenance	Medium	Low
Increased Human Presence	Medium-Low	Local	Highly Probable	Short-Long Term during construction and maintenance	Medium	Low
Vegetation Clearance	Medium-low	Local	Definite	Short-term during construction and maintenance	Medium	Low
Re-vegetation	Medium-Low	Local	Probable	Short duration	Medium	Low
Disturbances to Livestock	Medium-Low	Local	Probable	Short-Long Term Duration	Medium-Low	Low
Fire	Medium-High	Local and adjacent bushveld areas	Probable	Short-Long Term Duration	Medium-High	Low

Table 6: Summary table of ranking of potential impacts of the proposed alternative alignment (option 2) on vegetation and associated fauna

POTENTIAL IMPACT	INTENSITY	EXTENT	PROBABILITY OF OCCURENCE	DURATION	SIGNIFICANCE (WITHOUT MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Loss of Protected Tree species	Medium-High	Localized along power line and access roads servitude.	Highly Probable	Short-Long Term during construction and maintenance	Medium-High	Medium-Low
Loss of Faunal Habitat	Medium-High	Localized along power line and servitude.	Definite	Short-long term	Medium-High	Medium
Threatened Fauna	Medium-Low	Local	Probable	Short-Long Term during construction and maintenance	Medium	Low
Increased Human Presence	Medium-High	Local	Highly Probable	Short-Long Term during construction and maintenance	Medium-High	Medium-Low
Vegetation Clearance	Medium-High	Local	Definite	Short-term during construction as well as maintenance	Medium-High	Medium-Low

POTENTIAL IMPACT	INTENSITY	EXTENT	PROBABILITY OF OCCURENCE	DURATION	SIGNIFICANCE (WITHOUT MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Re-vegetation	Medium-Low	Local	Probable	Short duration	Medium	Low
Disturbances to Livestock	Medium-Low	Local	Probable	Short-Long Term Duration	Medium-Low	Low
Fire	Medium-High	Local and surrounding grassland areas	Probable	Short-Long Term Duration	Medium-High	Low

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APPENDIX

Table 7: List of frog species recorded during current and previous surveys and of species likely to occur on and surrounding the site. Due to habitat degradation and transformation on the site as well as possible deterioration in water quality from adjacent villages as well as pesticide, fertilizer and herbicide runoff entering rivers from the agricultural lands; actual species lists will contain far fewer species.

Common Name	Scientific Name	Breeding Habitat
African Bullfrog	*Pyxicephalus edulis*	Temporary shallow depressions and floodplain areas of the vlei. Also requires undisturbed open veld for foraging and sandy soils for burrowing.
Tremolo Sand Frog	*Tomopterna cryptotis*	Temporary rain pools, pans and floodplain areas
Natal Sand Frog	*Tomopterna natalensis*	Temporary and semi-permanent seepage and mud pools.
Russet-backed Sand Frog	*Tomopterna marmorata*	Seasonal mud pools, small ponds and floodplain areas
Knocking Sand Frog	*Tomopterna krugerensis*	Seasonal mud pools, small ponds and floodplain areas.
*Common Caco	*Cacosternum boettgeri*	Temporary marshes, ditches and grass inundated to a depth of about 2cm.
Red-Legged Kassina	*Kassina maculata*	Well vegetated pans, vleis, marshes and dams
Bubbling Kassina	*Kassina senegalensis*	Semi-permanent vleis, pans and shallows around dams.
Brown-backed Tree Frog	*Leptopelis mossambicus*	Shallow pans, pools and streams
Grey Tree Frog	*Chiromantis xerampelina*	Temporary rain pools, pans and floodplain areas
Red Toad	*Schismaderma carens*	Semi-permanent dams & ponds with water depth of more than one metre.
*Eastern Olive Toad	*Ametiophrynus (Bufo) garmani*	Permanent or semi-permanent bodies of water, quiet backwaters of rivers, natural or man-made in open wooded savannah.
*Guttural Toad	*Ametiophrynus* (*Bufo*)	Permanent and semi-permanent ponds

Common Name	Scientific Name	Breeding Habitat
	gutturalis	and backwaters in open habitat.
Flat-backed Toad	*Ametiophrynus* (*Bufo*) *maculatus*	Breeding habitat is riverine as is almost always associated with medium and large rivers.
Raucous Toad	*Amietophrynus rangeri*	Permanent or semi-permanent bodies of water, natural or man-made.
Northern Pygmy Toad	*Bufo fenoulheti*	Temporary pools on flat rocky outcrops or seasonal rain pools
*Common Platanna	*Xenopus laevis*	Permanent or semi-permanent bodies of water, natural or man-made.
Tropical Platanna	*Xenopus muelleri*	Permanent or semi-permanent bodies of water, natural or man-made.
*Common River Frog	*Afrana angolensis*	Present in all major rivers as well as permanent standing water and floodplain areas.
Banded Rubber Frog	*Phrynomantis bifasciatus*	Shallow ponds or inundated grass in savanna and *Acacia* veld.
*Dwarf Puddle Frog	*Phrynobatrachus mababiensis*	Shallow stagnant water amongst emergent vegetation on the edges of grassy pans, vleis, marshes and in the back-waters of slow streams.
*Snoring Puddle Frog	*Phrynobatrachus natalensis*	Pools or marshy area associated with the vlei
Plain Grass Frog	*Ptychadena anchietae*	Shallow pools (seasonal), inundated grassland areas of the vlei and dams.
Broad-banded Grass Frog	*Ptychadena mossambica*	Shallow pools (seasonal), inundated grassland areas of the vlei and dams, floodplains of rivers.
Sharp-nosed Grass Frog	*Ptychadena oxyrhynchus*	Shallow pools (seasonal), inundated grassland areas of the vlei and dams
*Bushveld Rain Frog	*Breviceps adspersus*	Eggs deposited in a subterranean chamber about 30cm below surface.
Mottled Shovel-nosed Frog	*Hemisus marmoratus*	Construct extensive tortuous tunnels in low muddy areas close to the edge of pools
Golden Leaf-	*Afrixalus aureus*	Margins of seasonal pools and pans

Common Name	Scientific Name	Breeding Habitat
folding Frog		
*Painted Reed Frog	*Hyperolius marmoratus*	Temporary pools, pans and vleis as well as permanent bodies of water such as dams, marshes, reedbeds on sluggish rivers and streams.
Water Lily Frog	*Hyperolius pusillus*	Shallow pans, ponds, vleis and dams with water lilies *Nymphaea sp.*
Tinker Reed Frog	*Hyperolius tuberilinguis*	Reed-beds around wetlands and rivers

*recorded during brief field survey.

Table 8: List of reptile species recorded during previous surveys as well as current survey. Due to habitat degradation and transformation and limited refugial habitat; actual species lists will contain far fewer species

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Agamidae	**Acanthocercus*	*atricollis*	*atricollis*	Southern Tree Agama	Least Concern (SARCA 2014)	
Agamidae	*Agama*	*aculeata*	*distanti*	Distant's Ground Agama	Least Concern (SARCA 2014)	Yes
Atractaspididae	*Amblyodipsas*	*polylepis*	*polylepis*	Common Purple-glossed Snake	Least Concern (SARCA 2014)	
Atractaspididae	*Aparallactus*	*capensis*		Black-headed Centipede-eater	Least Concern (SARCA 2014)	
Atractaspididae	*Atractaspis*	*bibronii*		Bibron's Stiletto Snake	Least Concern (SARCA 2014)	
Boidae	*Python*	*natalensis*		Southern African Python	Least Concern (SARCA 2014)	
Chamaeleonidae	**Chamaeleo*	*dilepis*	*dilepis*	Common Flap-neck Chameleon	Least Concern (SARCA 2014)	
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Least Concern (SARCA 2014)	
Colubridae	*Crotaphopeltis*	*hotamboeia*		Red-lipped Snake	Least Concern (SARCA 2014)	
Colubridae	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Least Concern (SARCA 2014)	
Colubridae	*Dipsadoboa*	*aulica*		Marbled Tree Snake	Least Concern (SARCA 2014)	
Colubridae	**Dispholidus*	*typus*	*typus*	Boomslang	Least Concern	

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
					(SARCA 2014)	
Colubridae	*Gonionotophis*	*capensis*	*capensis*	Common File Snake	Least Concern (SARCA 2014)	
Colubridae	*Gonionotophis*	*nyassae*		Black File Snake	Least Concern (SARCA 2014)	
Colubridae	*Hemirhagerrhis*	*nototaenia*		Eastern Bark Snake	Least Concern (SARCA 2014)	
Colubridae	*Lycodonomorphus*	*rufulus*		Brown Water Snake	Least Concern (SARCA 2014)	
Colubridae	*Lycophidion*	*capense*	*capense*	Cape Wolf Snake	Least Concern (SARCA 2014)	
Colubridae	*Philothamnus*	*hoplogaster*		South Eastern Green Snake	Least Concern (SARCA 2014)	
Colubridae	*Philothamnus*	*natalensis*	*occidentalis*	Western Natal Green Snake	Least Concern (SARCA 2014)	Yes
Colubridae	*Philothamnus*	*semivariegatus*		Spotted Bush Snake	Least Concern (SARCA 2014)	
Colubridae	*Prosymna*	*bivittata*		Two-striped Shovel-snout	Least Concern (SARCA 2014)	
Colubridae	*Prosymna*	*lineata*		Lined Shovel-snout	Least Concern (SARCA 2014)	
Colubridae	*Prosymna*	*stuhlmannii*		East African Shovel-snout	Least Concern (SARCA 2014)	
Colubridae	*Prosymna*	*sundevallii*		Sundevall's Shovel-snout	Least Concern (SARCA 2014)	
Colubridae	*Psammophis*	*angolensis*		Dwarf Sand Snake	Least Concern	

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
					(SARCA 2014)	
Colubridae	*Psammophis*	*brevirostris*		Short-snouted Grass Snake	Least Concern (SARCA 2014)	
Colubridae	*Psammophis*	*mossambicus*		Olive Grass Snake	Least Concern (SARCA 2014)	
Colubridae	*Psammophis*	*subtaeniatus*		Western Yellow-bellied Sand Snake	Least Concern (SARCA 2014)	
Colubridae	*Psammophylax*	*tritaeniatus*		Striped Grass Snake	Least Concern (SARCA 2014)	
Colubridae	*Pseudaspis*	*cana*		Mole Snake	Least Concern (SARCA 2014)	
Colubridae	*Rhamphiophis*	*rostratus*		Rufous Beaked Snake	Least Concern (SARCA 2014)	
Colubridae	*Telescopus*	*semiannulatus*	*semiannulatus*	Eastern Tiger Snake	Least Concern (SARCA 2014)	
Colubridae	*Thelotornis*	*capensis*	*capensis*	Southern Twig Snake	Least Concern (SARCA 2014)	
Cordylidae	***Chamaesaura***	***macrolepis***		**Large-scaled Grass Lizard**	**Near Threatened (SARCA 2014)**	
Cordylidae	*Cordylus*	*jonesii*		Jones' Girdled Lizard	Least Concern (SARCA 2014)	
Cordylidae	*Platysaurus*	*intermedius*	*wilhelmi*	Wilhelm's Flat Lizard	Least Concern (SARCA 2014)	Yes
Elapidae	*Aspidelaps*	*scutatus*	*intermedius*	Intermediate Shield Cobra	Least Concern (SARCA 2014)	Yes
Elapidae	*Dendroaspis*	*polylepis*		Black Mamba	Least Concern	

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
					(SARCA 2014)	
Elapidae	*Elapsoidea*	*boulengeri*		Boulenger's Garter Snake	Least Concern (SARCA 2014)	
Elapidae	*Naja*	*annulifera*		Snouted Cobra	Least Concern (SARCA 2014)	
Elapidae	**Naja*	*mossambica*		Mozambique Spitting Cobra	Least Concern (SARCA 2014)	
Gekkonidae	*Chondrodactylus*	*turneri*		Turner's Gecko	Least Concern (SARCA 2014)	
Gekkonidae	**Hemidactylus*	*mabouia*		Common Tropical House Gecko	Least Concern (SARCA 2014)	
Gekkonidae	*Homopholis*	*wahlbergii*		Wahlberg's Velvet Gecko	Least Concern (SARCA 2014)	
Gekkonidae	**Lygodactylus*	*capensis*	*capensis*	Common Dwarf Gecko	Least Concern (SARCA 2014)	
Gekkonidae	*Lygodactylus*	*nigropunctatus*	*nigropunctatus*	Black-spotted Dwarf Gecko	Least Concern (SARCA 2014)	Yes
Gekkonidae	*Lygodactylus*	*ocellatus*		Spotted Dwarf Gecko	Not listed	
Gekkonidae	*Pachydactylus*	*punctatus*		Speckled Gecko	Least Concern (SARCA 2014)	
Gekkonidae	*Pachydactylus*	*vansoni*		Van Son's Gecko	Least Concern (SARCA 2014)	
Gerrhosauridae	*Broadleysaurus*	*major*		Rough-scaled Plated Lizard	Least Concern (SARCA 2014)	
Gerrhosauridae	**Gerrhosaurus*	*flavigularis*		Yellow-throated	Least Concern	

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
				Plated Lizard	(SARCA 2014)	
Gerrhosauridae	**Gerrhosaurus*	*intermedius*		Black-lined Plated Lizard	Least Concern (SARCA 2014)	
Gerrhosauridae	*Matobosaurus*	*validus*		Common Giant Plated Lizard	Least Concern (SARCA 2014)	
Lacertidae	**Heliobolus*	*lugubris*		Bushveld Lizard	Least Concern (SARCA 2014)	
Lacertidae	**Meroles*	*squamulosus*		Common Rough-scaled Lizard	Least Concern (SARCA 2014)	
Lacertidae	*Nucras*	*holubi*		Holub's Sandveld Lizard	Least Concern (SARCA 2014)	
Lacertidae	*Nucras*	*intertexta*		Spotted Sandveld Lizard	Least Concern (SARCA 2014)	
Lacertidae	**Nucras*	*ornata*		Ornate Sandveld Lizard	Least Concern (SARCA 2014)	
Leptotyphlopidae	*Leptotyphlops*	*distanti*		Distant's Thread Snake	Least Concern (SARCA 2014)	
Leptotyphlopidae	*Leptotyphlops*	*incognitus*		Incognito Thread Snake	Least Concern (SARCA 2014)	
Leptotyphlopidae	*Leptotyphlops*	*scutifrons*	*conjunctus*	Eastern Thread Snake	Not listed	
Leptotyphlopidae	*Leptotyphlops*	*scutifrons*	*scutifrons*	Peters' Thread Snake	Not listed	
Leptotyphlopidae	*Myriopholis*	*longicauda*		Long-tailed Thread Snake	Least Concern (SARCA 2014)	
Pelomedusidae	**Pelomedusa*	*subrufa*		Marsh Terrapin	Least Concern	

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
					(SARCA 2014)	
Pelomedusidae	*Pelusios*	*sinuatus*		Serrated Hinged Terrapin	Least Concern (SARCA 2014)	
Scincidae	*Acontias*	*plumbeus*		Giant Legless Skink	Least Concern (SARCA 2014)	
Scincidae	**Afroablepharus*	*wahlbergii*		Wahlberg's Snake-eyed Skink	Least Concern (SARCA 2014)	
Scincidae	*Mochlus*	*sundevallii*	*sundevallii*	Sundevall's Writhing Skink	Least Concern (SARCA 2014)	
Scincidae	*Scelotes*	*bidigittatus*		Lowveld Dwarf Burrowing Skink	Least Concern (SARCA 2014)	Yes
Scincidae	*Scelotes*	*mossambicus*		Mozambique Dwarf Burrowing Skink	Least Concern (SARCA 2014)	
Scincidae	**Trachylepis*	*capensis*		Cape Skink	Least Concern (SARCA 2014)	
Scincidae	**Trachylepis*	*margaritifer*		Rainbow Skink	Least Concern (SARCA 2014)	
Scincidae	**Trachylepis*	*striata*		Striped Skink	Least Concern (SARCA 2014)	
Scincidae	*Trachylepis*	*varia*		Variable Skink	Least Concern (SARCA 2014)	
Testudinidae	*Kinixys*	*natalensis*		Natal Hinged Tortoise	Least Concern (SARCA 2014)	
Testudinidae	*Kinixys*	*spekii*		Speke's Hinged Tortoise	Least Concern (SARCA 2014)	
Testudinidae	*Stigmochelys*	*pardalis*		Leopard Tortoise	Least Concern	

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
					(SARCA 2014)	
Typhlopidae	*Afrotyphlops*	*bibronii*		Bibron's Blind Snake	Least Concern (SARCA 2014)	
Typhlopidae	*Megatyphlops*	*schlegelii*		Schlegel's Beaked Blind Snake	Least Concern (SARCA 2014)	
Typhlopidae	*Rhinotyphlops*	*lalandei*		Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)	
Varanidae	*Varanus*	*albigularis*	*albigularis*	Rock Monitor	Least Concern (SARCA 2014)	
Varanidae	**Varanus*	*niloticus*		Water Monitor	Least Concern (SARCA 2014)	
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern (SARCA 2014)	
Viperidae	*Causus*	*defilippii*		Snouted Night Adder	Least Concern (SARCA 2014)	
Viperidae	**Causus*	*rhombeatus*		Rhombic Night Adder	Least Concern (SARCA 2014)	

* observed during brief field survey

Table 9: Mammal species recorded during initial faunal survey and supplemented with previous field surveys conducted in similar habitat (1998-2011). Due to habitat degradation and transformation as well as high levels of poaching and hunting actual species lists will contain far fewer species.

Family	Genus	Species	Subspecies	Common name	Red list category
Bovidae	*Aepyceros*	*melampus*		Impala	Least Concern
Bovidae	*Connochaetes*	*taurinus*	taurinus		Least Concern
Bovidae	*Damaliscus*	*lunatus*		Common Tsessebe	Least Concern (IUCN 2008)
Bovidae	*Hippotragus*	*niger*		Sable Antelope	Not listed
Bovidae	*Kobus*	*ellipsiprymnus*		Waterbuck	Not listed
Bovidae	*Raphicerus*	*campestris*		Steenbok	Least Concern
Bovidae	*Redunca*	*arundinum*		Southern Reedbuck	Least Concern
Bovidae	*Sylvicapra*	*grimmia*		Bush Duiker	Least Concern
Bovidae	*Syncerus*	*caffer*		African Buffalo	Least Concern
Bovidae	*Tragelaphus*	*angasii*		Nyala	Least Concern
Bovidae	*Tragelaphus*	*scriptus*		Bushbuck	Least Concern
Bovidae	*Tragelaphus*	*strepsiceros*		Greater Kudu	Least Concern
Canidae	***Canis***	***adustus***		**Side-striped Jackal**	**Near Threatened**
Canidae	*Canis*	*mesomelas*		Black-backed Jackal	Least Concern
Canidae	***Lycaon***	***pictus***		**African wild dog**	**Endangered**
Cercopithecidae	*Cercopithecus*	*aethiops*	pygerythrus	Vervet Monkey	Least Concern
Cercopithecidae	*Papio*	*ursinus*		Chacma Baboon	Least Concern
Elephantidae	*Loxodonta*	*africana*		African Bush Elephant	Least Concern
Equidae	*Equus*	*quagga*		Plains Zebra	Not listed
Felidae	***Acinonyx***	***jubatus***		**Cheetah**	**Vulnerable**
Felidae	***Leptailurus***	***serval***		**Serval**	**Near Threatened**
Felidae	***Panthera***	***leo***		**Lion**	**Vulnerable**

Family	Genus	Species	Subspecies	Common name	Red list category
Felidae	*Panthera*	*pardus*		Leopard	Least Concern
Galagidae	*Galago*	*moholi*		Moholi Bushbaby	Least Concern
Giraffidae	*Giraffa*	*camelopardalis*	giraffa	The South African Giraffe	Least Concern
Gliridae	*Graphiurus*	*murinus*		Forest African Dormouse	Least Concern
Herpestidae	*Galerella*	*sanguinea*		Slender Mongoose	Least Concern
Herpestidae	*Helogale*	*parvula*		Common Dwarf Mongoose	Least Concern
Herpestidae	*Ichneumia*	*albicauda*		White-tailed Mongoose	Least Concern
Herpestidae	*Suricata*	*suricatta*		Meerkat	Least Concern
Hippopotamidae	*Hippopotamus*	*amphibius*		Common Hippopotamus	Least Concern
Hipposideridae	*Hipposideros*	*caffer*		Sundevall's Leaf-nosed Bat	Data deficient
Hyaenidae	***Crocuta***	***crocuta***		**Spotted Hyena**	**Near Threatened**
Hystricidae	*Hystrix*	*africaeaustralis*		Cape Porcupine	Least Concern
Leporidae	*Lepus*	*saxatilis*		Scrub Hare	Least Concern
Molossidae	*Chaerephon*	*pumilus*		Little Free-tailed Bat	Least Concern
Molossidae	*Tadarida*	*aegyptiaca*		Egyptian Free-tailed Bat	Least Concern
Mustelidae	***Mellivora***	***capensis***		**Honey Badger**	**Near Threatened**
Nycteridae	*Nycteris*	*thebaica*		Egyptian Slit-faced Bat	Least Concern
Pteropodidae	*Epomophorus*				Not listed
Sciuridae	*Paraxerus*	*cepapi*		Smith's Bush Squirrel	Least Concern
Suidae	*Phacochoerus*	*africanus*		Common Wart-hog	Least Concern
Vespertilionidae	*Neoromicia*	*capensis*		Cape Serotine	Least Concern
Vespertilionidae	*Neoromicia*	*nanus*		Banana Pipistrelle	Least Concern
Vespertilionidae	*Scotophilus*	*dinganii*		Yellow-bellied House	Least

Family	Genus	Species	Subspecies	Common name	Red list category
				Bat	Concern
Viveridae	*Genetta*	*maculata*		Common Large-spotted Genet (Rusty-spotted Genet)	Least Concern
Viverridae	*Civettictis*	*civetta*		African Civet	Least Concern
Viverridae	*Genetta*	*genetta*		Common Genet	Least Concern

*observed during brief field survey

APPENDIX D3

HERITAGE & PALAEONTOLOGICAL ASSESSMENT

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21October 2011

CULTURAL HERITAGE RESOURCES IMPACT ASSESSMENT FOR TWO ALTERNATIVE POWER LINES FROM THE EXISTING MBUMBU TRACTION SUBSTATION TO THE PROPOSED TSAKANI SUBSTATION THAT WILL RUN THROUGH THE FOLLOWING FARMS: BURLINGTON 217KU; ISLINGTON 219KU; EDINBURG 228KU; LUDLOW 227KU; EGLINGTON 225KU, MPUMALANGA PROVINCE

DEFINITION

The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of paleontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

PROTECTED SITES IN TERMS OF THE NATIONAL HERITAGE RESOURCES ACT, ACT NO. 25 OF 1999

The following are the most important sites and objects protected by the National Heritage Act:

- Structures or parts of structures older than 50 years.
- Archaeological sites and objects.
- Paleontological sites.
- Meteorites.
- Ship wrecks.
- Burial grounds.
- Graves of victims of conflict.
- Public monuments and memorials.
- Structures, places and objects protected through the publication of notices in the Gazette and Provincial Gazette.
- Any other places or objects, which are considered to be of interest or of historical or cultural significance.
- Geological sites of scientific or cultural importance.

- Sites of significance relating to the history of slavery in South Africa.
- Objects to which oral traditions are attached.
- Sites of cultural significance or other value to a community or pattern of South African history.
- These sites may not be altered, damaged, destroyed or developed without prior approval of the South African National Heritage Resources Agency (SAHRA).

TERMS OF REFERENCE

The following comprise the objectives of this cultural and heritage resources impact assessment.

- To review existing information, desktop survey and pre-assessment.
- To record all heritage resources as defined in the South African Heritage Resources Act (Act 25 of 1999).
- To conduct field and site assessments of all of the known heritage resources in the area as well as searching the entire 1ha for heritage resources.
- To record oral traditions and history.
- To document and map all heritage resources.
- To assess and evaluate all significant heritage resources found.
- To compile an impact assessment of the proposed site.

METHODOLOGY

All appropriate documents on the Lowveld dealing with heritage were studied. The area is poorly documented except for the adjacent National Kruger Park where the University of Pretoria has surveyed the area in detail (Meyer, A 1986)

The fieldwork was conducted by vehicle and on foot. A large portion of the survey area allows for inspection by vehicle.

ARCHAEOLOGICAL AND HISTORICAL BACKGROUND THE AREA

This section of the Lowveld has been poorly surveyed in the past, most probably because of all the informal settlements in the area. In contrast herewith the northern Lowveld towards Phalaborwa has been intensively surveyed (Miller, D. Kellick, D. and Van der Merwe N.J. 2001: 401 – 417; & Evers, T.M. and Van der Merwe N.J. 1987: 87 – 106)

To the south Evers has recorded an Early Iron Age site at Plaston near White River (Evans, T.M. 197: 170 – 178).

Just east of the surveyed area is the National Kruger Park. Most work in the area has been done by Prof. André Meyer of the Pretoria University. He has recorded a few Early Iron Age sites but most sites are Late Iron Age sites which mainly occur near major water resources. What is also important is to note that most of the area was Tsetse Fly area which had a severe impact on domesticated cattle sheep and goats (Meyer, A, 1986). The author also excavated a Late Iron Age site at Mluwati River. No remains of domesticated animals were found on the site (Küsel, U.S. 2001).

A number of cultural heritage resources impact assessments have been done in the area (Roodt, F. 2003; Roodt, H. 1999; Van der Walt, J. 2003; Van Schalkwyk, J.A. 2001 (i); Van Schalkwyk, J.A. 2001 (ii) and Van Schalkwyk, L.O. 2006.

Of these cultural heritage resources impact assessments only two Late Iron Age sites were found by Van Schalkwyk, J.A. (2001 (i)).

RESULTS

The proposed routs of the power line run through rural settlement areas, informal settlements and Lowveld bushveld (Van Wyk, B. & Van Wyk, P. 1997).

The route of the power line also crosses a large number of old maize and sorghum fields. Where the bushveld vegetation was dense the area had to be surveyed on foot.

Two alternative power lines roots were inspected for the project. Both lines start at S24° 41' 1.9" & E31° 10' 56.3".The lines end at S24° 39' 20.5" & E31° 19' 31.2". The proposed site of the substation at S24° 39' 59.4" & E31° 19' 38.4" was also inspected on foot. See attached maps.

1. Purple Route

The purple line runs from the starting point in a north eastern direction through Lowveld bushveld vegetation – see photograph

Starting point of both proposed routes

Then it crosses two streams and the dirt road at S24° 39' 14.4' & E31° 14' 20.1" – see photograph.

From here the line will run east to the end destination at S24° 39' 21.3" & E31° 19' 29.2". Along this section of the route it will also run through bushveld vegetation but will also cross some old fields where maize and sorghum was planted – see photograph.

End destination of the proposed power lines

No important cultural heritage resources or graves were found along this route.

2. Green Route

This route starts at the same point as the purple route but follows a more southerly direction crossing a large dam to S24° 42' 9.9: & E31° 13' 37.2" – see photograph

From here it follows an easterly direction. Along this section the route runs through an informal settlement area and across old fields see photograph

The power line will end at the same spot as the purple line at S24° 39' 20.3" & E31° 19' 29.2". This last section also runs through bushveld and old fields -see photograph on purple line

No important cultural heritage resources or graves were found along this route.

3. Proposed Substation site

The proposed site for the new substation lies near the river bed. The area is typical river vegetation with large trees and shrubs at S24° 39' 59.4" & E31° 19' 38.4". ***The site was inspected on foot and no important cultural heritage resources or graves were found.*** The site was photographically recorded north, northeast, east, southeast, south, southwest, west, and northwest – see photographs.

North

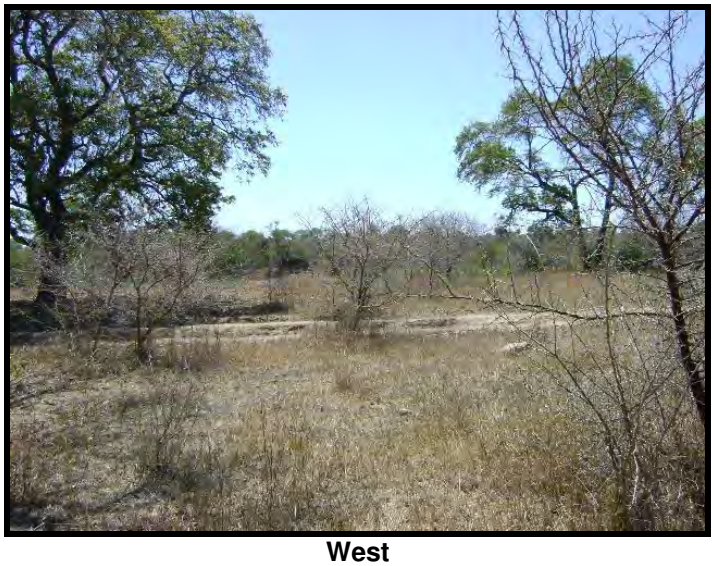
North East

East

South East

South

Southwest



West

Northwest

CONCLUSION

No important cultural heritage resources or graves are present on any of the two alternative routes. From a heritage point of view it does not really matter which route is preferred.

RECOMMENDATIONS

There is no objection to the construction of any of the two investigated routes given for the Mbumbu – Tsakani power line.

If during construction any cultural heritage resources or graves are unearthed all work has to be stopped until the site has been inspected and mitigated by a cultural heritage practitioner.

SITE INFORMATION

Owners contact details:

Eskom is still negotiating with the land owners for use of the land.

Developers contact details:

Mr. Josiah Zungu
Eskom Holdings SoC Pty Ltd
Eskom Distribution – Mpumalanga Region
PO Box 579, Nelspruit, 1200
Tel: 013 755 9655
Cell: 084 622 5412
Fax: 086 668 5894
Email: ZunguJ@eskom.co.za

Consultants contact détails:
Nicole Botham
Environmental Consultant
Royal HaskoningDHV
Tel: 012 367 5916
Fax: 012 367 5878
Email: nicole.botham@rhdhv.com

Type of development (e.g. low cost housing project, mining etc.)
17km 132kV power line

Whether rezoning and/or subdivision of land is involved:
Not Applicable

Full location of Province, Magisterial District/Local Authority, property (e.g. farm, erf name and number:
Bushbuckridge Local Municipality]
Ehlanzeni District Municipality
Mpumalanga Province

FARM NAME	NUMBER	PORTION
Burlington	217KU	0
Burlington	217KU	1
Burlington	217KU	2
Islington	219KU	0
Edinburgh	228KU	0
Edinburgh	228KU	2
Ludlow	227KU	0
Ludlow	227KU	3
Eglington	225KU	0

Location map must have the polygon of the area to be surveyed on it and full geographical coordinates for all relevant points and where applicable indication of the area to be developed (footprint):

See attached

If possible an aerial photograph of the specific area showing the location of all site.

See Attached

REFERENCES

- 1/50 000 Maps: 2431 CA, CB, CC & CD
- Archaeological database of the National Cultural Museum Pretoria
- Google Maps
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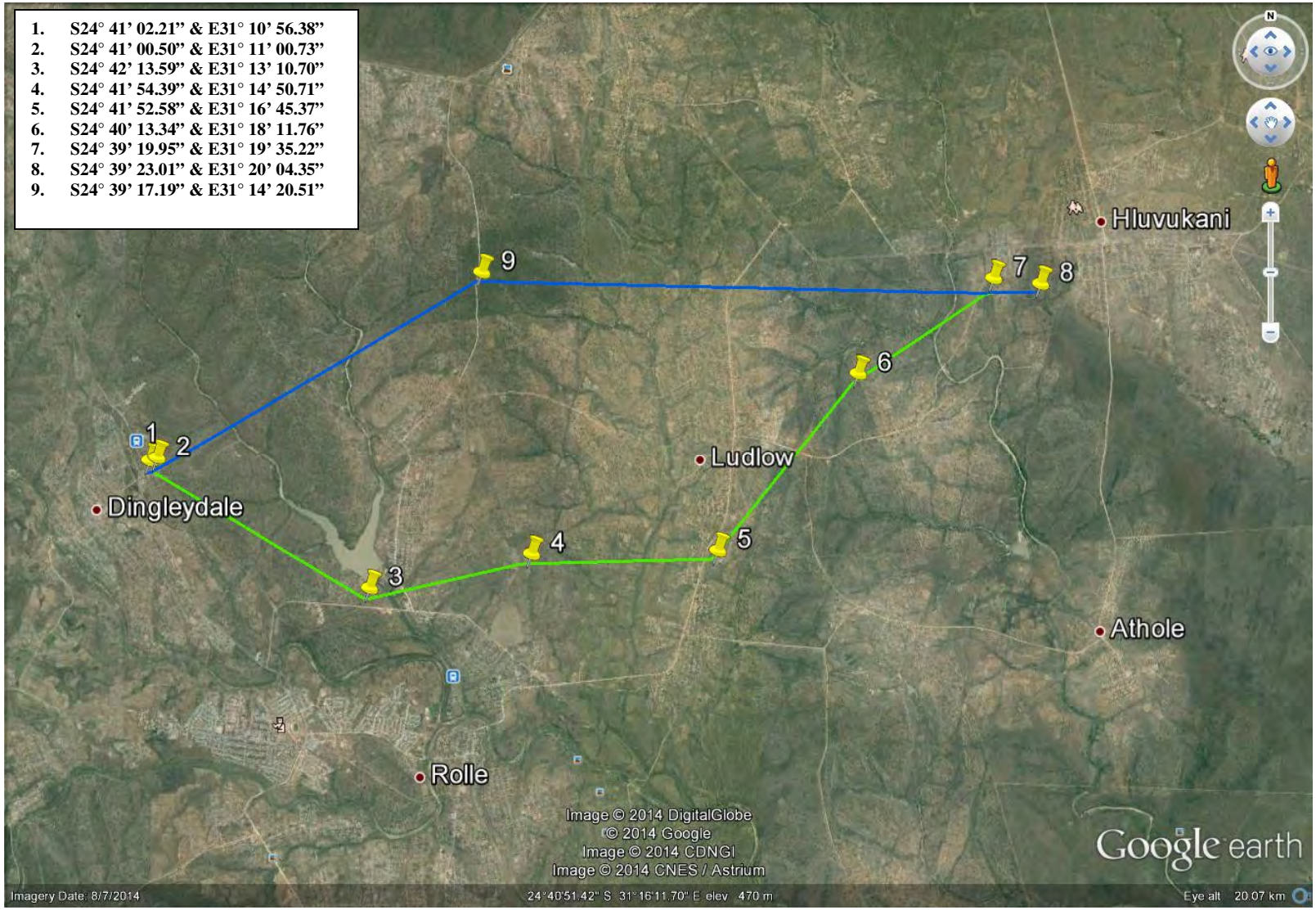
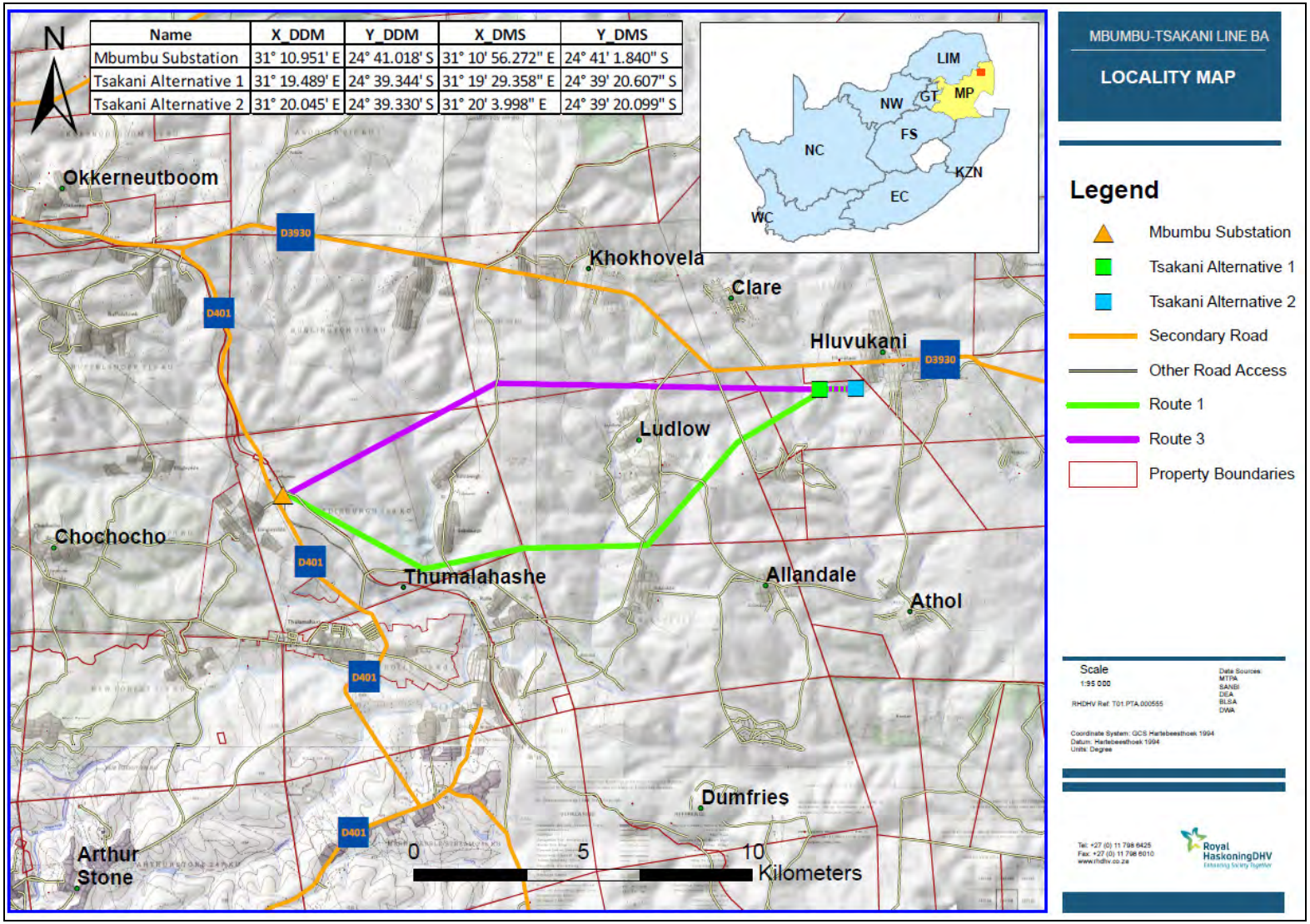

1. S24° 41’ 02.21” & E31° 10’ 56.38”
2. S24° 41’ 00.50” & E31° 11’ 00.73”
3. S24° 42’ 13.59” & E31° 13’ 10.70”
4. S24° 41’ 54.39” & E31° 14’ 50.71”
5. S24° 41’ 52.58” & E31° 16’ 45.37”
6. S24° 40’ 13.34” & E31° 18’ 11.76”
7. S24° 39’ 19.95” & E31° 19’ 35.22”
8. S24° 39’ 23.01” & E31° 20’ 04.35”
9. S24° 39’ 17.19” & E31° 14’ 20.51”
Hluvukani
Ludlow
Dingleydale
Athole
Rolle
Image © 2014 DigitalGlobe
© 2014 Google
Image © 2014 CDNGI
Image © 2014 CNES / Astrium
Google earth
Imagery Date: 8/7/2014
24°40'51.42" S 31°16'11.70" E elev 470 m
Eye alt 20.07 km


N
Name | X_DDM | Y_DDM | X_DMS | Y_DMS
Mbumbu Substation | 31° 10.951' E | 24° 41.018' S | 31° 10' 56.272" E | 24° 41' 1.840" S
Tsakani Alternative 1 | 31° 19.489' E | 24° 39.344' S | 31° 19' 29.358" E | 24° 39' 20.607" S
Tsakani Alternative 2 | 31° 20.045' E | 24° 39.330' S | 31° 20' 3.998" E | 24° 39' 20.099" S
LIM
NW
GT
MP
FS
NC
KZN
EC
WC
Okkerneutboom
D3930
D401
Khokhovela
Clare
Hluvukani
D3930
Ludlow
Chochocho
D401
Thumalahashe
Allandale
Athol
D401
Dumfries
D401
Arthur Stone
0
5
10
Kilometers
MBUMBU-TSAKANI LINE BA
LOCALITY MAP
Legend
Mbumbu Substation
Tsakani Alternative 1
Tsakani Alternative 2
Secondary Road
Other Road Access
Route 1
Route 3
Property Boundaries
Scale
1:95 000
RHDHV Ref: T01.PTA.000555
Data Sources:
MTPA
SANBI
DEA
BLSA
DWA
Coordinate System: GCS Hartebeesthoek 1994
Datum: Hartebeesthoek 1994
Units: Degree
Tel: +27 (0) 11 798 6425
Fax: +27 (0) 11 798 6010
www.rhdhv.co.za
Royal HaskoningDHV

Report for proposed Eskom 17 km Mbumbu-Tsakani 132 kV powerline

Bushbuckridge Local Municipality, Ehlanzeni District Municipality, Mpumalanga Province

Farms: Burlington 217KU (portion 0,1,2), Isligton 219KU (portion 0), Eglington 225KU (portion 5,6,8), Ludlow 227KU (portion 0,3), and Edinburg 228KU (portion 0,2).

Fourie, H. Dr heidicindy@yahoo.com

Palaeontological Desktop Impact Assessment: Exemption

Commissioned by: Royal Haskoning DHV

P.O. Box 25302, Monument Park, Pretoria, 0105

012 367 5916

2014/10/27

Ref:

B. Executive summary

Outline of the development project: Royal Haskoning DHV has appointed Dr H. Fourie, a palaeontologist, to undertake a Desktop Paleontological Impact Assessment as part of the Heritage Impact Assessment for –

Eskom Holdings SoC (Pty) Ltd proposes the feasibility of the construction of a new 17 km, 132 kV power line and substation in the Bushbuckridge Local Municipality, Ehlanzeni District Municipality, Mpumalanga Province. The development may entail the construction of pylons, footings and foundations. Several small towns are close by, Hluvukani, Edinburgh, Allandale and Ludlow. The power line will cross over the farms of Burlington 217KU (portion 0,1,2), Islington 219KU (portion 0), Eglington 225KU (portion 5,6,8), Ludlow 227KU (portion 0,3), and Edinburg 228KU (portion 0,2). The Tsakani substation is present on Eglington 225KU.

This project includes several Routes and Alternatives.
Route 1: Purple Route – From Mbumbu substation crossing over Edinburgh 228KU in a north-easterly direction over Burlington 217KU and Islington 219KU, over Ludlow 227KU and ending at the Tsakani Substation.
Route 2: Green Route – From Mbumbu substation crossing over Edinburgh 228KU in an easterly direction, it then turns north over Ludlow 227KU towards the Tsakani Substation.
Tsakani Substation Alternative 1: Close to the township of Hluvukani on Eglington 225KU.
Tsakani Substation Alternative 2: Closer to the township of Hluvukani.

The **National Heritage Resources Act 25 of 1999** requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. The Republic of South Africa (RSA) has aremarkably rich fossil record that stretches back in time for some 3.5 billion years and must be protected for its scientific value. Fossil heritage of national and international significance is found within all provinces of the RSA. South Africa's unique and non-renewable palaeontological heritage is protected in terms of the National Heritage Resources Act. According to this act, palaeontological resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

The main aim of the assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources.

This report prescribes to the Heritage Impact Assessment of Section 38 of the National Heritage Resources Act 25 of 1999.

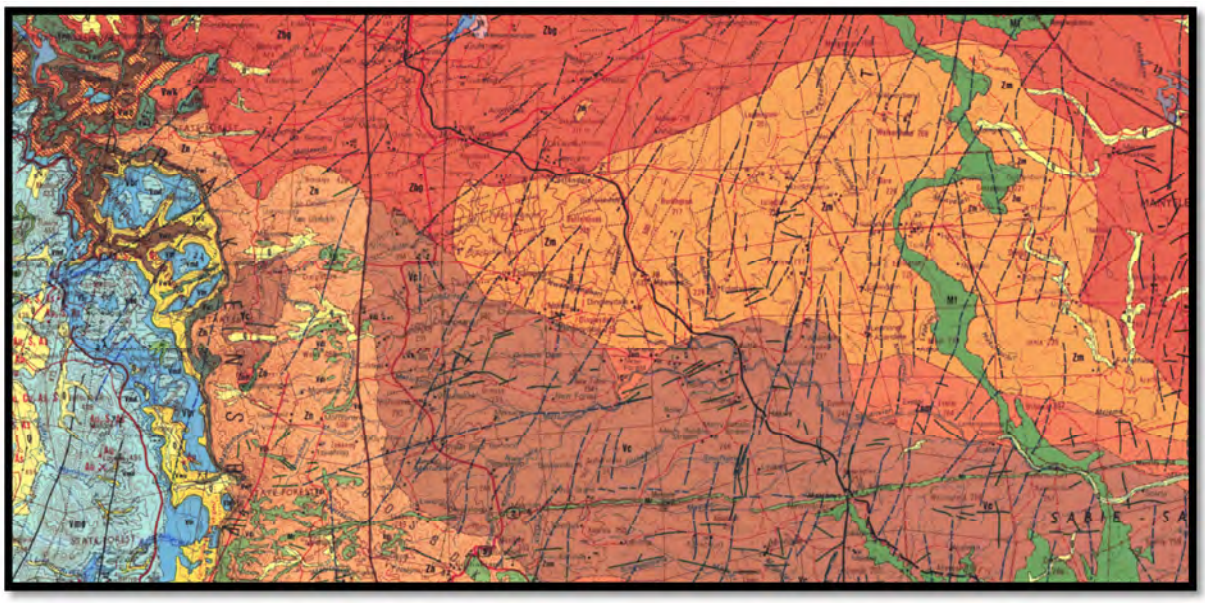
For this study, resources such as geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.

A Palaeontological Impact Assessment is generally warranted where rock units of LOW to VERY 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 area is unknown. The specialist will inform whether further monitoring and mitigation are necessary.

Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act, 1999 (No 25 of 1999):
(i) (i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.
Section 38, 1(b) requires the details of the construction of a bridge or similar structure exceeding 50m in length.

It is proposed to comment and recommend on the impact of the development on fossil heritage, and if mitigation or conservation is necessary.

Outline of the geology and the palaeontology:
The geology was obtained from the Geological Map of South Africa, 1:100 000 (Visser 1984) and 2430 Pilgrim's Rest 1:250 000 (Walraven 1986).



Legend to Map and short explanation (Walraven 1986).
Zm –Light-grey, medium-grained biotite gneiss with coarse-grained quartz-feldspar leucosones (orange), Makhutswi Gneiss (Randian).
Mt – Medium to coarse-grained gabbro, olivine gabbro and quartz gabbro (green), Timbavati gabbro (Mokolian).
-------- - Lineament (possible dyke).

Summary of findings: The desktop palaeontological impact assessment was undertaken during October 2014 and the following is reported:
The formations present are the Timbavati Gabbro (Mt) and the Makhutswi Gneiss (Zm).

The intrusives of the Randian age are granitoid bodies of the basement complex. The Makhutswi Gneiss is leucocratic migmatite and banded gneiss of granodioritic and tonalitic composition (Kent 1980).

The Kaapvaal Craton has its origin between 3500 and 3000 Ma. There are several complexes, volcanoes and plugs that are of known or assumed Mokolian age, one such intrusive is the Timbavati Gabbro. It is a dyke-like differentiated intrusion containing gabbro and olivine gabbro. The resting place is north-west of Satara, Kruger National Park and good exposures are found along the Timbavati River. Age is determined as 967±4 till 1123±13 Ma (Kent 1980).

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally LOW to VERY HIGH, but here locally INSIGNIFICANT OR ZERO for the Makhutswi Gneiss.

Recommendation: The impact of the development on fossil heritage is INSIGNIFICANT OR ZERO and therefore mitigation or conservation measures are not necessary for this development. A Phase 1 Palaeontological Assessment is not recommended. The topsoil, subsoil, overburden, inter-burden and bedrock do not need to be surveyed for fossiliferous outcrops, but care must be taken during the digging of foundations when intruding underlying formations.

This project includes several Routes and Alternatives:
Route 1: Purple Route – From Mbumbu substation crossing over Edinburgh 228KU in a north-easterly direction over Burlington 217KU and Islington 219KU, over Ludlow 227KU and ending at the Tsakani Substation.

Route 2: Green Route – From Mbumbu substation crossing over Edinburgh 228KU in an easterly direction, it then turns north over Ludlow 227KU towards the Tsakani Substation.
Tsakani Substation Alternative 1: Close to the township of Hluvukani on Eglington 225KU.
Tsakani Substation Alternative 2: Closer to the township of Hluvukani.

Stakeholders: Developer – Eskom Holdings SoC (Pty) Ltd, 28 c/o vd Merwe and Ferreira Street, Nelspruit, 1200. Tel 013 755 9655 .
Environmental – Royal Haskoning DHV, P.O. Box 25302, Monument Park, 0105. Tel 012 367 5916.

C Table of Contents

D. Background information on the project

Report This report is part of the environmental impact assessment process under the NEMA (National Environmental Management Act) [as amended].

Outline of development

Eskom Holdings SoC (Pty) Ltd proposes the feasibility of the construction of a new 17 km, 132 kV power line and substation in the Bushbuckridge Local Municipality, Ehlanzeni District Municipality, Mpumalanga Province. The development may entail the construction of pylons, footings and foundations. The power line will cross over the farms of Burlington 217KU (portion 0,1,2), Islington 219KU (portion 0), Eglington 225KU (portion 5,6,8), Ludlow 227KU (portion 0,3), and Edinburg 228KU (portion 0,2).

This project includes several Options and Alternatives:
Route 1: Purple Route – From Mbumbu substation crossing over Edinburgh 228KU in a north-easterly direction over Burlington 217KU and Islington 219KU, over Ludlow 227KU and ending at the Tsakani Substation.
Route 2: Green Route – From Mbumbu substation crossing over Edinburgh 228KU in an easterly direction, then it turns north over Ludlow 227KU towards the Tsakani Substation.
Tsakani Substation Alternative 1: Close to the township of Hluvukani on Eglington 225KU.
Tsakani Substation Alternative 2: Closer to the township of Hluvukani.

Google.earth map, elevation 1696 ft. (Provided by Royal Haskoning DHV).

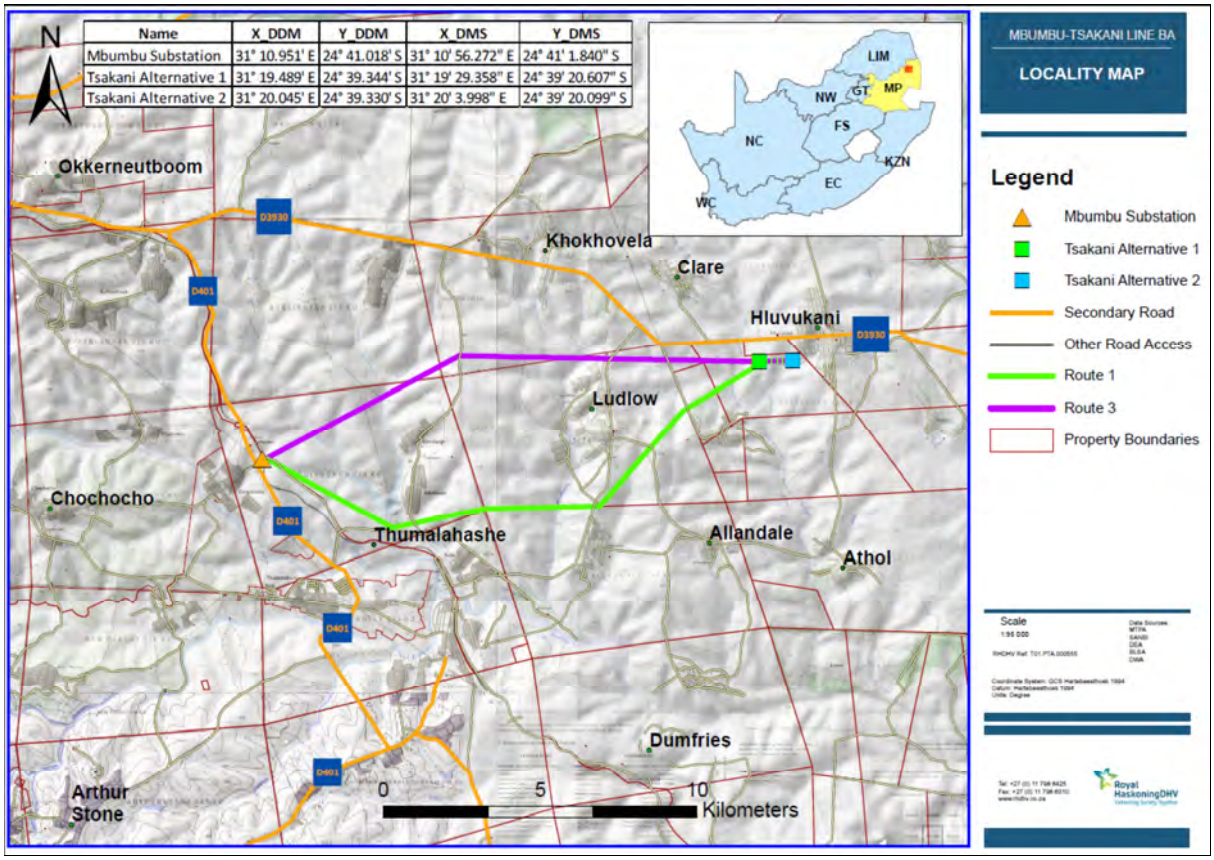
Rezoning/ and or subdivision of land: Servitude will be acquired by Eskom.
Name of developer and consultant: Royal Haskoning DHV and Eskom Holdings SoC (Pty) Ltd.
Terms of reference: Dr H. Fourie is a palaeontologist commissioned to do a desktop palaeontological impact assessment to ascertain if any palaeontological sensitive material is present in the development area. This study will advise on the impact on fossil heritage mitigation or conservation necessary, if any.
Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research, University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. For the past nine years she carried out field work in the Eastern Cape Province and Mpumalanga Province. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 20 years.
Legislative requirements: South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act no: 25 of 1999. An electronic copy of this report must be supplied to SAHRA/PHRA.

E. Description of property or affected environment
Location and depth:
The development may entail the construction of pylons, footings and foundations. Towns close by are Hluvukani, Edinburgh, Allandale, Rolle and Ludlow.

Eskom Holdings SoC (Pty) Ltd proposes the feasibility of the construction of a new 17 km, 132 kV power line and substation in the Bushbuckridge Local Municipality, Ehlanzeni District Municipality, Mpumalanga Province. The development may entail the construction of pylons, footings and foundations. The power line will cross over the farms of Burlington 217KU (portion 0,1,2), Islington 219KU (portion 0), Eglington 225KU (portion 5,6,8), Ludlow 227KU (portion 0,3), and Edinburg 228KU (portion 0,2).

There are signs of rural development. Depth of footings and foundations are determined by the structures to be planted or constructed.

Topocadastral Map (Provided by Royal Haskoning DHV).



F. Description of the Geological Setting

Description of the rock units:

The development is taking place in an area covered by the Timbavati Gabbro and the Makhutswi Gneiss.

The intrusives of the Randian age are granitoid bodies of the basement complex. The Makhutswi Gneiss is leucocratic migmatite and banded gneiss of granodioritic and tonalitic composition (Kent 1980). A gneiss is a metamorphic rock containing quartz, feldspar, mica, and rarer dark minerals.

The Kaapvaal Craton has its origin between 3500 and 3000 Ma. There are several complexes, volcanoes and plugs that are of known or assumed Mokolian age, one such intrusive is the Timbavati Gabbro. It is a dyke-like differentiated intrusion containing gabbro and olivine gabbro. The resting place is north-west of Satara, Kruger National Park and good exposures are found along the Timbavati River. Age is determined as 967±4 till 1454±59 Ma (Kent 1980). Low ridges present in the southwestern portion of the Kruger National Park are composed of neatly piled boulders of dark grey to black rock. They are in fact dykes, formed by basaltic magma about 1,100 million years ago. They represent a significant event in the history of the Kaapvaal-Zimbabwe Craton (McCarthy and Rubidge 2005). A gabbro is a mafic igneous rock that is dark coloured, containing abundant dark minerals plus feldspar.

This project includes several Options and Alternatives:

Route 1: Purple Route – From Mbumbu substation crossing over Edinburgh 228KU in a north-easterly direction over Burlington 217KU and Islington 219KU, over Ludlow 227KU and ending at the Tsakani Substation.

Route 2: Green Route – From Mbumbu substation crossing over Edinburgh 228KU in an easterly direction, then it turns north over Ludlow 227KU towards the Tsakani Substation.

Tsakani Substation Alternative 1: Close to the township of Hluvukani on Eglington 225KU.

Tsakani Substation Alternative 2: Closer to the township of Hluvukani.

G. Background to Palaeontology of the area

Summary: When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a desktop and or field scoping (survey) study by a professional palaeontologist is usually warranted. The main purpose of a field scoping (survey) study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase may be required (SG 2.2 SAHRA AMPHOB 2012).

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally LOW to VERY HIGH, but here locally INSIGNIFICANT OR ZERO for the Makhutswi Gneiss.

Criteria used (Fossil Heritage Layer Browser/SAHRA):

Rock unit	Significance/vulnerability	Recommended action
Kaapvaal Craton	Insignificant or Zero	No palaeontological studies are required
Timbavati Gabbro	Insignificant or Zero	No palaeontological studies are required
Makhutswi Gneiss	Insignificant or Zero	No palaeontological studies are required

Databases and collections: Ditsong: National Museum of Natural History.

Impact: INSIGNIFICANT OR ZERO. There are no significant fossil resources that may be impacted by the development.

H. Description of the Methodology

The desktop palaeontological impact assessment scope was undertaken during October 2014.

Assumptions and Limitations:-

The accuracy and reliability of the report may be limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.

3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.
5. Lack of rocky outcrops.
6. A site visit was not conducted.
7. Insufficient data from developer and exact lay-out plan for all structures.

I. Description of significant fossil occurrences (Heritage value)

All Karoo Supergroup geological formations are ranked LOW to VERY HIGH, but here the impact is potentially INSIGNIFICANT OR ZERO for the Timbavati Gabbro and the Makhutswi Gneiss (Almond *et al.* 2013).

J. Recommendation

a. There is no objection to the development, and it is not necessary to request a Phase 1 Palaeontological Impact Assessment to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity is INSIGNIFICANT OR ZERO. A Phase 2 Palaeontological Mitigation will only be required if the Phase 1 Palaeontological Assessment finds fossiliferous outcrops. Exemption is given.
b. This project will benefit the economy, the growth of the community and social development in general.
c. Preferred choice: None, all the Options and Alternatives are possible as the impact is insignificant or zero.
d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling, or blasting or caves are found SAHRA/PHRA must be notified. All construction activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures.

Sampling and collecting:
Wherefore a permit is need from the South African Heritage Resources Agency (SAHRA).

a. Objections: None.
b. Conditions of development: See Recommendation.
c. Areas that may need a permit: No.
d. Permits for mitigation: Needed from SAHRA / PHRA - none.

K. Conclusions

a. All the land involved in the development was assessed and none of the property is unsuitable for development.
b. All information needed for the Desktop Palaeontological Impact Assessment scope was provided by the Consultant.
c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency are discussed.
d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures. Especially shallow caves.
e. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment and adjacent areas as well as for safety and security reasons.

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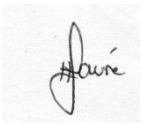
Declaration

I, Heidi Fourie, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project for which I was appointed to do a palaeontological scope. There are no circumstances that compromise the objectivity of me performing such work.

Heidi Fourie accepts no liability, and the client, by receiving this document, indemnifies Heidi Fourie against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the use of the information contained in this document.

This report may not be altered in any way and any parts drawn from this report must make reference to this report.



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Heidi Fourie
2014/10/27

APPENDIX D4

SOCIAL SURVEY

SOCIAL SURVEY

FOR

THE PROPOSED CONSTRUCTION OF TSAKANI SUBSTATION AND A 17KM 132KV POWER LINE FROM THE EXISTING MBUMBU SUBSTATION TO THE PROPOSED TSAKANI SUBSTATION AT BUSHBUCKRIDGE, MPUMALANGA PROVINCE

October 2014

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THE PROPOSED CONSTRUCTION OF TSAKANI SUBSTATION AND A 17KM 132KV POWER LINE FROM THE EXISTING MBUMBU SUBSTATION TO THE PROPOSED TSAKANI SUBSTATION AT BUSHBUCKRIDGE, MPUMALANGA PROVINCE

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Hilda Bezuidenhout
October 2014

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1. INTRODUCTION

Royal HaskoningDHV (RHDHV) requested that a Social Survey be conducted for the proposed construction of Tsakani substation and a 132kV power line from the existing Mbumbu substation to the proposed Tsakani substation. The site falls within the Bushbuckridge area in Mpumalanga. The Social Survey, together with other specialist studies, forms part of the Environmental Impact Assessment (Basic Assessment) process. EIA practitioners draw on inputs from a range of scientific disciplines, with the benefit of translating good theory into good practice (DEAT, 2002a). The applicant is Eskom Distribution (Northern Region) and the decision-making authority the National Department of Environmental Affairs.

1.1 Terms of reference

The issues raised in the EIA form the basis for the terms of reference of specialist studies (DEAT, 2002a).

The Social Survey provides a baseline description of the study area, specifically focussing on the communities living and working in close proximity to the proposed development. The extent to which the communities are informed about the proposed construction of the new substation and powerline, and their opinions about the project, will be reported on, as well as any issues which they would like to be addressed as part of the process. Recommendations will be made to enhance the current social environment and it is proposed that these recommendations be included as conditions, should a positive decision on whether the development can proceed, be made.

The process included the following:

- Confirmation of study area;
- Review of available secondary data (desktop study);
- Assessment of the data collected during the public participation exercises;
- Social and economic baseline description of the potentially impacted areas;
- Field work, consisting of administering surveys to a sample of the affected communities;
- Capturing, summarising and interpreting the data collected during the field work; and
- Recommending measures that will enhance the social environment, based on responses from participants.

1.2 Specialist details

This study was done by:

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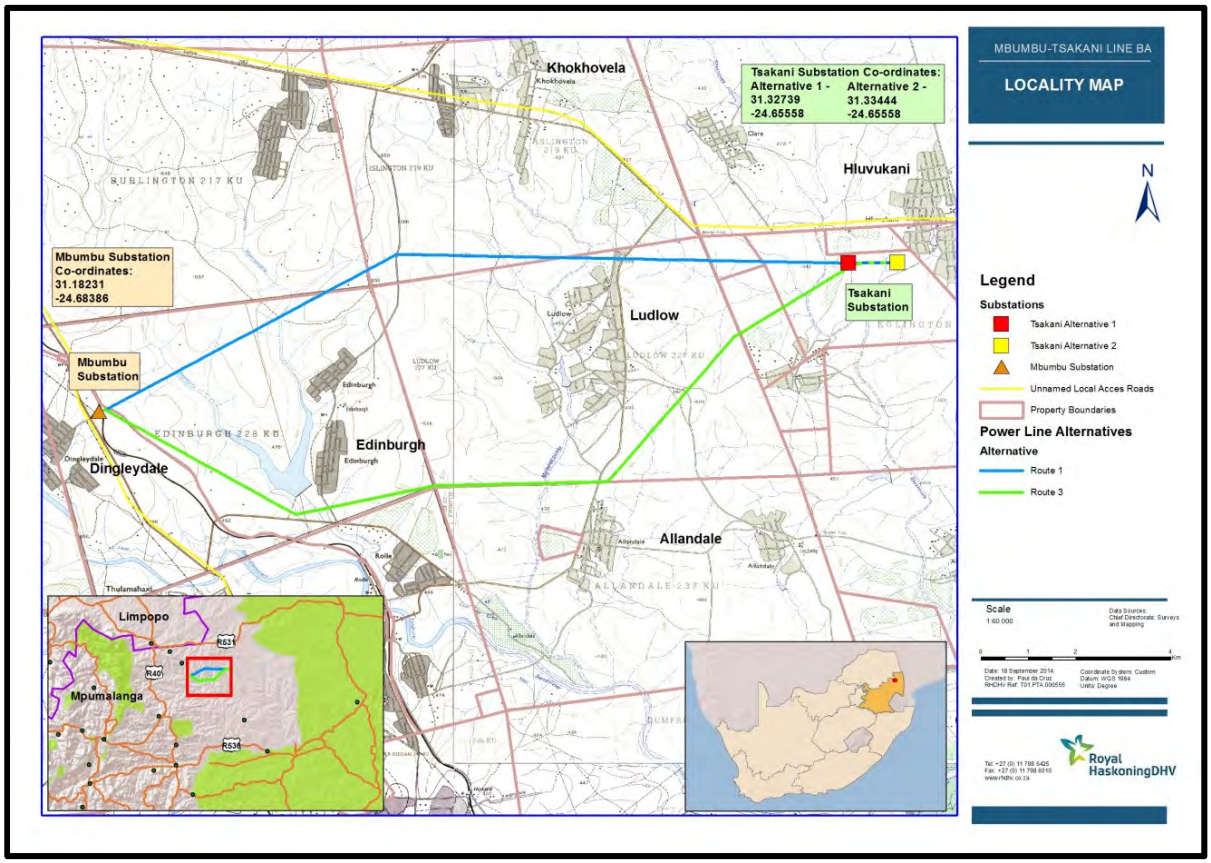
1.3 Assumptions and limitations

The following assumptions and limitations are applicable to this study:

- The study was based on present information available to the author.
- Maps that formed part of the Basic Assessment Process were drawn from.
- A sample of the population residing in the affected communities was interviewed as part of the data gathering exercise.
- Any data relating to the economic profile of the area was obtained from municipal sources, such as municipality/provincial websites, Integrated Development Plans (IDPs), Service Delivery and Budget Implementation Plans (SDBIPs) and census data.
- This report only applies to the proposed construction of the Tsakani substation and Mbumbu-Tsakani power line and will not be accurate for and applicable to similar infrastructure at other sites.

2. PROJECT DESCRIPTION AND BACKGROUND

Eskom Distribution (Northern Region) proposes the construction of a 17km 132kV overhead power line linking the existing Mbumbu substation and the new proposed Tsakani substation in the municipal area of Bushbuckridge, Mpumalanga Province. The nearest settlements to the proposed Tsakani substation and along the power line route are Hluvukani, Clare, Islington (also referred to as Khokhovela), Ludlow, Allandale and Edinburgh. The site falls within a rural area and access to most settlements is by means of dirt roads.



Source: RHDHV

Figure 1: Locality map

Two route alternatives for the power line have been identified by Eskom:

- Route alternative 1: green route (17.05km); and
- Route alternative 2: blue route (15.48km).

Two site alternatives for the proposed Tsakani substation have also been identified. Both site alternatives are located south-west of Hluvukani settlement on land belonging to the Mnisi and Amashangana Tribal Authorities. The two sites are vacant degraded bushveld. The proposed new substation will occupy an area of approximately 100mx150m (1.5ha). It is planned that construction commences in July 2015, taking place over a period of approximately 18 months.

3. CONDUCTING SOCIAL SURVEYS AS PART OF APPLICATIONS FOR NEW DEVELOPMENTS

3.1 Defining social surveys

According to Neuman (1997) social survey is a type of research design that produces quantitative information about the social world, as well as describes characteristics of people or the social world; in other words surveys explain and explore. It asks people about their beliefs, opinions, characteristics and behaviour and is the most widely used data gathering technique in social sciences. Respondents of social surveys are sampled and then asked to answer the same questions. Surveys can be administered in the following ways: mail and self-administered questionnaires, telephone interviews and face-to-face interviews.

3.2 Benefits of considering the social environment

Considering the social environment in which proposed developments will take place have numerous benefits:

- It enriches the decision-making process by potentially resulting in a different, better informed decision than the one that would otherwise have been made.
- Decision-making criteria are applied consistently.
- A more holistic view of developments and their impacts are obtained.
- Provision of recommendations to positively affect or enhance the social environment, which ideally are included as conditions for issuing an authorisation, and thereby ultimately enforced.
- Promotion of transparency and accountability in all applications for new developments.
- Social learning by developers, planners, decision-makers and the community, resulting in successful implementation of projects.
- Contributing to sustainability because development is more successful and sustainable if it has the "buy-in" of the communities that are affected by it.

3.3 Legal mandate to address social issues in Environmental Impact Assessment

3.3.1 Constitution of the Republic of South Africa

Aucamp (2009a) writes that there is a clear mandate in the Constitution of the Republic of South Africa (Act 108 of 1996) to include social issues in the EIA process. The Bill of Rights in the Constitution states:

Everyone has the right –

- to an environment that is not harmful to their health and wellbeing; and
- to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
    - prevent pollution;

- promote conservation; and
- secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

3.3.2 National Environmental Management Act

The National Environmental Management Act (Act 107 of 1998) (NEMA) states that, whereas many inhabitants of South Africa live in an environment that is harmful to their health and well-being, the following (relating to the social environment) are acknowledged.

- Everyone has the right to an environment that is not harmful to his or her health or well-being.
- The State must respect, protect, promote and fulfil the *social*, economic and environmental rights of everyone and strive to meet the basic needs of previously disadvantaged communities.
- Inequality in the distribution of wealth and resources, and the resultant poverty, are among the important causes as well as the results of environmentally harmful practices.
- Sustainable development requires the integration of *social*, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations.
- Everyone has the right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -
  - prevent pollution and ecological degradation;
  - promote conservation; and
  - secure ecologically sustainable development and use of natural resources while promoting justifiable economic and *social* development.

Aucamp (2009b) lists environmental principles that must be adhered to in all Acts pertaining to the environment. The following NEMA principles listed refer directly to the human/social environment.

- Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.
- Development must be socially, environmentally and economically sustainable.
- Environmental justice must be pursued as to not unfairly discriminate unfairly discriminate against any person, particularly vulnerable and disadvantaged persons.
- Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing must be pursued.
- Decisions must take into account the interests, needs and values of all interested and affected parties, including all forms of traditional and ordinary knowledge.
- The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.

Section 24 of NEMA states that the potential impact on the environment, *socio-economic conditions* and cultural heritage of activities that require authorisation must be considered, investigated and assessed prior to implementation, in order to give effect to the general objectives of integrated environmental management.

3.3.3 Environmental Impact Assessment Regulations

According to Regulation 7 (1) of the Environmental Impact Assessment (EIA) Regulations that were passed in terms of Chapter 5 of NEMA in June 2010 the decision-making authority is entitled to all information that has or may have the potential of influencing any decision with regard to an application. It can be argued that, since social impacts have the potential of influencing the authority's decision, as much information on potential social impacts as practicably possible should be supplied to the decision-making authority as part of the application (Bezuidenhout, 2009).

The EIA Regulations also prescribe the content of both Basic Assessment Reports and Environmental Impact Assessment Reports and include the following features applicable to social impacts.

- A description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, *social*, economic and cultural aspects of the environment may be affected by the proposed activity (Content of Basic Assessment Reports: Regulation 22 (2)(d) and Environmental Impact Assessment Reports: Regulation 31 (2)(d)).
- A description of identified alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives will have on the environment and *the community that may be affected by the activity* (Content of Basic Assessment Reports: Regulation 22 (2)(h) and Environmental Impact Assessment Reports: Regulation 31 (2)(g)).

It is clear from the above that, although there are no explicit requirements for conducting comprehensive SIAs in NEMA or the EIA Regulations, environmental and social interests should be considered equally important (Bezuidenhout, 2009).

This, however, is not commonly applied in practice, often due to time and cost constraints associated with conducting specialist social impact studies as part of the EIA application process. Field (2006) poses the question: "If EIA processes do not consider the three E's (environment, economy and equity) in an integrated fashion, where does this take place and who is responsible? The NEMA is unambiguous in requiring that development should be economically, socially and environmentally sustainable and that a consideration of these aspects *must* be integrated".

3.4 Link between environmental impacts and social impacts

According to the ICGP (1994) there are a number of resemblances between environmental impacts and social impacts. Just as EIAs focus its attention on threatened or endangered plant and wildlife species, studies relating to the social environment must devote particular attention to the impacts

on vulnerable segments of the human population, such as the poor, the elderly, the unemployed, minority groups and women. Just like ecosystems that are deemed sensitive, are protected from change that is harmful, the population should be protected from activities that will be harmful to them, based on meanings and social significance assigned to the particular change. It further states that persons not familiar with the social sciences are often tempted to treat social constructions as mere perceptions or emotions, instead of reality. During controversial projects, parties are often tempted to dismiss the concerns of others as being merely imagined or perceived.

There are, however, two important reasons not to omit such concerns from EIAs and associated social studies, regardless of whether the views are widely accepted internally or come from critics: "First, positions taken by all sides in a given controversy are likely to be shaped by (differing) perceptions of the policy or project, and the decision to accept one set of perceptions while excluding another, may not be scientifically defensible. Second, if the agency asserts that its critics are 'emotional' or 'misinformed', for example, it is guaranteed to raise the level of hostility between itself and community members and will stand in the way of a successful resolution of the problem" (ICGP, 1994).

3.5 Social variables

Different types of social variables exist. These variables can almost be used as a 'check-list' when identifying potential social impacts of a proposed development.

Vanclay (cited in DEAT, 2006) identified categories of social variables that can be used as a guideline to ensure that all potential impacts are considered.

Table 1: Categories of social variables

Health and social well-being	Death; nutrition; actual health and fertility; perceived health; mental health; aspirations for future; autonomy; stigmatization; feelings in relation to the project
Quality of the living environment	Physical quality – exposure to noise, dust, risk, odour etc.; leisure and recreation opportunities; aesthetic quality; availability of housing; quality of housing; physical and social infrastructure; personal safety and hazard exposure; crime and violence
Economic impacts and material well-being	Workload; standard of living; economic prosperity and resilience; income; property values; employment; replacement cost of environmental functions; economic dependency
Cultural impacts	Change in cultural values; violation of culture; experience of being culturally marginalized; commercial exploitation of culture; loss of local language; loss of natural and cultural heritage
Family and community impacts	Alterations in family structure; obligations to family/ancestors; family violence; social networks – interaction with others in community; community connection – sense of belonging; community cohesion; social

	differentiation and inequity; social tension and violence
Institutional, legal, political and equity impacts	Capacity of government agency to handle workload generated by project; integrity of government agencies – absence of corruption and competence of agency; legal rights; human rights; participation in decision making; access to legal advice; fairness of distribution of impacts across community
Gender relations	Women's physical integrity – can decide about own body; personal autonomy of women – independence in all aspects; gendered division of labour – income, household, childbearing and rearing of children; access to resources and facilities; political emancipation of women

Source: DEAT, 2006

In addition, the Interorganizational Committee on Guidelines and Principles for SIA (2003) provides a list of social variables that must be investigated when conducting socio-economic impacts assessments.

Table 2: ICGP list of social variables

Population change	Population size, density and change; influx and outflow of temporary workers; presence of seasonal (leisure) residents; relocation of individuals or families; racial and ethnic composition and distribution
Community/ Institutional arrangements	Voluntary associations; interest group activity; size and structure of local government; industrial/commercial diversification; employment/income characteristics; local/regional/ national linkages; employment equity of disadvantaged groups; historical experience of change
Political and social resources	Distribution of power and authority; inter-organisational cooperation; conflict between newcomers and long term residents; identification of stakeholders; interested and affected parties; leadership capability and characteristics
Individual and family level impacts	Displacement/relocation concerns; trust in political and social institutions; residential stability; family and friendship networks; density of acquaintanceships; perceptions of risk, health and safety; attitudes towards the proposed action; concerns about social well-being
Community resources	Change in community infrastructure; indigenous populations; changing land use patterns; family and friendship networks; effects on known cultural, historical, sacred and archaeological resources

Source: ICGP, 2003

These variables should be used in all four project stages, which will be discussed in detail in the next section.

3.6 Project stages

There are four stages in the project cycle, namely planning, construction/implementation, operation/maintenance and decommissioning. Social impacts will be different for each stage and not all social impacts will occur at each stage (ICGP, 1994).

The ICGP (1994) developed a matrix to demonstrate how social impacts occur in each stage and to assist in identifying all those impacts, using the list of social variables they compiled.

Table 3: Matrix relating project stage to social variables

Social variables	Planning	Construction/ implementation	Operation/ maintenance	Decommissioning
Population change: population size, density and change; influx and outflow of temporary workers; presence of seasonal (leisure) residents; relocation of individuals or families; racial and ethnic composition and distribution				
Community/ Institutional arrangements: voluntary associations; interest group activity; size and structure of local government; industrial/ commercial diversification; employment/ income characteristics; local/regional/ national linkages; employment equity of disadvantaged groups; historical experience of change				
Political and social resources: distribution of power and authority; inter-organisational cooperation; conflict between newcomers and long term residents; identification of stakeholders; interested and affected parties; leadership capability and characteristics				
Individual and family level impacts: displacement/ relocation concerns; trust in political and social institutions; residential stability; family and friendship networks; density of acquaintanceships; perceptions of risk, health and safety; attitudes towards the proposed action; concerns about social well-being				
Community resources: change in community infrastructure; indigenous populations; changing land use patterns; family and friendship networks; effects on known cultural, historical, sacred and archaeological resources				

Source: ICGP, 1994

4. SOCIAL BASELINE OF THE STUDY AREA

The most common source of quantitative data in social surveys is census data, which is used to produce demographic profiles. It is commonly used to provide baseline information. Other sources include Integrated Development Plans (IDPs), Spatial Development Frameworks (SDFs), Service Delivery and Budget Implementation Plans (SDBIPs) and Employment, Growth and Development Plans (EGDPs).

Baseline conditions are the existing conditions and past trends associated with the human environment in which the proposed activity is to take place (DEAT, 2006).

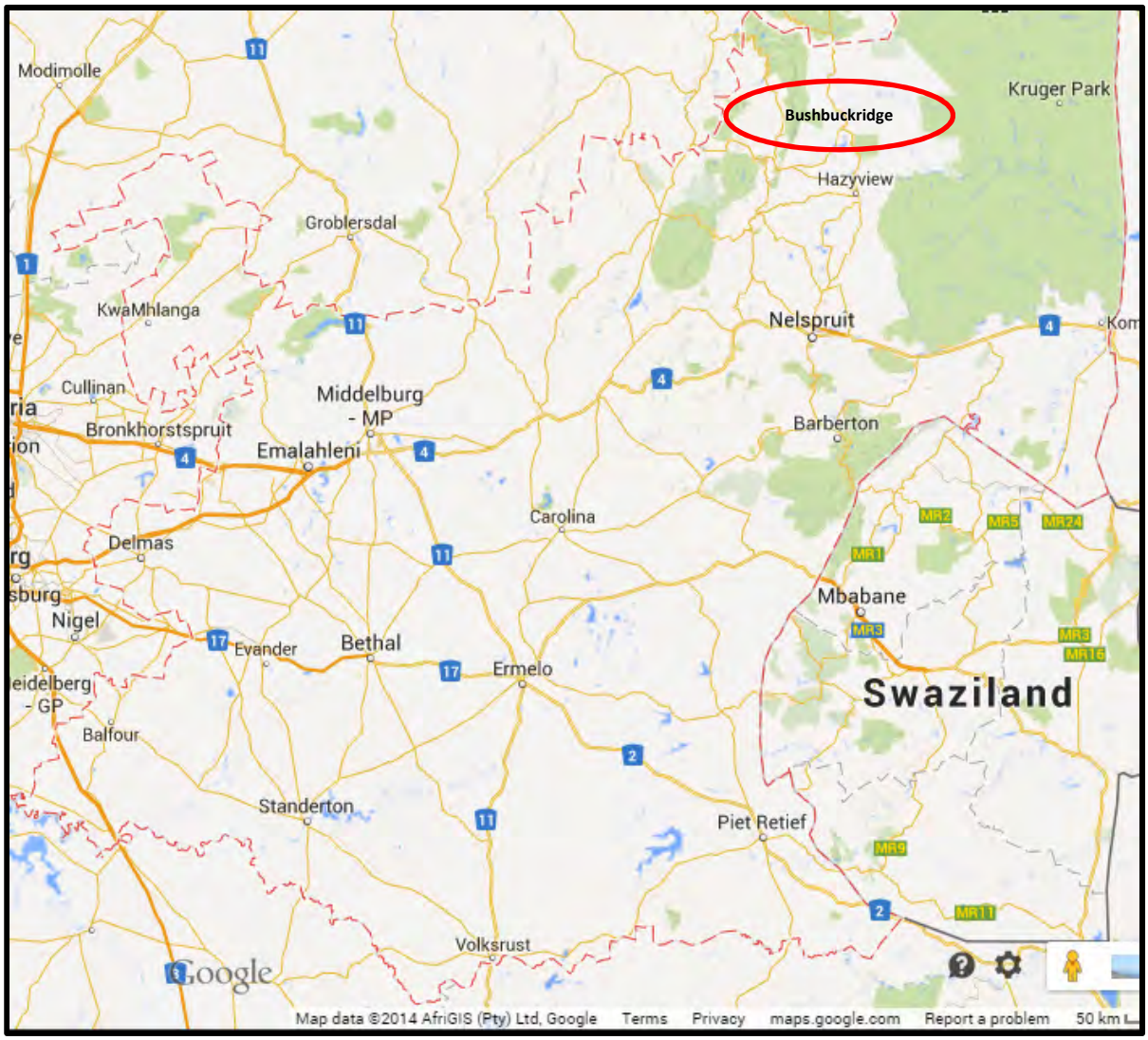
Establishing the baseline conditions is essential for describing the receiving environment, the *status quo* and for identifying and predicting potential impacts.

The baseline conditions pertaining to the proposed construction of the proposed Tsakani substation and Mbumbu-Tsakani power line will be discussed in the context of the province (Mpumalanga), district (Ehlanzeni) and local municipality (Bushbuckridge).

4.1 Provincial level – Mpumalanga Province

4.1.1 Mpumalanga background information

Mpumalanga (which means 'place where the sun rises') is the second smallest province in the country (after Gauteng) but has the fourth-largest economy in South Africa. The capital is Nelspruit (Mbombela). The province is bordered by Mozambique and Swaziland in the east and Gauteng in the west. Its landscape is characterised by high plateau grasslands in the west and the low-lying area known as the Lowveld in the east. The Lowveld is a popular tourist destination, with the Kruger National Park, Pilgrim's Rest, Barberton, Sabie, Graskop and various privately owned game reserves the main attractions. The Maputo Corridor, which links Maputo in Mozambique with Gauteng Province, runs through Mpumalanga and enables economic growth and development in the region. Important towns in the Highveld region of Mpumalanga include Witbank, Middelburg, Standerton, Secunda and Piet Retief (Mpumalanga Province).



Source: Google Maps

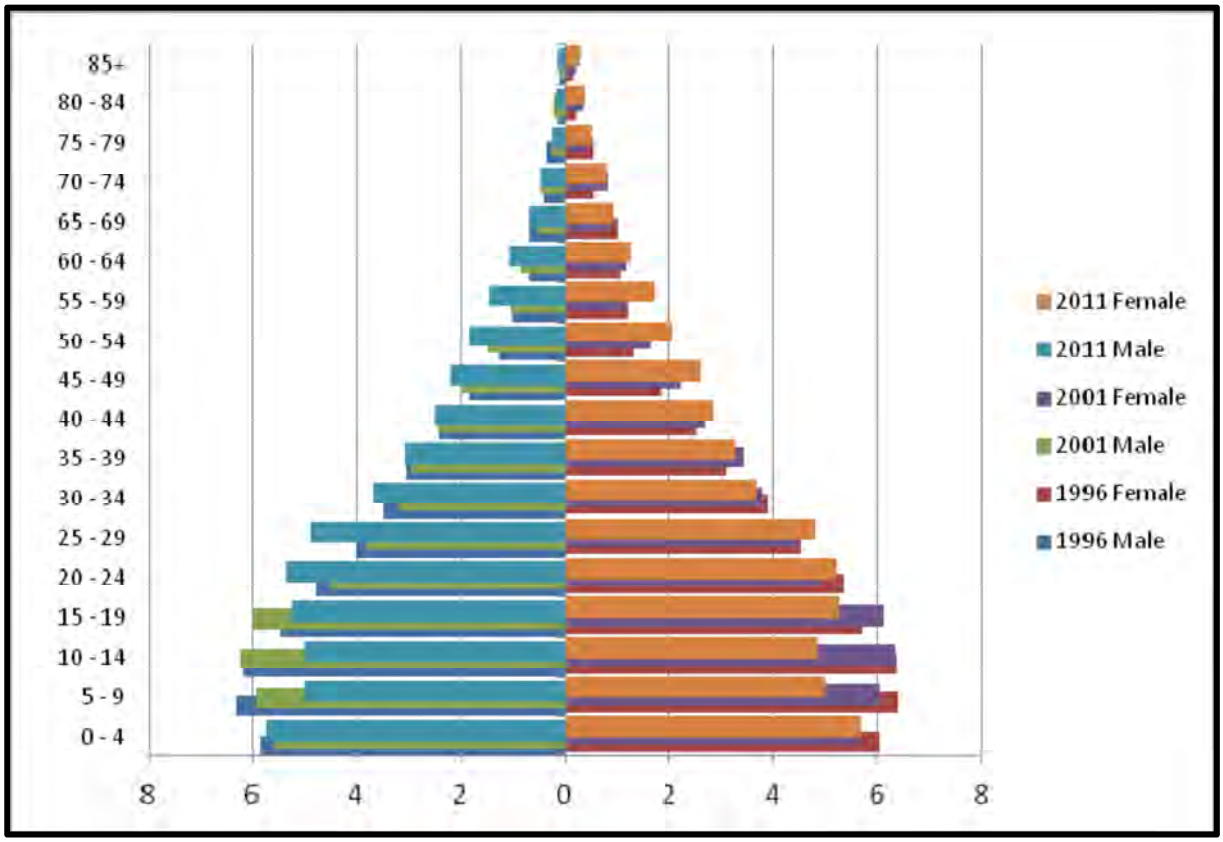
Figure 2: Mpumalanga, South Africa

The main industries in Mpumalanga Province are agriculture (citrus, mangoes, avocadoes, litchis, bananas, granadillas, guavas, nuts, cotton, tobacco, wheat, potatoes, sunflowers, maize and sheep), manufacturing (especially the large petrochemical industries such as Sasol II and III, chrome, alloy and steel), forestry, electricity generation and coal mining. Three of the southern hemisphere's largest power stations are located in Mpumalanga, and coal produced in the province feed these power stations (Mpumalanga Province).

Unemployment figures are very high in the province (see section on Demographics) and Economic Development (including job creation) has been identified as the first of six areas that should be focused on in the province's Growth and Development Strategy. The second Key Priority Area is Development Infrastructure (including electricity networks) (Mpumalanga Province).

4.1.2 Demographics

Figure 3 shows that the population of Mpumalanga is still young; the majority of the population is aged below 35 years.



Source: Census 2011 Municipal report – Mpumalanga

Figure 3: Distribution of population by age and sex, Mpumalanga - 1996, 2001 and 2011

4.2 District level – Ehlanzeni District

4.2.1 Ehlanzeni background information

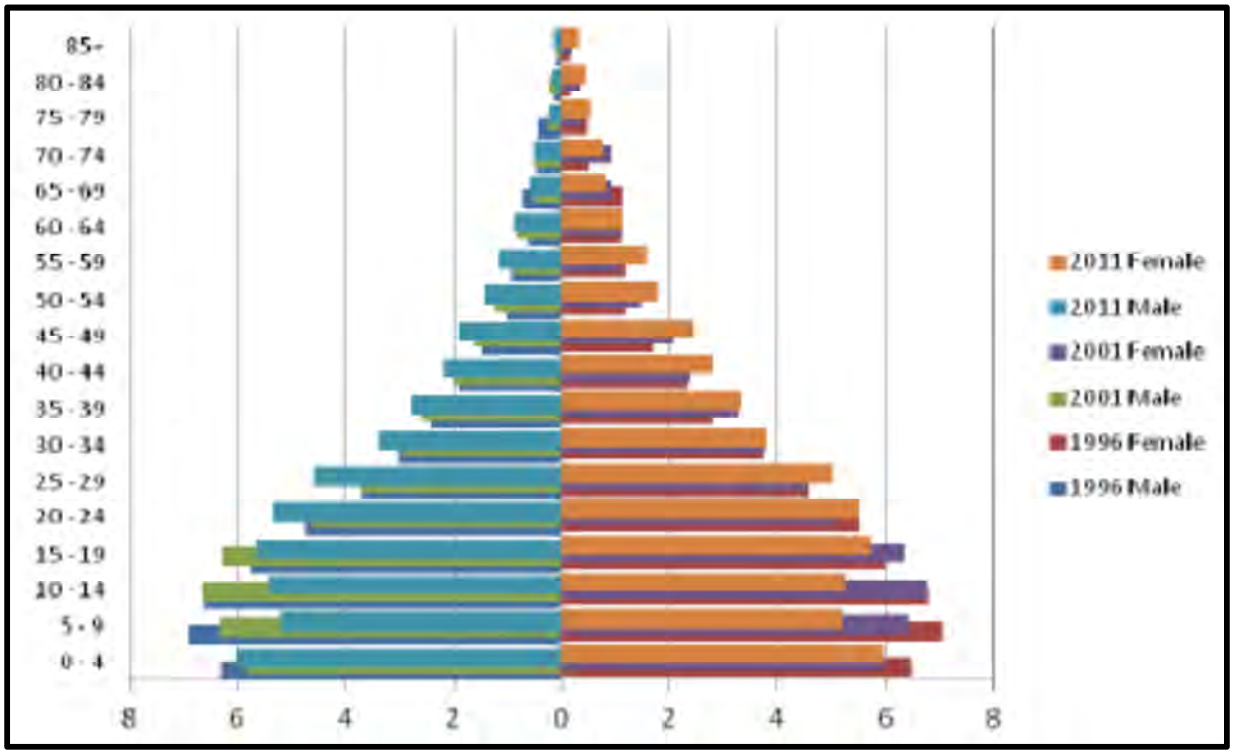
Ehlanzeni District Municipality is one of three district municipalities in Mpumalanga Province. It comprises five local municipalities, namely Nelspruit (Mbombela), Umjindi, Bushbuckridge, Nkomazi and Thaba Chweu. Nelspruit is the capital of Mpumalanga and home to the Mpumalanga Provincial Government. As a result it is the most concentrated economic hub within the province.

Cities and towns include Bushbuckridge, Barberton, Emoyeni, Entokozweni, Graskop, Hazyview, Kaapschehoop, Kabokweni, Kanyamazane, Komatipoort, Luphisi, Lydenburg, Malelane, Marloth Park, Matsulu, Nelspruit, Mpakeni, Msogwaba, Ngodwana, Pilgrimsrest, Sabie, Sabie Park, Skukuza,

Tekwane and White River. The main economic sectors in the district are mining, agriculture, textiles, tourism and hospitality (Ehlanzeni District Municipality).

4.2.2 Demographics

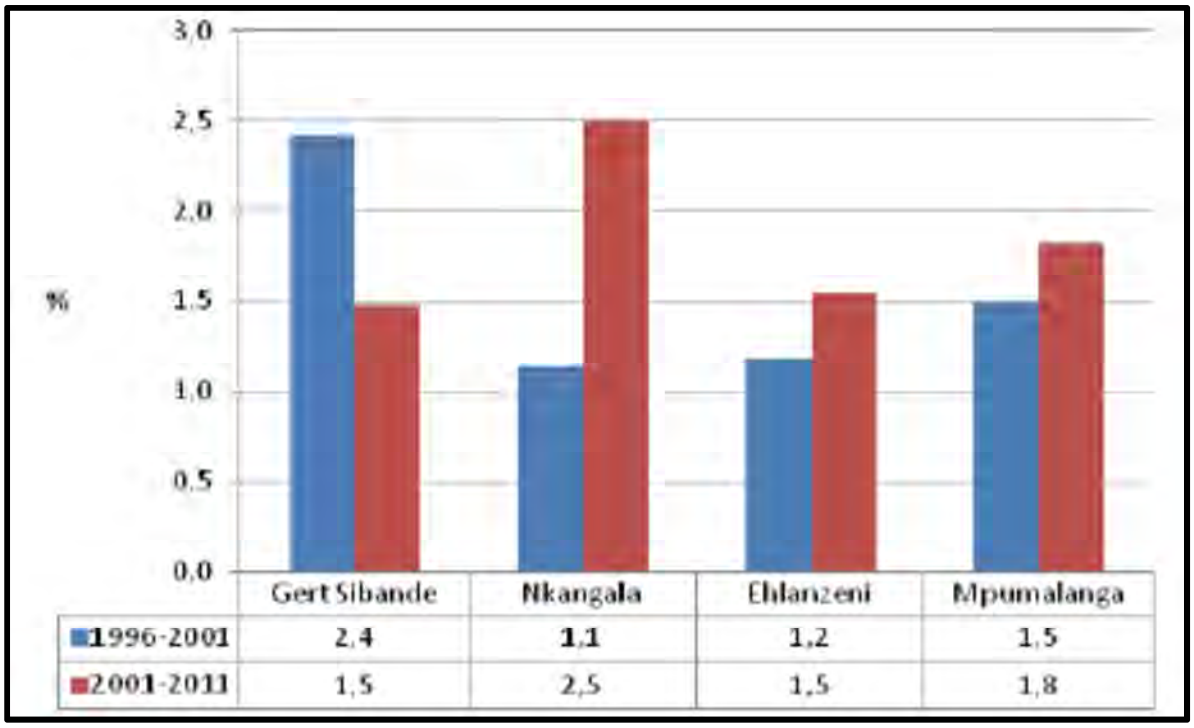
The distribution of Ehlanzeni district's population by age and sex is very similar to that of the province as a whole, with the majority of the population aged below 35 years.



Source: Census 2011 Municipal report – Mpumalanga

Figure 4: Distribution of population by age and sex, Ehlanzeni – 1996, 2001 and 2011

Figure 5 shows that the province has experienced a slow growth in population. For the periods 1996-2001 and 2001-2011, the provincial population is estimated to have grown by 1.5% and 1.8% respectively. A similar growth pattern is also seen in Ehlanzeni District.

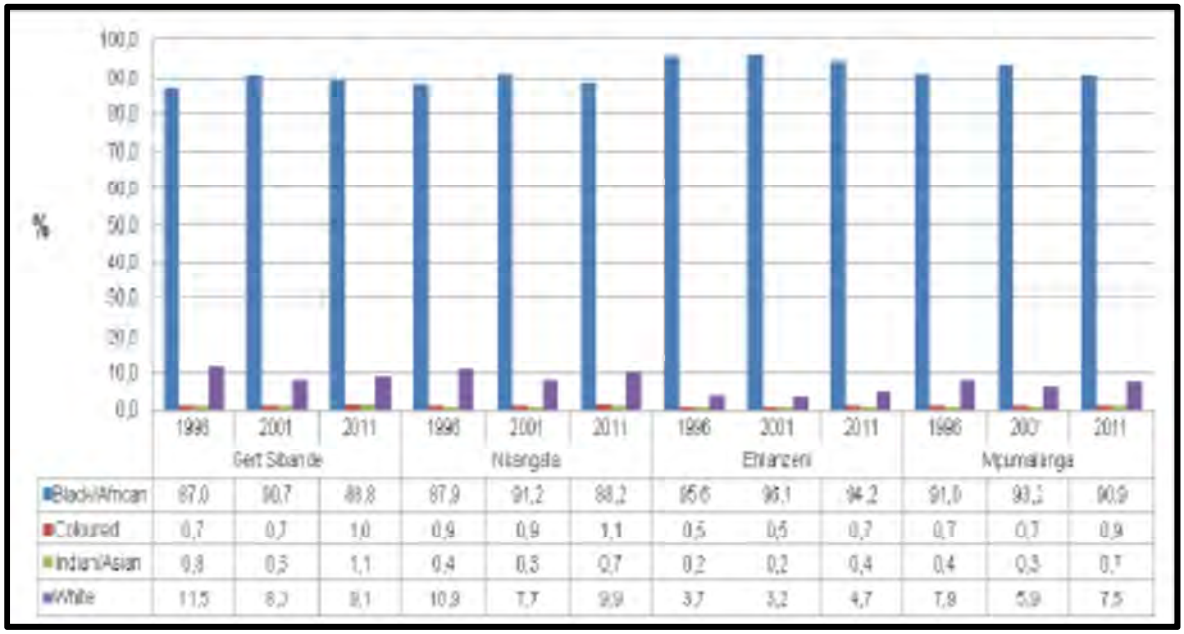


	Gert Sibande	Nkangala	Ehlanzeni	Mpumalanga
1996-2001	2,4	1,1	1,2	1,5
2001-2011	1,5	2,5	1,5	1,8

Source: Census 2011 Municipal report – Mpumalanga

Figure 5: Population growth rates by district municipality – 1996, 2001 and 2011

Figure 6 mirrors the population group composition of the country, with the majority being Black African, with Coloured and Indian/Asian population groups constituting the lowest percentage. 90.9% of the population in Mpumalanga were Black African in 2011, with Ehlanzeni district consistently having the highest concentration of Black Africans compared to the other districts. However, it has the lowest concentration of White population compared to the rest of the province (4.7%). A marginal increase has been seen in the proportion of the Indians/Asian population in the province.

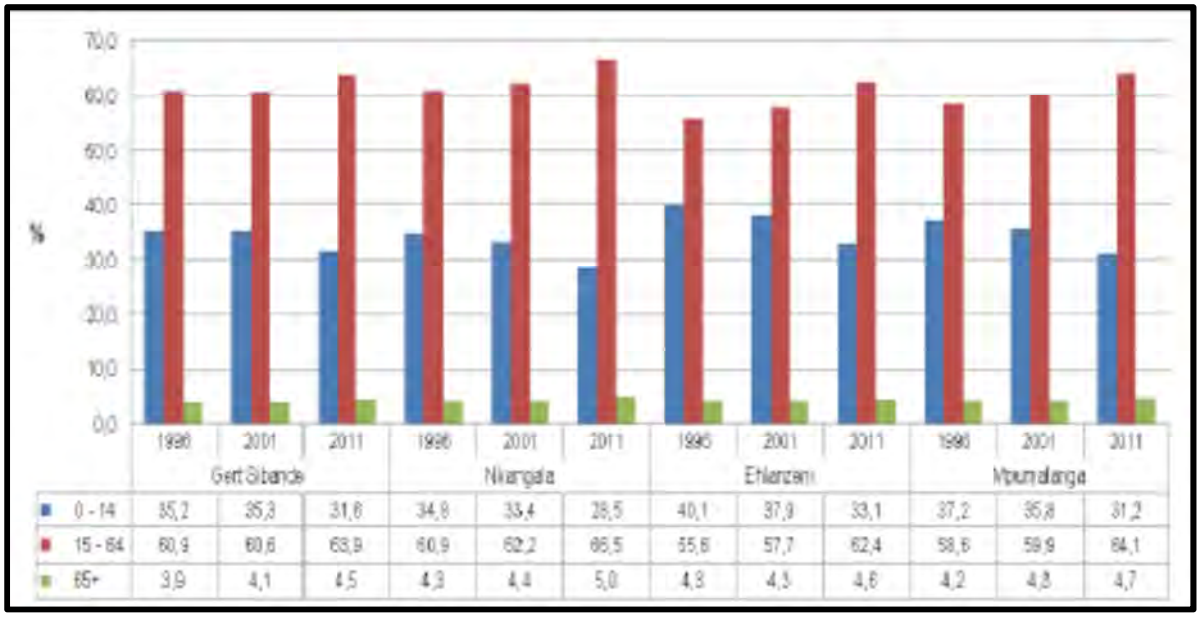


	1996	2001	2011	1996	2001	2011	1996	2001	2011	1996	2001	2011
	Gert Sibande			Nkangala			Ehlanzeni			Mpumalanga		
Black/African	87,0	90,7	89,8	87,9	91,2	88,2	95,6	96,1	94,2	91,0	93,1	90,9
Coloured	0,7	0,7	1,0	0,9	0,9	1,1	0,5	0,5	0,7	0,7	0,7	0,9
Indian/Asian	0,8	0,5	1,1	0,4	0,5	0,7	0,2	0,2	0,4	0,4	0,3	0,7
White	11,5	8,0	8,1	10,8	7,7	9,9	3,7	3,2	4,7	7,8	5,9	7,5

Source: Census 2011 Municipal report – Mpumalanga

Figure 6: Distribution of the population by population group and district municipality – 1996, 2001 and 2011

Figure 7 shows a consistent decline in the proportion of the population aged 0-14 years in the Ehlanzeni District and an increase in the proportion of age group 15-64 years. Members of age group 65+ in the Ehlanzeni District remained almost constant.

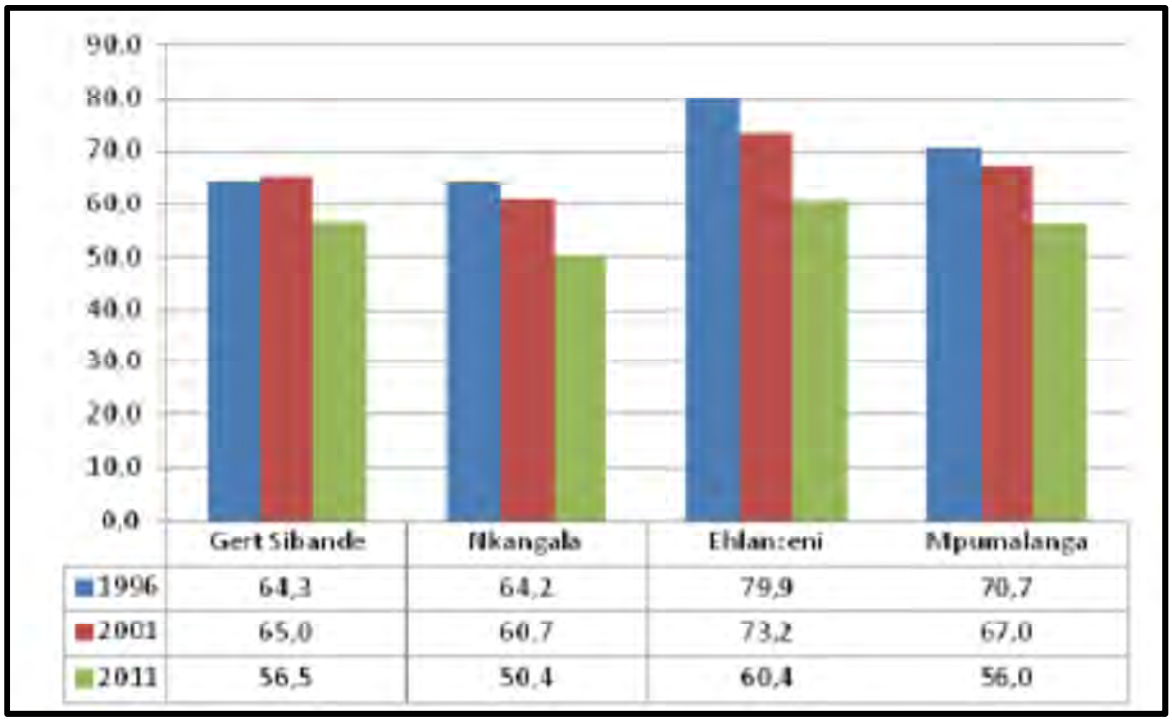


	Gert Sibande			Nkangala			Ehlanzeni			Mpumalanga		
0 - 14	35,2	35,3	31,6	34,8	33,4	28,5	40,1	37,9	33,1	37,2	35,8	31,2
15 - 64	60,9	60,6	63,9	60,9	62,2	66,5	55,6	57,7	62,4	58,6	59,9	64,1
65+	3,9	4,1	4,5	4,3	4,4	5,0	4,3	4,3	4,6	4,2	4,3	4,7

Source: Census 2011 Municipal report – Mpumalanga

Figure 7: Distribution of the population by functional age groups and district municipality – 1996, 2001 and 2011

Dependency ratios provide insights into the burden borne by those who are in working age group (15-64 years) to support those aged 0-14 years and 65+ years. Figure 8 indicates that dependency ratio in Mpumalanga has been declining over time from 70.7% in 1996 to 67.0% in 2001, and then to 56.0% in 2011. This indicates a movement in the age distribution structure towards a larger labour force. Ehlanzeni District has consistently shown a higher than provincial average.

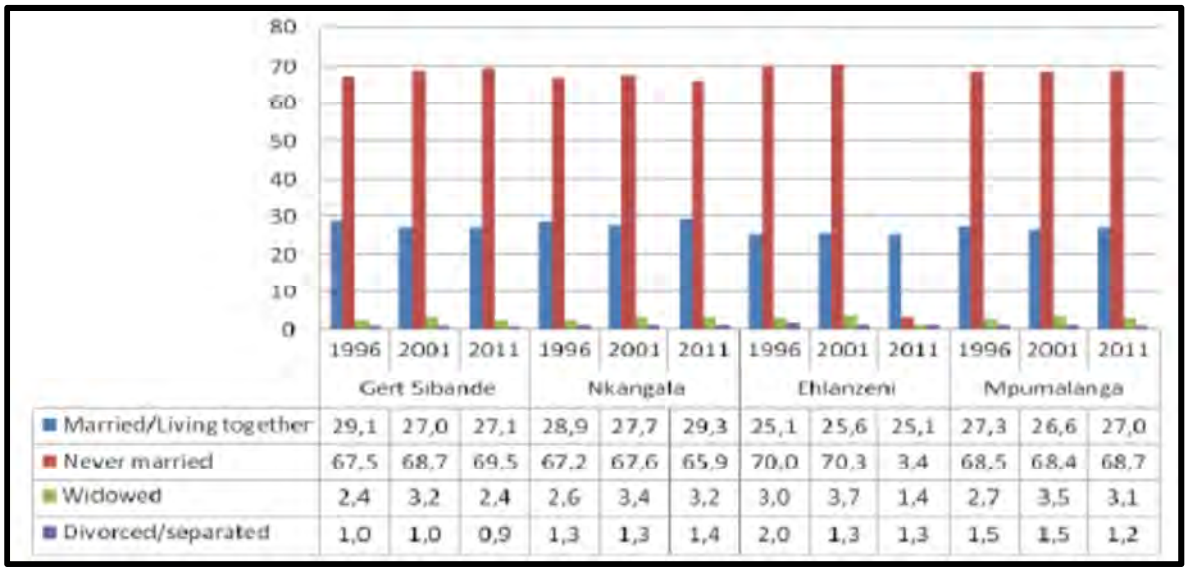


	Gert Sibande	Nkangala	Ehlanzeni	Mpumalanga
1996	64,3	64,2	79,9	70,7
2001	65,0	60,7	73,2	67,0
2011	56,5	50,4	60,4	56,0

Source: Census 2011 Municipal report – Mpumalanga

Figure 8: Dependency ratios by district municipality – 1996, 2001 and 2011

Figure 9 shows a sharp decrease in the proportion of the population who has never married in Ehlanzeni from 2001 to 2011.

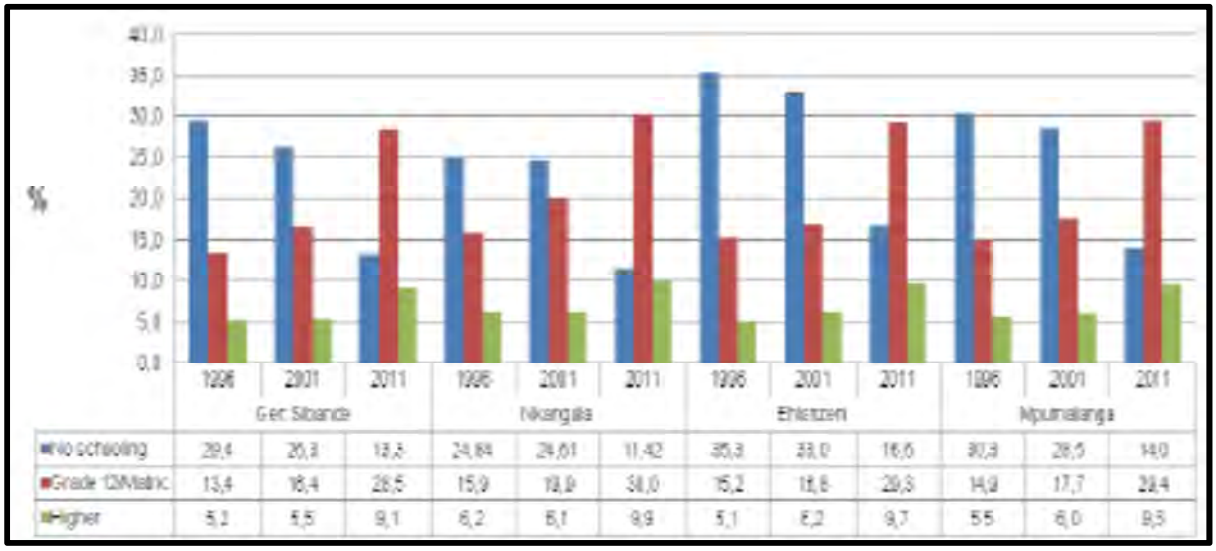


	1996	2001	2011	1996	2001	2011	1996	2001	2011	1996	2001	2011
	Gert Sibande			Nkangala			Ehlanzeni			Mpumalanga		
Married/Living together	29,1	27,0	27,1	28,9	27,7	29,3	25,1	25,6	25,1	27,3	26,6	27,0
Never married	67,5	68,7	69,5	67,2	67,6	65,9	70,0	70,3	3,4	68,5	68,4	68,7
Widowed	2,4	3,2	2,4	2,6	3,4	3,2	3,0	3,7	1,4	2,7	3,5	3,1
Divorced/separated	1,0	1,0	0,9	1,3	1,3	1,4	2,0	1,3	1,3	1,5	1,5	1,2

Source: Census 2011 Municipal report – Mpumalanga

Figure 9: Distribution of the population by marital status and district municipality – 1996, 2001 and 2011

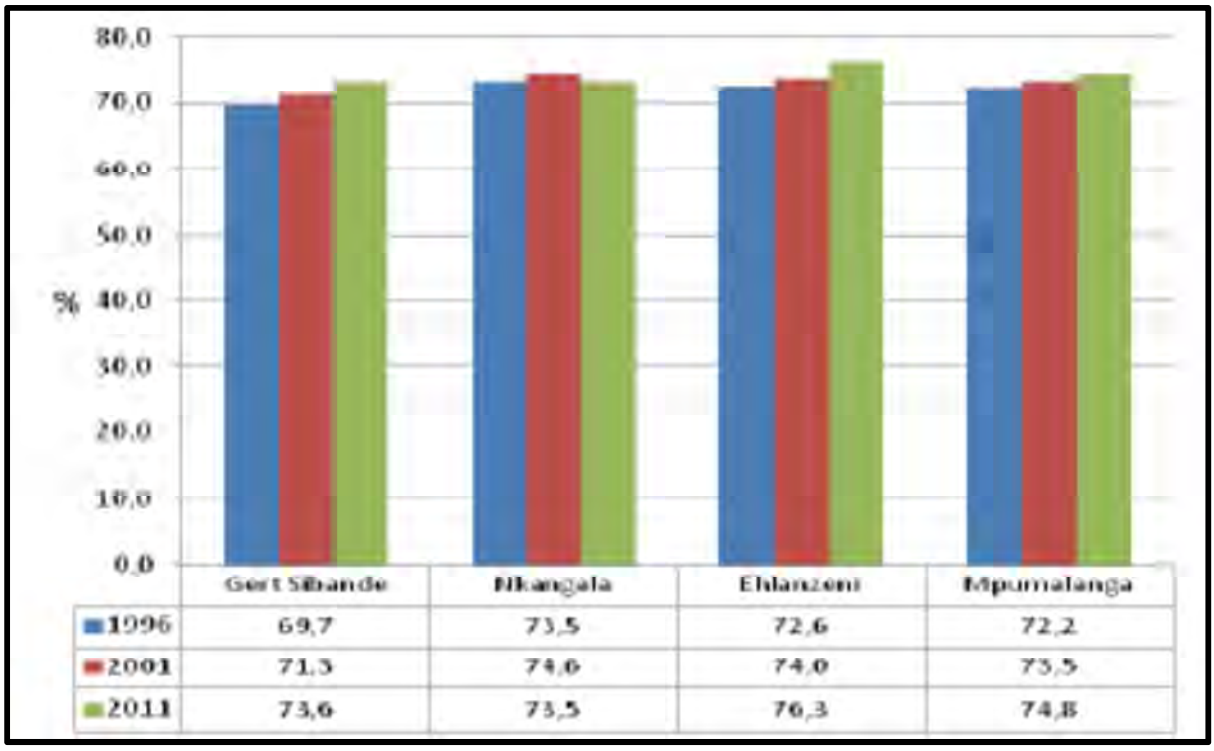
Figure 10 shows an increase in the proportion of the population with Grade 12/Matric and Higher Education. Also striking is the drastic reduction in the population with no schooling. This is the case in all the districts and the province as a whole.



Source: Census 2011 Municipal report – Mpumalanga

Figure 10: Distribution of the population aged 20 years and older by highest level of education attained and district municipality – 1996, 2001 and 2011

Figure 11 shows a slight increase in the proportion of the population attending school except in Nkangala, where there was a decrease from 2001 to 2011. Ehlanzeni has a slightly higher percentage of people attending school than the other districts.

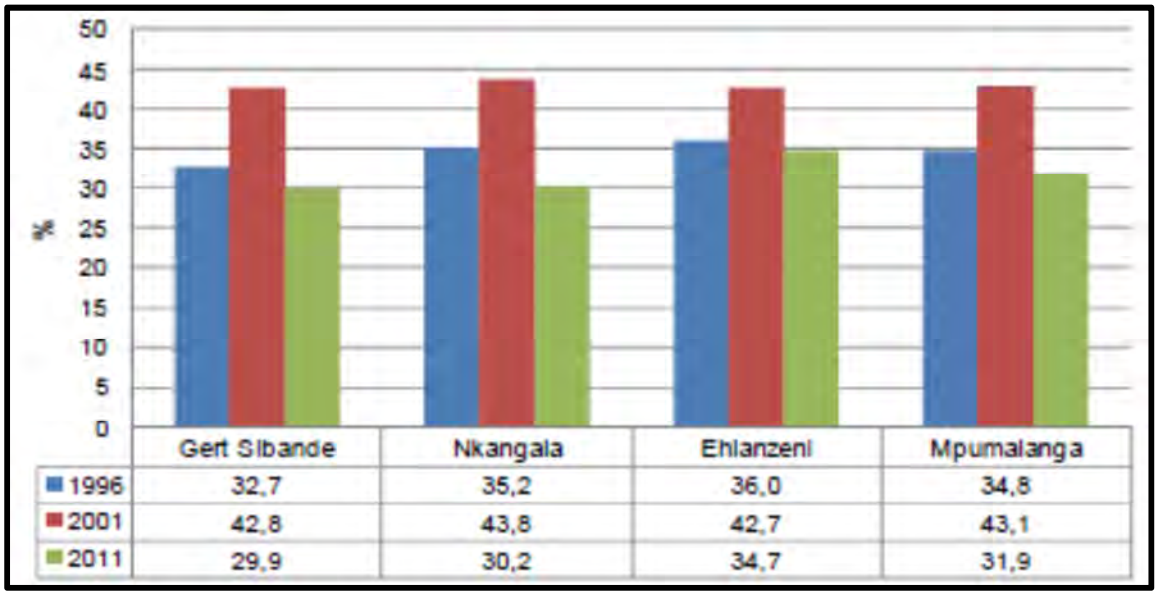


	Gert Sibande	Nkangala	Ehlanzeni	Mpumalanga
1996	69,7	73,5	72,6	72,2
2001	71,3	74,6	74,0	73,5
2011	73,6	73,5	76,3	74,8

Source: Census 2011 Municipal report – Mpumalanga

Figure 11: Distribution of the population aged between 5 and 24 years by school attendance and district municipality – 1996, 2001 and 2011

Trends in the unemployment rate, as shown by Figure 12**Error! Reference source not found.**, suggest an increase between 1996 and 2001, and thereafter a decline across districts. Ehlanzeni District's 2011 figure is significantly higher than the national unemployment figure of 26.6%.

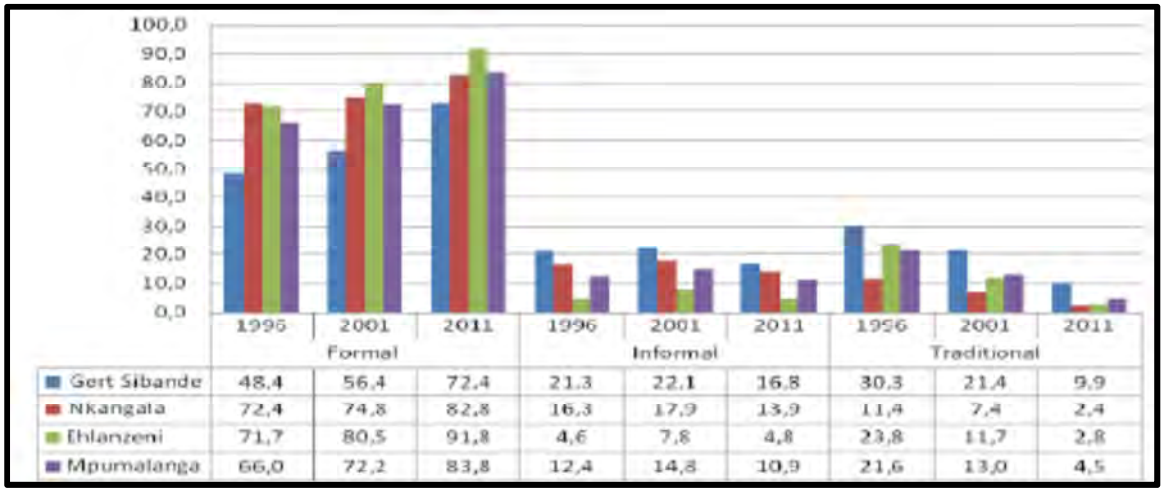


	Gert Sibande	Nkangala	Ehlanzeni	Mpumalanga
1996	32,7	35,2	36,0	34,8
2001	42,8	43,8	42,7	43,1
2011	29,9	30,2	34,7	31,9

Source: Census 2011 Municipal report – Mpumalanga

Figure 12: Unemployment rate (official definition) by district municipality – 1996, 2001 and 2011

Figure 13 shows a significant increase in the proportion of households residing in formal dwellings across the province, as well as a decline in informal and traditional dwellings.

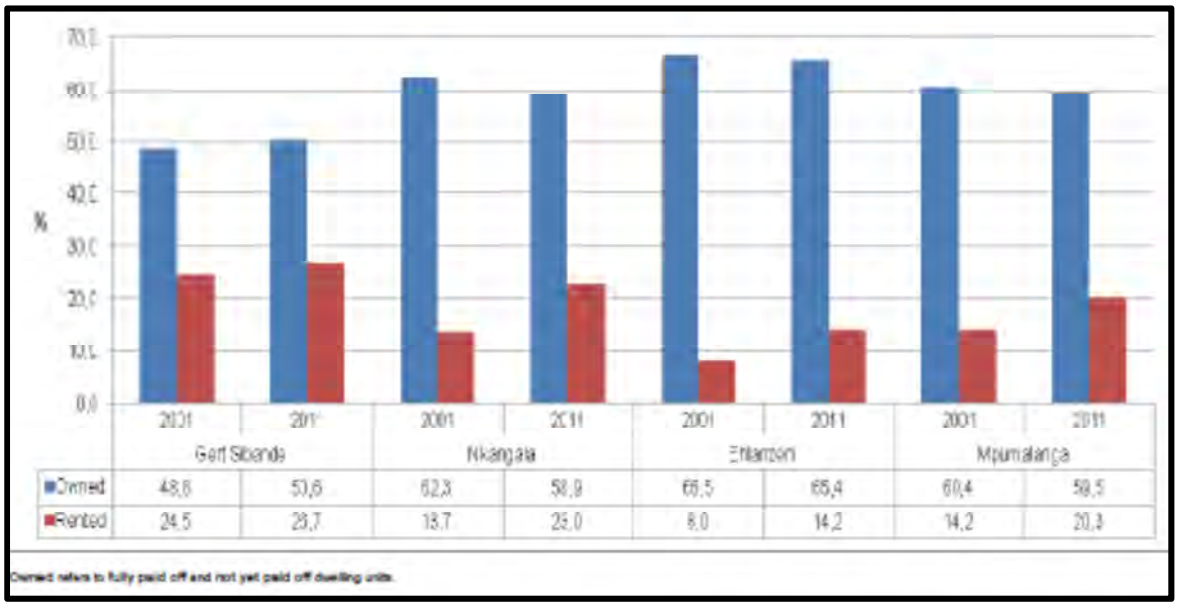


	1996	2001	2011	1996	2001	2011	1996	2001	2011
	Formal			Informal			Traditional		
Gert Sibande	48,4	56,4	72,4	21,3	22,1	16,8	30,3	21,4	9,9
Nkangala	72,4	74,8	82,8	16,3	17,9	13,9	11,4	7,4	2,4
Ehlanzeni	71,7	80,5	91,8	4,6	7,8	4,8	23,8	11,7	2,8
Mpumalanga	66,0	72,2	83,8	12,4	14,8	10,9	21,6	13,0	4,5

Source: Census 2011 Municipal report – Mpumalanga

Figure 13: Distribution of households by type of main dwelling and district municipality – 1996, 2001 and 2011

Figure 14 shows a decline in the proportion of households that own their dwellings, except in Gert Sibande District. On the other hand there is an increase in the proportion of households renting their property in the province. Ehlanzeni District has the highest percentage of households that own their dwellings of all the districts.



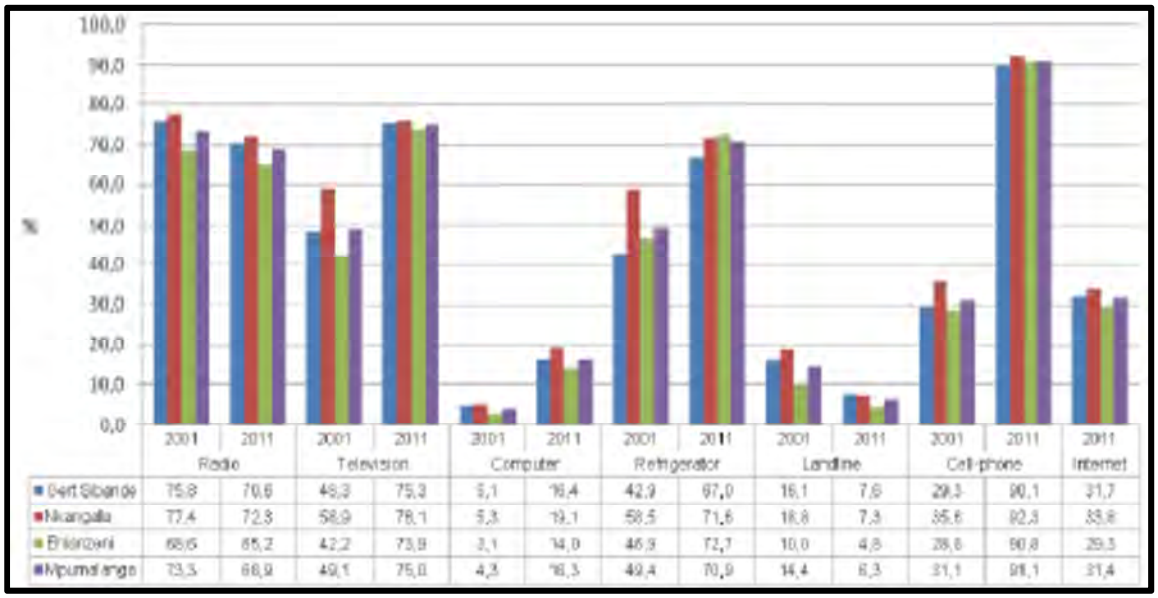
	2001	2011	2001	2011	2001	2011	2001	2011
	Gert Sibande		Nkangala		Ehlanzeni		Mpumalanga	
Owned	48,6	53,6	62,3	58,9	66,5	65,4	60,4	59,5
Rented	24,5	28,7	13,7	25,0	8,0	14,2	14,2	20,3

Owned refers to fully paid off and not yet paid off dwelling units

Source: Census 2011 Municipal report – Mpumalanga

Figure 14: Distribution of households by tenure status and district municipality – 2001 and 2011

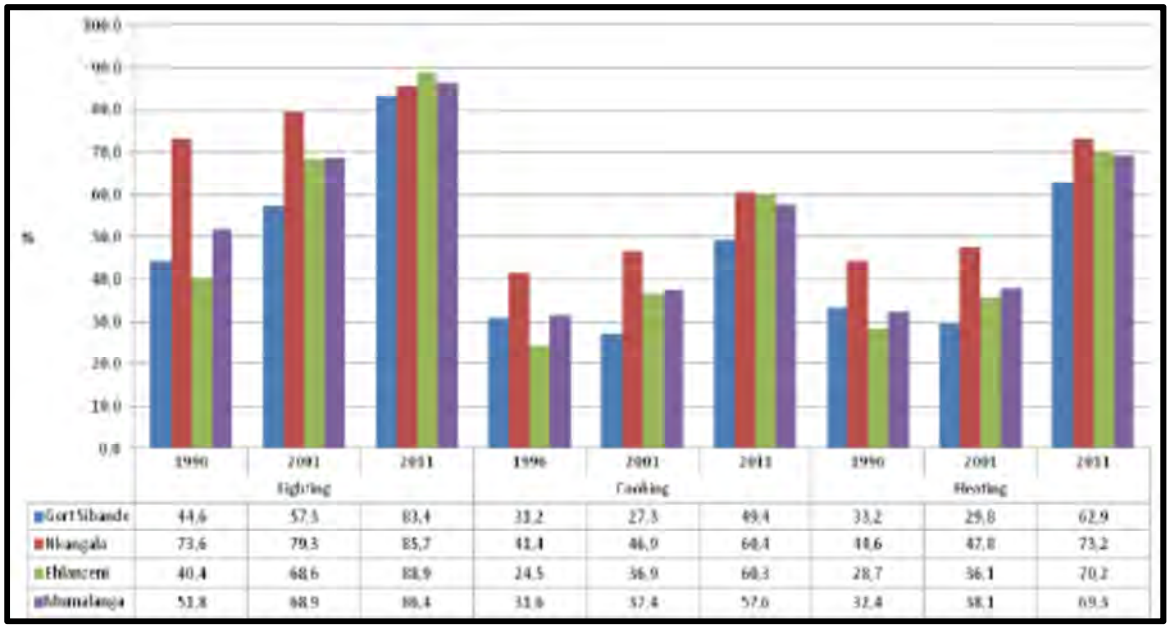
Figure 15 shows a decline in the proportion of households owning radios and landlines/telephones but an increase in households owning televisions, computers, refrigerators and cell phones from 2001 to 2011. The proportion of households with access to internet is around 30% across the province.



Source: Census 2011 Municipal report – Mpumalanga

Figure 15: Distribution of households who own a radio, television, computer, refrigerator, landline/telephone, cell phone and access to internet by district municipality – 2001 and 2011

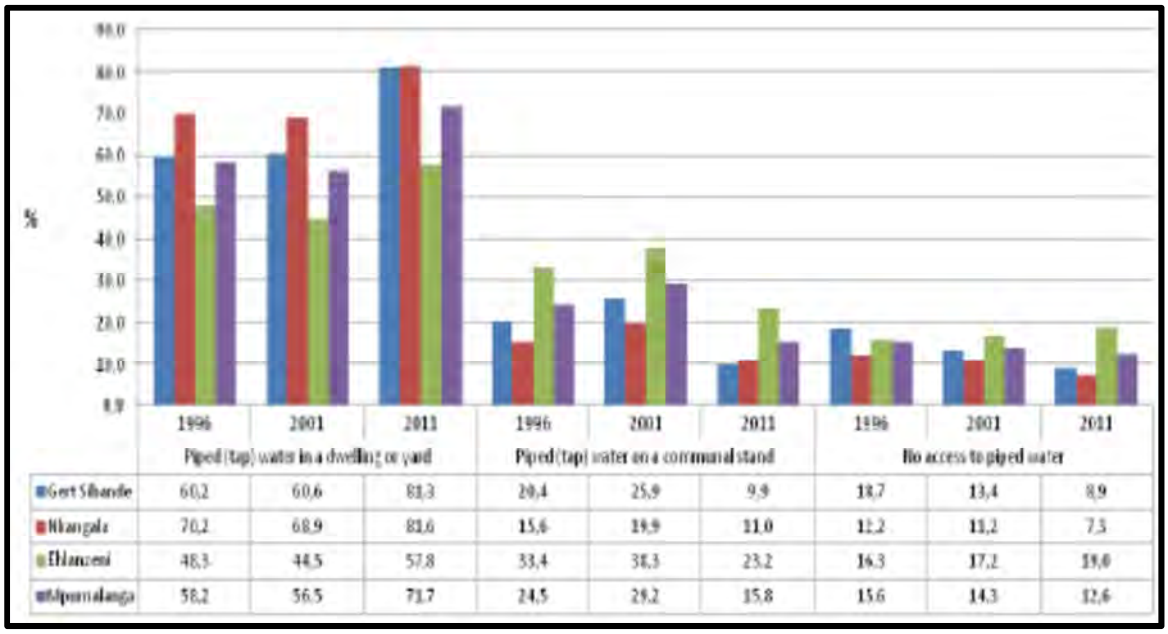
Figure 16 shows that the proportion of households using electricity as the main source of energy for lighting, heating and cooking increased significantly across the province.



Source: Census 2011 Municipal report – Mpumalanga

Figure 16: Distribution of households using electricity for lighting, cooking and heating by district municipality – 1996, 2001 and 2011

Figure 17 shows an increase in the proportion of households having access to piped water in their dwelling or yard. Alongside is the decline in the proportion of households having access to piped water on a communal stand or no access to piped water except in Ehlanzeni district which saw an increase over time. The proportion of households having access to piped water on a communal stand increased from 1996 to 2001 and in 2011 shows a decline.

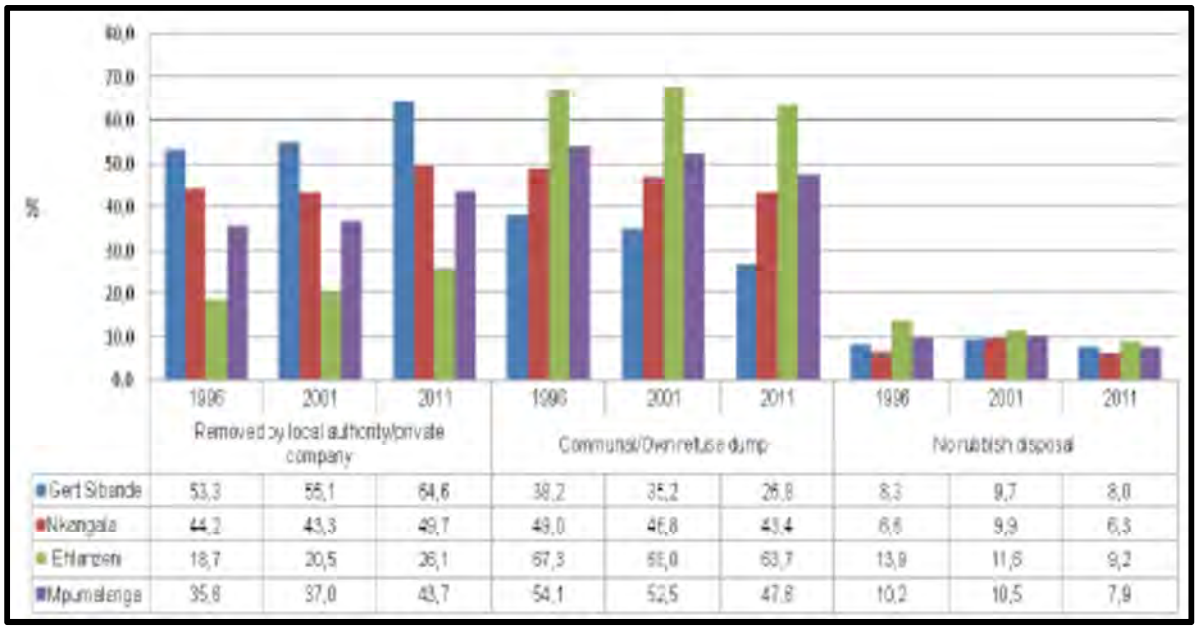


	Piped (tap) water in a dwelling or yard			Piped (tap) water on a communal stand			No access to piped water		
	1996	2001	2011	1996	2001	2011	1996	2001	2011
Gert Sibande	60,2	60,6	81,3	20,4	25,9	9,9	18,7	13,4	8,9
Nkangala	70,2	68,9	83,6	15,6	19,9	11,0	12,2	11,2	7,5
Ehlanzeni	48,3	44,5	57,8	33,4	38,3	23,2	16,3	17,2	19,0
Mpumalanga	58,2	56,5	71,7	24,5	29,2	15,8	15,6	14,3	12,6

Source: Census 2011 Municipal report – Mpumalanga

Figure 17: Distribution of households having access to piped water by district municipality – 1996, 2001 and 2011

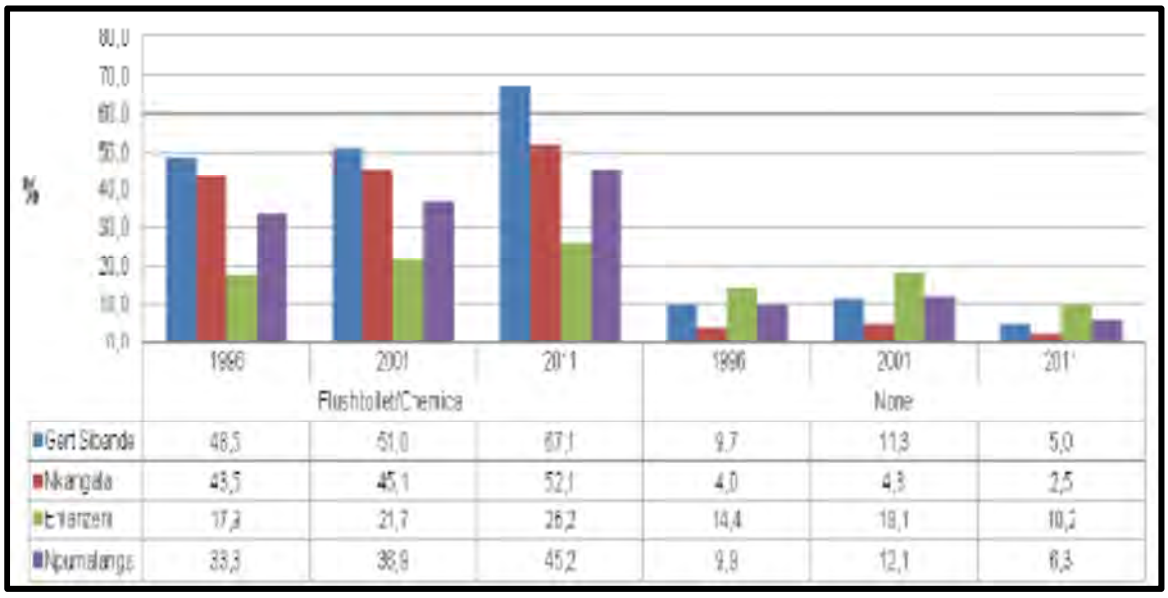
Figure 18 shows that there is an increase in the proportion of households whose refuse is removed by local authority or private company in all districts. Alongside is the decline in the proportion of households with communal or own refuse dump or no rubbish disposal.



Source: Census 2011 Municipal report – Mpumalanga

Figure 18: Distribution of households by type of refuse removal and district municipality – 1996, 2001 and 2011

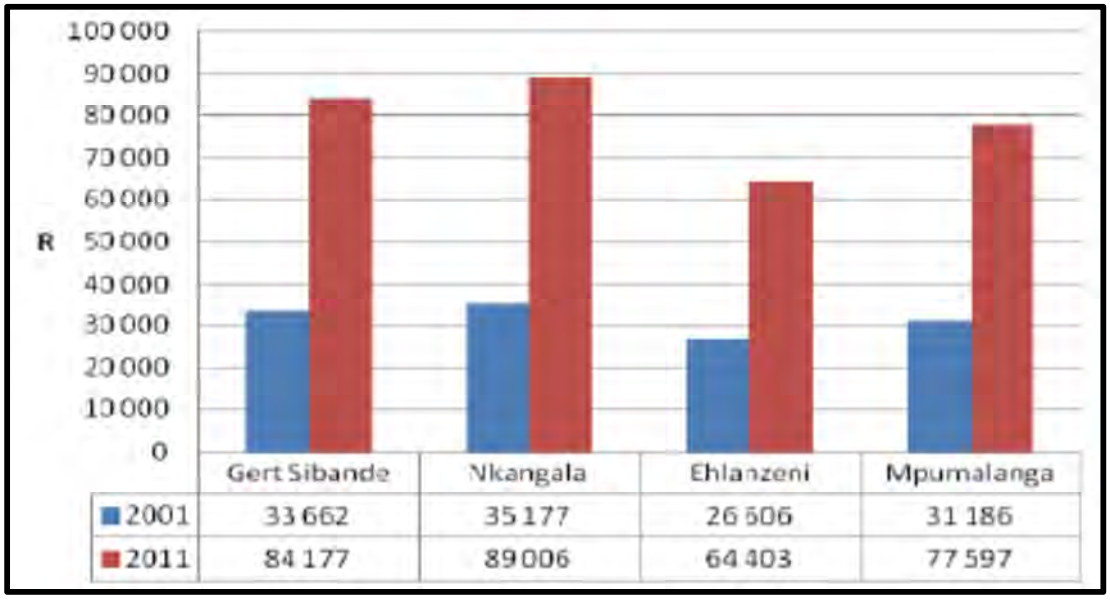
Figure 19 shows an increase in the proportion of households with flush or chemical toilets. Only about a quarter of the households use flush/chemical toilets in Ehlanzeni while in Gert Sibande, which has the highest proportion; has a third of the households using flush/chemical toilets in 2011. The graph also suggests a decline in the proportion of households with no toilet facilities.



Source: Census 2011 Municipal report – Mpumalanga

Figure 19: Distribution of households by type of toilet facility and district municipality – 1996, 2011 and 2011

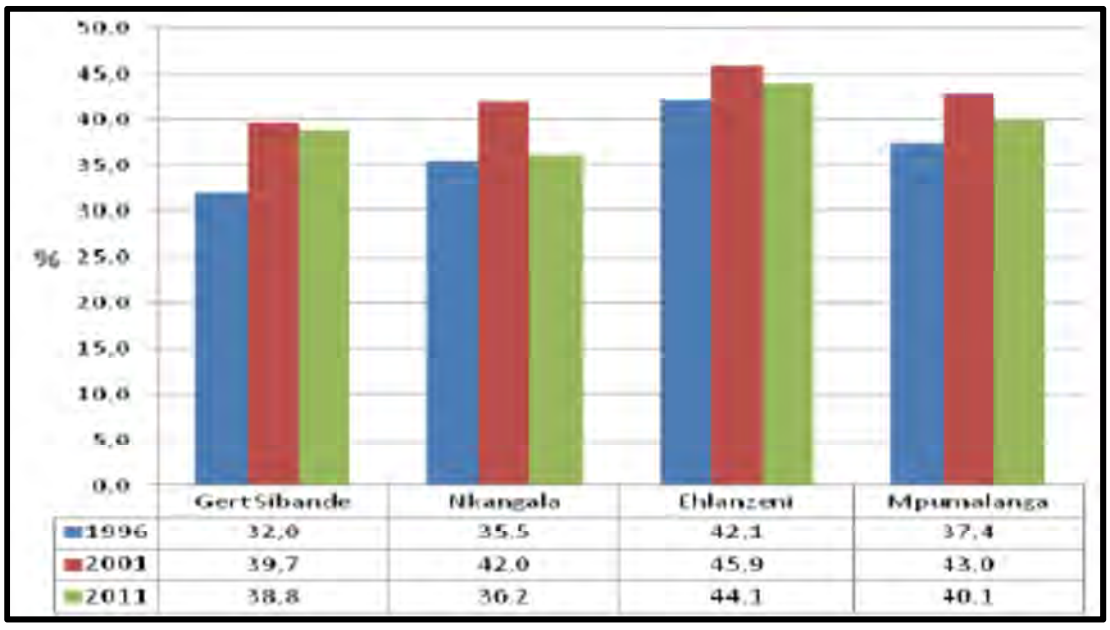
Figure 20 shows a more than 100% increase in average household income in the province. Ehlanzeni District's income is the lowest of all the districts.



Source: Census 2011 Municipal report – Mpumalanga

Figure 20: Distribution of average household income by district municipality – 2001 and 2011

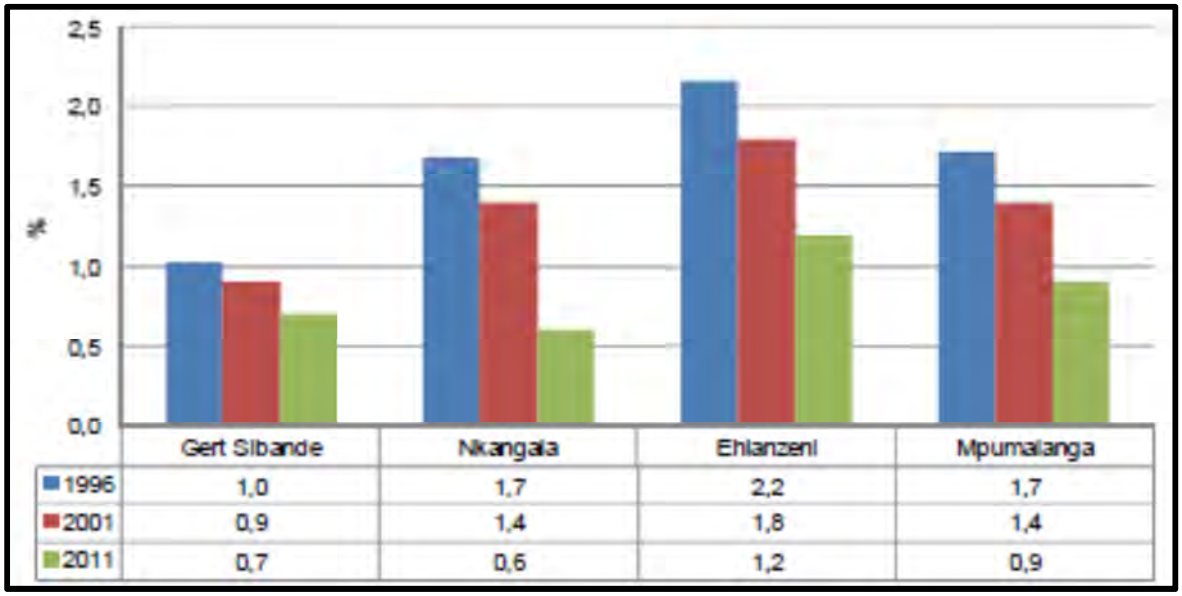
Figure 21 shows an increase in the proportion of households headed by females in 2001 and a decline thereafter.



Source: Census 2011 Municipal report – Mpumalanga

Figure 21: Distribution of female headed households by district municipality – 1996, 2001 and 2011

Figure 22 shows that the proportion of households headed by children has declined over time. Ehlanzeni has the highest proportion of child headed households.



	Gert Sibande	Nkangala	Ehlanzeni	Mpumalanga
1996	1,0	1,7	2,2	1,7
2001	0,9	1,4	1,8	1,4
2011	0,7	0,6	1,2	0,9

Source: Census 2011 Municipal report – Mpumalanga

Figure 22: Distribution of child headed households by district municipality – 1996, 2001 and 2011

4.3 Local (municipal) level – Bushbuckridge Local Municipality

4.3.1 Bushbuckridge background information

Bushbuckridge Local Municipality is a presidential nodal point located in the north-eastern part of Mpumalanga Province and south-eastern part of Limpopo Province. The municipal area provides a link to Lydenburg and other centres in the Lowveld, particularly Hoedspruit, Pilgrim's Rest and Graskop. Bushbuckridge Local Municipality can therefore be called the gateway to the major tourist attraction points in Mpumalanga and the eastern part of the Limpopo Province. Major towns include Bushbuckridge and Sabie Park. The main economic sectors are agriculture and tourism (Bushbuckridge Local Municipality).

The town of Bushbuckridge is characterised by a large number of smaller settlements sprawled over a large rural area. Many of the roads linking these villages are dirt roads.

4.3.2 Demographics

46% (246 022) of residents of Bushbuckridge is male and 54% (295 226) is female, as indicated in Table 4: Distribution of the population by age and sex; Bushbuckridge municipality – 1996, 2001 and 2011

MP325: Bushbuckridge	1996			2001			2011		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	34 331	35 402	69 734	30 203	31 066	61 269	35 470	34 892	70 362
5-9	40 560	41 443	82 003	35 586	36 172	71 758	32 634	32 283	64 917
10-14	38 570	39 944	78 514	38 203	38 583	76 786	33 228	31 845	65 074
15-19	34 372	36 523	70 894	34 348	34 505	68 853	33 911	33 904	67 815
20-24	23 727	30 018	53 745	21 036	25 747	46 783	27 017	29 316	56 333
25-29	17 324	24 441	41 764	13 269	20 751	34 020	18 457	24 801	43 258
30-34	12 012	18 286	30 298	10 441	17 040	27 481	13 363	19 278	32 641
35-39	9 718	14 451	24 169	8 917	14 809	23 726	10 710	16 788	27 498
40-44	7 034	11 529	18 563	6 722	11 229	17 951	8 998	14 553	23 552
45-49	6 052	8 460	14 512	5 872	10 023	15 895	7 528	12 976	20 504
50-54	4 143	6 269	10 412	4 942	7 417	12 359	5 675	9 700	15 375
55-59	4 197	6 235	10 433	3 692	5 414	9 106	5 186	8 956	14 142
60-64	2 955	6 411	9 366	3 663	5 907	9 570	4 513	6 594	11 107
65-69	4 120	6 860	10 980	2 411	5 306	7 717	3 068	5 424	8 492
70-74	2 472	3 186	5 658	2 610	5 507	8 117	2 801	4 823	7 623
75-79	2 503	2 968	5 470	1 442	2 153	3 595	1 371	3 628	4 999
80-84	807	1 021	1 828	1 319	2 059	3 378	1 143	3 273	4 417
85+	525	915	1 440	565	1 195	1 760	949	2 192	3 140
Total	245 421	294 361	539 783	225 241	274 883	500 124	246 022	295 226	541 249

Source: Census 2011 Municipal report – Mpumalanga

. There has been an increase in Bushbuckridge's population from 2001 (500 124) until 2011 (541 249). The largest number of people falls within the age groups 0-4, 5-9, 10-14 and 15-19 years. Thereafter there is a sharp decline. This suggests that a large number of adults leave the municipality, possibly is search of employment elsewhere.

Table 4: Distribution of the population by age and sex; Bushbuckridge municipality – 1996, 2001 and 2011

MP325: Bushbuckridge	1996			2001			2011		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	34 331	35 402	69 734	30 203	31 066	61 269	35 470	34 892	70 362
5-9	40 560	41 443	82 003	35 586	36 172	71 758	32 634	32 283	64 917
10-14	38 570	39 944	78 514	38 203	38 583	76 786	33 228	31 845	65 074
15-19	34 372	36 523	70 894	34 348	34 505	68 853	33 911	33 904	67 815
20-24	23 727	30 018	53 745	21 036	25 747	46 783	27 017	29 316	56 333
25-29	17 324	24 441	41 764	13 269	20 751	34 020	18 457	24 801	43 258
30-34	12 012	18 286	30 298	10 441	17 040	27 481	13 363	19 278	32 641
35-39	9 718	14 451	24 169	8 917	14 809	23 726	10 710	16 788	27 498
40-44	7 034	11 529	18 563	6 722	11 229	17 951	8 998	14 553	23 552
45-49	6 052	8 460	14 512	5 872	10 023	15 895	7 528	12 976	20 504
50-54	4 143	6 269	10 412	4 942	7 417	12 359	5 675	9 700	15 375
55-59	4 197	6 235	10 433	3 692	5 414	9 106	5 186	8 956	14 142
60-64	2 955	6 411	9 366	3 663	5 907	9 570	4 513	6 594	11 107
65-69	4 120	6 860	10 980	2 411	5 306	7 717	3 068	5 424	8 492
70-74	2 472	3 186	5 658	2 610	5 507	8 117	2 801	4 823	7 623
75-79	2 503	2 968	5 470	1 442	2 153	3 595	1 371	3 628	4 999
80-84	807	1 021	1 828	1 319	2 059	3 378	1 143	3 273	4 417
85+	525	915	1 440	565	1 195	1 760	949	2 192	3 140
Total	245 421	294 361	539 783	225 241	274 883	500 124	246 022	295 226	541 249

Source: Census 2011 Municipal report – Mpumalanga

Table 5 shows that Bushbuckridge's population has increased from 2001 to 2011, but declined from 1996.

Table 5: Population growth rates by municipality – 1996, 2001 and 2011

Municipality	Total population				
	1996	2001	Population growth rate (1996–2001)	2011	Population growth rate (2001–2011)
DC30: Gert Sibande	**797 400**	**900 007**	**2,42**	**1 043 194**	**1,48**
MP301: Albert Luthuli	182 719	187 751	0,54	186 010	-0,09
MP302: Msukaligwa	105 368	124 812	3,39	149 377	1,80
MP303: Mkhondo	100 388	143 077	7,09	171 982	1,84
MP304: Pixley Ka Seme	70 178	80 737	2,80	83 235	0,30
MP305: Lekwa	90 080	103 265	2,73	115 682	1,13
MP306: Dipaleseng	39 042	38 618	-0,22	42 390	0,93
MP307: Govan Mbeki	209 626	221 747	1,12	294 538	2,84
DC31: Nkangala	**962 249**	**1 018 422**	**1,13**	**1 308 129**	**2,50**
MP311: Victor Khanye	53 208	56 335	1,14	75 452	2,92
MP312: Emalahleni	236 040	276 413	3,16	395 466	3,58
MP313: Steve Tshwete	135 335	142 772	1,07	229 831	4,76
MP314: Emakhazeni	37 004	43 007	3,01	47 216	0,93
MP315: Thembisile	241 360	256 583	1,22	310 458	1,91
MP316: Dr JS Moroka	259 302	243 313	-1,27	249 705	0,26
DC32: Ehlanzeni	**1 364 221**	**1 447 125**	**1,18**	**1 688 615**	**1,54**
MP321: Thaba Chweu	65 909	81 681	4,29	98 387	1,86
MP322: Mbombela	426 090	476 903	2,25	588 794	2,11
MP323: Umjindi	48 547	53 744	2,03	67 156	2,23
MP324: Nkomazi	277 864	334 668	3,72	393 030	1,61
MP325: Bushbuckridge	545 811	500 128	-1,75	541 248	0,79
Mpumalanga	**3 123 870**	**3 365 554**	**1,49**	**4 039 939**	**1,83**

Source: Census 2011 Municipal report – Mpumalanga

Table 6: Sex ratios by municipality – 1996, 2001 and 2011

Municipality	Male			Female			Sex ratios		
	1996	2001	2011	1996	2001	2011	1996	2001	2011
DC30: Gert Sibande	**393 545**	**433 428**	**514 406**	**403 855**	**466 580**	**528 789**	**97**	**93**	**97**
MP301: Albert Luthuli	84 255	86 145	87 188	98 464	101 605	98 822	86	85	88
MP302: Msukaligwa	52 220	60 132	74 113	53 147	64 680	75 264	98	93	98
MP303: Mkhondo	48 673	67 913	82 263	51 714	75 164	89 719	94	90	92
MP304: Pixley Ka Seme	33 775	37 688	39 520	36 403	43 049	43 715	93	88	90
MP305: Lekwa	44 684	50 629	57 647	45 396	52 636	58 014	98	96	99
MP306: Dipaleseng	19 034	18 602	21 462	20 008	20 016	20 928	95	93	103
MP307: Govan Mbeki	110 904	112 318	152 211	98 722	109 429	142 326	112	103	107
DC31: Nkangala	**468 954**	**490 099**	**656 247**	**493 294**	**528 323**	**651 882**	**95**	**93**	**101**
MP311: Victor Khanye	26 466	27 738	38 816	26 742	28 597	36 636	99	97	106
MP312: Emalahleni	122 104	140 715	208 751	113 936	135 698	186 715	107	104	112
MP313: Steve Tshwete	68 509	70 593	119 411	66 826	72 179	110 421	103	98	108
MP314: Emakhazeni	18 553	21 137	24 099	18 451	21 870	23 117	101	97	104
MP315: Thembisile	112 739	118 731	147 676	128 621	137 852	162 783	88	86	91
MP316: Dr JS Moroka	120 583	111 186	117 494	138 719	132 127	132 211	87	84	89
DC32: Ehlanzeni	**642 963**	**679 847**	**803 403**	**721 258**	**767 277**	**885 212**	**89**	**89**	**91**
MP321: Thaba Chweu	33 174	40 716	50 415	32 735	40 964	47 972	101	99	105
MP322: Mbombela	205 091	227 671	285 750	220 998	249 233	303 044	93	91	94
MP323: Umjindi	26 079	28 352	35 141	22 468	25 392	32 016	116	112	110
MP324: Nkomazi	130 343	157 867	186 074	147 521	176 801	206 956	88	89	90
MP325: Bushbuckridge	248 276	225 241	246 023	297 536	274 887	295 224	83	82	83
Mpumalanga	**1 505 462**	**1 603 374**	**1 974 055**	**1 618 407**	**1 762 180**	**2 065 883**	**93**	**91**	**96**

Source: Census 2011 Municipal report – Mpumalanga

As can be seen from Table 7, Table 8, Table 9 and Table 10 *Black African* is by far the majority population group in Bushbuckridge (638 790), followed by *White* (1 053), *Coloured* (681) and *Indian/Asian* (644).

Table 7: Distribution of population by population group (Black African), sex and municipality – 1996, 2001 and 2011

Municipality	1996			2001			2011		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
DC30: Gert Sibande	**338 110**	**349 826**	**688 936**	**391 768**	**424 608**	**816 264**	**453 383**	**470 693**	**923 976**
MP301: Albert Luthuli	81 771	96 091	177 862	84 449	99 942	184 391	84 668	96 863	181 531
MP302: Msukaligwa	42 834	43 563	86 397	53 491	57 924	111 416	65 001	66 625	131 625
MP303: Mkhondo	44 256	47 298	91 554	64 695	71 828	136 523	77 528	85 304	162 832
MP304: Pixley Ka Seme	29 628	32 178	61 806	34 570	39 778	74 348	35 596	39 761	76 357
MP305: Lekwa	36 013	36 849	72 862	43 702	45 351	89 053	48 375	48 988	97 363
MP306: Dipaleseng	16 512	17 444	33 956	16 888	18 190	35 078	19 289	18 790	38 079
MP307: Govan Mbeki	88 096	76 403	164 499	93 960	91 495	185 456	122 927	114 263	237 190
DC31: Nkangala	**408 346**	**432 613**	**840 959**	**446 776**	**482 813**	**928 589**	**576 306**	**674 934**	**1 160 240**
MP311: Victor Khanye	21 727	21 930	43 657	24 507	25 221	49 728	31 875	30 214	62 089
MP312: Emalahleni	91 831	84 194	176 025	116 401	110 919	227 321	171 024	150 644	321 668
MP313: Steve Tshwete	46 561	44 660	91 221	56 653	57 718	114 371	88 889	80 158	169 048
MP314: Emakhazeni	16 271	16 122	32 392	18 772	19 541	38 313	20 985	20 183	41 168
MP315: Thembisile	112 087	127 822	239 909	118 430	137 572	256 002	146 040	161 912	307 952
MP316: Dr JS Moroka	119 870	137 886	257 756	111 012	131 942	242 953	116 493	131 823	248 316
DC32: Ehlanzeni	**608 726**	**687 585**	**1 297 310**	**661 781**	**738 307**	**1 390 088**	**752 680**	**835 323**	**1 588 002**
MP321: Thaba Chweu	27 769	26 985	54 753	35 228	35 065	70 293	41 280	39 005	80 285
MP322: Mbombela	185 127	201 020	386 147	211 382	232 452	443 834	254 829	271 579	526 408
MP323: Umjindi	22 881	19 246	42 127	25 348	22 302	47 649	30 772	27 674	58 446
MP324: Nkomazi	127 937	145 159	273 096	155 417	174 413	329 830	181 260	202 814	384 074
MP325: Bushbuckridge	246 012	295 175	541 187	224 406	274 075	498 481	244 539	294 251	538 790
Mpumalanga	**1 357 182**	**1 470 024**	**2 827 208**	**1 489 312**	**1 645 728**	**3 135 040**	**1 781 388**	**1 880 860**	**3 662 218**

Source: Census 2011 Municipal report – Mpumalanga

Table 8: Distribution of population by population group (Coloured), sex and municipality – 1996, 2001 and 2011

Municipality	1996			2001			2011		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
DC30: Gert Sibande	**2 873**	**2 951**	**5 825**	**3 019**	**3 016**	**6 035**	**6 488**	**6 299**	**10 787**
MP301: Albert Luthuli	119	121	240	155	142	297	237	197	434
MP302: Msukaligwa	200	223	423	202	176	378	480	412	892
MP303: Mkhondo	237	265	502	285	302	587	450	444	894
MP304: Pixley Ka Seme	127	149	276	185	217	402	260	267	528
MP305: Lekwa	1 032	1 050	2 082	918	1 019	1 937	1 592	1 712	3 304
MP306: Dipaleseng	15	19	34	29	39	68	96	117	213
MP307: Govan Mbeki	1 243	1 126	2 369	1 244	1 122	2 366	2 353	2 149	4 502
DC31: Nkangala	**4 073**	**4 235**	**8 308**	**4 232**	**4 500**	**8 733**	**7 432**	**7 439**	**14 871**
MP311: Victor Khanye	111	131	241	108	149	257	408	401	810
MP312: Emalahleni	1 931	1 946	3 877	1 910	2 046	3 956	3 417	3 299	6 717
MP313: Steve Tshwete	1 716	1 800	3 516	1 728	1 919	3 647	2 952	3 036	5 987
MP314: Emakhazeni	93	80	173	252	213	466	303	260	563
MP315: Thembisile	127	157	283	151	171	321	222	326	547
MP316: Dr JS Moroka	95	113	208	83	103	186	130	117	247
DC32: Ehlanzeni	**2 944**	**3 218**	**6 162**	**3 885**	**3 997**	**7 881**	**6 249**	**6 725**	**10 974**
MP321: Thaba Chweu	625	732	1 358	748	861	1 609	1 239	1 353	2 592
MP322: Mbombela	1 504	1 566	3 070	1 837	1 973	3 810	2 709	2 883	5 592
MP323: Umjindi	330	402	731	412	429	841	614	726	1 340
MP324: Nkomazi	220	213	433	285	311	596	428	461	889
MP325: Bushbuckridge	265	306	571	383	422	806	259	302	561
Mpumalanga	**9 890**	**10 404**	**20 294**	**10 918**	**11 513**	**22 428**	**18 149**	**18 462**	**36 611**

Source: Census 2011 Municipal report – Mpumalanga

Table 9: Distribution of population by population group (Indian/Asian), sex and municipality – 1996, 2001 and 2011

	1996			2001			2011		
Municipality	Male	Female	Total	Male	Female	Total	Male	Female	Total
DC30: Gert Sibande	3 281	3 218	6 499	2 787	2 812	5 598	6 128	4 873	11 002
MP301: Albert Luthuli	138	134	273	136	114	251	514	241	755
MP302: Msukaligwa	411	483	894	395	429	824	975	703	1 678
MP303: Mkhondo	540	523	1 063	384	389	773	786	630	1 417
MP304: Pixley Ka Seme	218	207	426	228	237	466	536	422	958
MP305: Lekwa	537	550	1 087	470	485	955	736	660	1 396
MP306: Dipaleseng	183	172	355	142	133	276	203	190	393
MP307: Govan Mbeki	1 254	1 148	2 402	1 031	1 024	2 055	2 378	2 028	4 406
DC31: Nkangala	1 812	1 738	3 550	1 395	1 287	2 682	5 706	3 843	9 549
MP311: Victor Khanye	45	50	95	54	47	101	170	89	259
MP312: Emalahleni	663	651	1 314	557	535	1 092	2 080	1 481	3 562
MP313: Steve Tshwete	975	917	1 891	675	638	1 313	1 959	1 741	3 700
MP314: Emakhazeni	91	77	169	59	46	105	212	118	330
MP315: Thembisile	16	23	39	18	8	26	747	283	1 031
MP316: Dr JS Moroka	22	21	42	31	23	55	538	130	668
DC32: Ehlanzeni	1 481	1 438	2 899	1 438	1 236	2 674	4 330	3 038	7 368
MP321: Thaba Chweu	166	147	313	160	140	300	341	254	595
MP322: Mbombela	847	847	1 694	816	727	1 543	2 277	1 947	4 223
MP323: Umjindi	281	306	588	253	270	523	397	291	689
MP324: Nkomazi	86	73	159	153	63	216	882	433	1 316
MP325: Bushbuckridge	81	64	145	56	36	92	432	111	544
Mpumalanga	6 554	6 394	12 948	5 619	5 344	10 964	16 165	11 763	27 917

Source: Census 2011 Municipal report – Mpumalanga

Table 10: Distribution of population by population group (White), sex and municipality – 1996, 2001 and 2011

	1996			2001			2011		
Municipality	Male	Female	Total	Male	Female	Total	Male	Female	Total
DC30: Gert Sibande	46 466	45 320	90 785	35 867	36 244	72 111	47 197	47 083	94 279
MP301: Albert Luthuli	1 620	1 653	3 272	1 405	1 407	2 812	1 478	1 459	2 938
MP302: Msukaligwa	8 530	8 597	17 127	6 043	6 152	12 195	7 346	7 360	14 707
MP303: Mkhondo	3 345	3 406	6 760	2 549	2 646	5 195	3 221	3 226	6 447
MP304: Pixley Ka Seme	3 616	3 676	7 292	2 705	2 816	5 521	2 969	3 199	6 167
MP305: Lekwa	6 810	6 700	13 509	5 539	5 781	11 320	6 649	6 564	13 212
MP306: Dipaleseng	2 169	2 176	4 346	1 543	1 654	3 197	1 818	1 814	3 633
MP307: Govan Mbeki	19 376	19 113	38 489	16 083	15 787	31 870	23 716	23 460	47 176
DC31: Nkangala	52 218	52 118	104 337	38 687	39 613	78 300	64 997	64 880	129 856
MP311: Victor Khanye	4 451	4 504	8 956	3 069	3 180	6 249	6 197	5 864	12 060
MP312: Emalahleni	26 879	26 533	53 412	21 846	22 198	44 044	31 038	30 855	61 893
MP313: Steve Tshwete	18 803	18 935	37 738	11 536	12 004	23 541	24 988	25 198	50 186
MP314: Emakhazeni	1 978	2 029	4 007	2 054	2 069	4 123	2 542	2 534	5 076
MP315: Thembisile	86	93	179	132	101	234	162	138	299
MP316: Dr JS Moroka	22	24	46	60	60	119	69	71	141
DC32: Ehlanzeni	26 001	26 128	50 129	22 983	23 738	46 701	39 384	40 296	79 659
MP321: Thaba Chweu	4 317	4 570	8 886	4 580	4 899	9 479	7 114	7 185	14 299
MP322: Mbombela	16 441	16 385	32 826	13 636	14 080	27 716	25 231	26 220	51 451
MP323: Umjindi	2 315	2 398	4 714	2 339	2 391	4 730	3 267	3 288	6 555
MP324: Nkomazi	1 539	1 450	2 989	2 012	2 015	4 027	3 201	3 101	6 301
MP325: Bushbuckridge	389	325	714	396	354	749	550	503	1 053
Mpumalanga	122 685	122 698	245 261	97 527	99 594	197 121	161 557	162 038	303 595

Source: Census 2011 Municipal report – Mpumalanga

In Bushbuckridge Local Municipality the majority people fall within the functional age group 15-64 years, which is the economically active group. The smallest number of people by far falls in the age group 65+ years. This means that the birth rate is much higher than the mortality rate in the municipality.

Table 11: Distribution of the population by functional age groups, sex and municipality – 1996, 2001 and 2011

MP325: Bushbuckridge	1996			2001			2011		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-14	113 461	116 789	230 250	103 991	105 823	209 814	101 333	99 020	200 353
15-64	121 533	162 622	284 166	112 901	152 843	265 744	135 359	176 865	312 224
65+	10 427	14 951	26 378	8 349	16 221	24 570	9 332	19 340	28 672
Total	245 421	294 361	539 782	226 241	274 887	500 128	248 023	295 224	541 247

Source: Census 2011 Municipal report – Mpumalanga

Dependency ratios indicate to what extent the working age group (15-64 years) has to support those aged 0-14 years and 65+ years. Bushbuckridge's dependency ratio has decreased since 1996 till 2011. This is consistent with the fact that its population aged between 15 and 64 years, have grown during this period, from 284 166 (1996) to 286 744 (2001) and 312 224 (2011), as can be seen in Table 12.

Table 12: Dependency ratios by municipality – 1996, 2001 and 2011

Municipality	Population aged 14 years and younger			Population aged 65 years and older			Population aged between 15 and 64 years			Dependency ratios		
	1996	2001	2011	1996	2001	2011	1996	2001	2011	1996	2001	2011
DC30: Gert Sibande	277 288	317 634	329 426	30 862	38 961	47 075	478 592	646 412	866 882	64,3	66,0	66,6
MP301: Albert Luthuli	77 348	76 236	67 801	8 254	9 054	9 867	94 656	102 461	108 342	90,4	83,2	71,7
MP302: Msukaligwa	35 664	43 566	45 410	4 088	5 114	6 067	65 189	76 133	97 901	61,0	63,9	52,6
MP303: Mkhondo	36 931	56 532	62 923	3 931	5 684	7 280	58 609	80 861	101 779	69,7	76,9	69,0
MP304: Pixley Ka Seme	25 334	31 166	29 050	3 545	4 142	4 733	39 755	45 429	49 452	72,6	77,7	68,3
MP305: Lekwa	28 839	33 136	33 084	3 864	4 422	5 793	56 627	65 707	76 784	57,8	57,2	50,6
MP306: Dipaleseng	12 698	12 708	11 953	1 925	2 043	2 476	23 720	23 867	27 961	61,6	61,8	51,6
MP307: Govan Mbeki	60 454	64 290	79 205	5 345	6 503	10 859	141 036	150 955	204 474	46,7	46,9	44,0
DC31: Nkangala	329 840	339 946	372 788	40 641	44 815	65 419	676 738	833 861	869 923	64,2	60,7	60,4
MP311: Victor Khanye	15 834	17 992	21 285	2 201	2 364	3 562	33 849	35 979	50 604	53,3	56,6	49,1
MP312: Emalahleni	68 078	78 420	99 553	6 658	7 902	14 145	157 740	190 091	281 768	47,4	45,4	40,4
MP313: Steve Tshwete	39 583	42 284	57 569	4 381	4 767	9 849	88 298	95 720	162 413	49,8	49,2	41,5
MP314: Emakhazeni	11 877	13 562	13 201	2 028	2 139	2 745	22 236	27 306	31 271	62,5	57,5	51,0
MP315: Thembisile	94 861	95 449	99 732	10 467	11 708	15 317	134 757	149 426	195 409	78,2	71,7	58,9
MP316: Dr JS Moroka	99 607	92 240	81 447	14 905	15 736	19 801	139 858	135 338	148 457	81,9	79,8	68,2
DC32: Ehlanzeni	636 673	648 850	658 484	57 447	62 639	77 219	743 483	836 638	1 062 932	78,8	73,2	60,4
MP321: Thaba Chweu	19 253	23 214	24 762	2 892	3 609	4 844	42 508	54 858	68 781	52,1	48,9	43,0
MP322: Mbombela	154 909	164 782	175 651	16 551	18 886	24 822	244 104	293 236	388 320	70,2	62,6	51,6
MP323: Umjindi	13 025	14 648	18 420	1 639	1 990	2 807	32 609	37 106	45 930	44,7	44,8	46,2
MP324: Nkomazi	119 236	136 392	139 279	10 987	13 585	16 075	139 887	184 692	237 677	93,1	81,2	65,4
MP325: Bushbuckridge	230 250	209 814	200 352	25 378	24 570	28 671	284 155	265 744	312 224	90,0	88,2	73,4
Mpumalanga	1 143 781	1 206 430	1 260 679	129 040	144 215	189 714	1 799 793	2 014 909	2 589 647	70,7	67,0	66,0

Source: Census 2011 Municipal report – Mpumalanga

The majority of residents in Bushbuckridge has never been married (400 252), despite the fact that the population's age groups between 15 and 64 years represent by far the majority of people. It is unclear if traditional weddings were included in this category. If not, it could offer an explanation for

why such a high number of people indicated that they are not married. 111 400 residents indicated that they are married, 22 786 are widows/widowers and 6 810 are separated/divorced.

Table 13: Distribution of the population by marital status and municipality – 1996, 2001 and 2011

	1996					2001					2011				
Municipality	Married/ living together	Never married	Widowed	Divorced/ separated	Total	Married/ living together	Never married	Widowed	Divorced/ separated	Total	Married/ living together	Never married	Widowed	Divorced/ separated	Total
DC30:Gert Sibande	227 315	528 242	18 848	7 763	779956	243 362	618 617	28 941	9 087	900 007	282 823	726 461	26 610	9 808	1 043 184
MP301:Albert Luthuli	37 727	137 936	3 683	1 061	180407	39 093	140 497	6 733	1 429	187 761	37 159	142 935	4 782	1 135	186 010
MP302: Msukaligwa	32 179	66 665	2 895	1 216	102956	35 124	83 713	4 394	1 582	124 812	42 016	102 668	3 319	1 375	149 377
MP303: Mkhondo	23 575	72 004	1 967	610	98156	31 513	107 381	3 571	612	143 077	36 612	132 089	2 432	848	171 982
MP304: Pixley Ka Seme	16 404	49 533	2 057	500	68494	17 643	59 762	2 771	561	80 737	18 035	62 223	2 378	599	83 235
MP305: Lekwa	27 700	65 768	2 608	1 148	87224	31 103	67 333	3 573	1 356	103 366	34 951	76 885	3 479	1 348	116 662
MP306: Dipaleseng	12 856	23 279	1 417	616	38168	11 595	24 623	1 721	679	38 618	13 421	27 039	1 480	450	42 390
MP307:Govan Mbeki	76 873	121 058	4 017	2 601	204549	77 283	135 308	6 179	2 978	221 747	100 428	182 612	7 644	3 854	294 538
DC31: Nkangala	273 917	638 332	24 607	11 816	948771	282 382	688 401	34 216	13 414	1 018 422	383 684	862 348	44 603	17 714	1 308 129
MP311:Victor Khanye	17 527	32 838	1 543	739	52647	17 479	35 896	2 117	843	56 336	24 897	47 162	2 281	1 113	75 462
MP312: Emalahleni	86 253	135 198	5 691	4 810	231952	98 519	165 284	7 289	5 320	276 413	139 620	238 876	10 590	6 380	395 466
MP313:Steve Tshwete	50 267	77 135	3 277	2 208	132887	49 329	87 192	4 089	2 162	142 772	86 230	133 603	6 138	3 860	229 832
MP314: Emakhazeni	11 111	23 036	1 115	445	35707	12 840	27 956	1 608	603	43 007	13 932	31 052	1 566	666	47 216
MP315: Thembisile	54 419	177 315	6 042	2 085	239 861	56 059	189 190	8 769	2 864	256 883	68 503	226 426	12 051	3 479	310 458
MP316:Dr JS Moroka	54 340	190 811	6 939	1 628	253718	48 166	182 883	10 344	1 921	243 315	50 382	185 230	11 878	2 216	249 706
DC32: Ehlanzeni	336 268	938 339	39 830	26 636	1340771	369 900	995 478	63 468	28 279	1 447 126	424 386	1 187 911	63 946	22 380	1 688 616
MP321:Thaba Chweu	21 360	38 043	2 018	1 183	62604	28 628	48 708	2 874	1 470	81 681	33 899	60 078	2 970	1 441	98 387
MP322: Mbombela	110 637	285 176	10 880	8 801	416494	132 322	318 577	15 633	10 371	476 904	166 008	396 335	16 662	9 790	588 794
MP323: Umjindi	14 939	29 033	967	600	45539	17 795	33 831	1 348	771	53 744	20 138	44 698	1 531	789	67 156
MP324: Nkomazi	62 341	202 636	7 580	3 558	276116	80 092	237 996	11 892	4 688	334 669	92 955	286 549	9 997	3 530	393 030
MP325: Bushbuckridge	126 988	383 452	18 186	12 394	541020	111 063	356 365	21 721	10 979	500 128	111 400	400 252	22 786	6 810	641 248
Mpumalanga	837497	2 100 913	82 885	48 204	3087498	895 844	2 302 498	118 624	69 790	3 386 664	1 090 686	2 776 711	123 961	49 682	4 039 939

Source: Census 2011 Municipal report – Mpumalanga

The majority of residents of Bushbuckridge has some secondary education (87 603), followed by Grade 12 (69 824), no schooling (60 737), some primary education (32 629), higher education (20 210) and completed primary school (10 811).

Table 14: Distribution of the population aged 20 years and older by highest level of education attained, sex and municipality – 1996, 2001 and 2011

MP326: Bushbuckridge	1996			2001			2011		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
No schooling	33 493	58 448	91 941	29 538	57 698	87 236	16 300	34 436	50 737
Some primary	10 850	15 049	25 899	13 382	17 925	31 307	13 278	19 352	32 629
Complete primary	4 703	6 657	11 360	4 662	5 850	10 512	4 506	6 405	10 911
Some secondary	24 615	30 779	55 395	22 440	29 057	51 497	39 214	48 389	87 603
Std 10/ Grade 12	16 234	20 870	37 104	11 327	16 035	27 362	29 030	40 794	69 824
Higher	4 377	4789	9 166	5 553	7 993	13 546	7 915	12 294	20 210
Total	94 272	136 682	230 884	86 902	134 559	221 461	110 242	161 672	271 914

Source: Census 2011 Municipal report – Mpumalanga

The majority residents by far in Bushbuckridge Local Municipality have indicated that they do attend school.

Table 15: Distribution of the population aged between 5 and 24 years by school attendance, sex and municipality – 1996, 2001 and 2011

MP325: Bushbuckridge									
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Attending	104 132	108 581	212 713	102 712	101 408	204 120	102 653	97 388	200 041
Not Attending	31 230	37 345	68 576	26 380	33 472	59 852	22 699	28 289	50 988
Total	135 362	145 926	281 287	129 092	134 880	263 972	126 352	126 677	251 029

Source: Census 2011 Municipal report – Mpumalanga

The unemployment rate in the local municipality has gone down since 2001, from 62.7% to 52.6% in 2011. This is, however, still significantly higher (double) than the current National unemployment rate of 26.6%. It is also by far the highest of all the local municipalities in the province.

Table 16: Distribution of the population aged between 15 and 64 years by employment status – 1996, 2001 and 2011

	Employed			Unemployed			Unemployment rates		
Municipality	1996	2001	2011	1996	2001	2011	1996	2001	2011
DC30: Gert Sibande	**184 688**	**178 078**	**252 046**	**88 613**	**134 114**	**107 383**	**32,7**	**42,8**	**29,9**
MP301: Albert Luthuli	20 357	20 463	28 593	22 038	22 416	15 878	52,0	52,3	35,7
MP302: Msukaligwa	29 300	27 998	40 519	10 382	17 353	14 707	26,2	38,3	26,6
MP303: Mkhondo	21 550	24 216	29 888	10 524	20 476	16 954	32,8	45,8	36,2
MP304: Pixley Ka Seme	13 270	11 704	13 904	6 558	12 034	7 871	33,1	50,7	36,1
MP305: Lekwa	25 864	26 510	33 334	8 229	15 277	11 637	24,1	36,6	25,9
MP306: Dipaleseng	8 283	7 566	10 483	4 065	6 393	6 207	32,9	45,8	37,2
MP307: Govan Mbeki	65 963	60 619	95 324	27 818	40 165	34 109	29,7	39,9	26,4
DC31: Nkangala	**210 284**	**198 932**	**348 936**	**114 248**	**155 081**	**150 228**	**35,2**	**43,8**	**30,2**
MP311: Victor Khanye	13 416	13 224	21 510	7 119	9 804	8 490	34,7	42,6	28,3
MP312: Emalahleni	74 996	76 583	135 277	27 168	47 677	51 210	26,6	38,4	27,5
MP313: Steve Tshwete	45 923	41 619	81 810	11 311	22 785	20 325	19,8	35,4	19,9
MP314: Emakhazeni	10 297	11 680	13 360	3 462	5 016	4 699	25,2	30,0	26,0
MP315: Thembisile	34 908	33 451	61 291	30 973	35 173	36 058	47,0	51,3	37,0
MP316: Dr JS Moroka	30 744	22 374	33 688	34 215	34 606	29 444	52,7	60,7	46,6
DC32: Ehlanzeni	**222 130**	**247 810**	**348 437**	**126 164**	**186 038**	**184 428**	**36,0**	**42,7**	**34,7**
MP321: Thaba Chweu	21 729	27 916	34 112	4 988	9 384	9 116	18,7	25,2	21,1
MP322: Mbombela	96 463	108 453	160 823	38 889	65 646	63 567	28,7	37,7	28,3
MP323: Umjindi	16 556	17 854	20 894	4 562	6 395	7 681	21,6	26,4	26,9
MP324: Nkomazi	40 149	55 008	72 588	21 446	38 855	37 881	34,8	41,4	34,3
MP325: Bushbuckridge	47 233	38 580	60 459	55 279	64 759	67 041	53,9	62,7	52,6
Mpumalanga	**617 000**	**626 818**	**846 417**	**329 026**	**474 214**	**442 017**	**34,8**	**43,1**	**31,9**

Source: Census 2011 Municipal report – Mpumalanga

The average household size in the Bushbuckridge Local Municipality is 4, down from 4.6 in 2001 and 4.8 in 1996. The number of households in Bushbuckridge is 134 197, the second highest in the district, after Mbombela, which has 161 773 households.

Table 17: Average household size by municipality – 1996, 2001 and 2011

	Total Population			Total Number of Households			Average Household size		
Municipality	1996	2001	2011	1996	2001	2011	1996	2001	2011
DC30: Gert Sibande	**770 863**	**874 438**	**1 012 736**	**173 053**	**211 818**	**273 480**	**4,6**	**4,1**	**3,7**
MP301: Albert Luthuli	180 754	184 050	183 314	35 543	39 652	47 705	5,1	4,6	3,8
MP302: Msukaligwa	102 537	121 723	143 632	24 876	29 689	40 932	4,1	4,1	3,5
MP303: Mkhondo	97 113	139 827	168 206	18 697	27 888	37 433	5,2	5,0	4,5
MP304: Pixley Ka Seme	68 887	79 406	82 256	14 538	18 002	19 838	4,7	4,4	4,1
MP305: Lekwa	87 569	99 891	111 510	20 463	25 199	31 071	4,3	4,0	3,6
MP306: Dipaleseng	38 902	38 248	41 793	9 450	9 474	12 637	4,1	4,0	3,3
MP307: Govan Mbeki	195 192	211 291	282 024	49 487	61 714	83 874	3,9	3,4	3,4
DC31: Nkangala	**848 563**	**893 262**	**1 275 822**	**207 280**	**245 429**	**368 811**	**4,6**	**4,0**	**3,6**
MP311: Victor Khanye	52 727	54 873	73 667	12 471	13 428	20 548	4,2	4,1	3,6
MP312: Emalahleni	228 246	264 265	382 464	56 290	74 917	119 874	4,1	3,5	3,2
MP313: Steve Tshwete	131 992	138 707	217 073	33 619	36 229	64 971	3,9	3,8	3,3
MP314: Emakhazeni	35 832	39 833	45 642	9 272	9 723	13 722	3,9	4,1	3,3
MP315: Thembisile	240 791	254 730	308 890	47 472	57 548	75 634	5,1	4,4	4,1
MP316: Dr JS Moroka	256 965	240 855	248 186	48 165	53 583	62 162	5,3	4,5	4,0
DC32: Ehlanzeni	**1 338 198**	**1 390 864**	**1 651 016**	**289 458**	**328 377**	**445 087**	**4,6**	**4,2**	**3,7**
MP321: Thaba Chweu	62 348	70 950	91 990	20 071	21 257	33 352	3,1	3,3	2,8
MP322: Mbombela	413 545	452 184	573 877	91 584	112 321	161 773	4,5	4,0	3,5
MP323: Umjindi	48 547	53 744	67 156	11 613	14 459	19 563	4,2	3,7	3,4
MP324: Nkomazi	277 864	334 668	393 030	53 043	71 840	96 202	5,2	4,7	4,1
MP325: Bushbuckridge	544 130	494 779	537 725	113 147	108 500	134 197	4,8	4,6	4,0
Mpumalanga	**3 056 704**	**3 268 562**	**3 938 572**	**669 801**	**785 424**	**1 076 488**	**4,6**	**4,1**	**3,7**

Source: Census 2011 Municipal report – Mpumalanga

128 670 of people living in Bushbuckridge reside in formal dwellings, followed by 3 634 in traditional dwellings and 1 597 in informal dwellings.

Table 18: Distribution of households by type of main dwelling and municipality – 1996, 2001 and 2011

	Formal			Traditional			Informal		
Municipality	1996	2001	2011	1996	2001	2011	1996	2001	2011
DC30: Gert Sibande	88168	119 445	197 881	130444	45 307	27 145	82947	48 887	45 936
MP301: Albert Luthuli	17693	23 164	36 497	42462	13 747	7 994	39726	2 740	2 857
MP302: Msukaligwa	15243	19 428	30 827	14527	6 210	3 993	2947	4 051	5 715
MP303: Mkhondo	6909	10 765	24 399	5486	14 998	11 048	3931	2 124	1 150
MP304: Pixley Ka Seme	7017	10 523	16 227	10779	5 376	3 103	854	2 103	1 448
MP305: Lekwa	11811	13 692	22 858	5523	2 849	570	1869	8 657	7 414
MP306: Dipaleseng	3992	5 459	8 521	3054	704	70	5335	3 311	3 985
MP307: Govan Mbeki	25501	36 413	59 552	1581	1 422	366	3457	23 879	23 365
DC31: Nkangala	146176	183 489	286 362	1611	18 064	8 648	21333	43 898	49 614
MP311: Victor Khanye	7985	8 334	16 291	20879	1 167	521	36854	3 926	3 158
MP312: Emalahleni	39634	50 254	92 597	1638	4 851	2 721	2643	19 813	23 138
MP313: Steve Tshwete	24765	26 776	53 929	2952	3 516	1 102	12901	5 937	9 190
MP314: Emakhazeni	5558	6 622	11 229	3170	2 226	736	5172	874	1 537
MP315: Thembisile	29756	45 877	64 774	1945	3 603	2 875	1598	8 068	7 678
MP316: Dr JS Moroka	38476	45 605	56 531	6781	2 701	692	10102	5 277	4 813
DC32: Ehlanzeni	202074	284 486	408 483	4384	38 426	12 486	4439	26 457	21 367
MP321: Thaba Chweu	14696	14 603	24 881	57103	1 899	1 316	16368	4 755	6 790
MP322: Mbombela	69143	95 190	149 966	2245	6 884	2 737	2690	10 246	7 816
MP323: Umjindi	7587	9 328	16 171	1751	1 890	858	2 124	3 194	2 357
MP324: Nkomazi	32192	54 990	88 775	18 155	12 900	3 950	1 930	3 803	2 797
MP325: Bushbuckridge	78456	90 383	128 670	30 949	14 852	3 634	2 442	3 265	1 597
Mpumalanga	438414	587 409	801 696	30948	101 796	48 288	2442	116 220	116 806

Source: Census 2011 Municipal report – Mpumalanga

The majority of residents of Bushbuckridge own their homes (95 019 fully paid off and 2 812 not paid off). 4 909 rent accommodation and 29 185 occupy their residences rent-free.

Table 19: Distribution of households by tenure status and municipality – 2001 and 2011

	Owned and fully paid off		Owned but not yet paid off		Rented		Occupied rent-free	
Municipalities	2001	2011	2001	2011	2001	2011	2001	2011
DC30: Gert Sibande	80 684	110 849	22 660	27 748	51 811	72 883	58 484	63 422
MP301: Albert Luthuli	23 026	24 241	1 917	2 601	2 596	5 284	12 113	14 069
MP302: Msukaligwa	10 371	14 276	2 837	3 504	8 122	13 409	8 359	8 033
MP303: Mkhondo	8 018	14 772	2 878	4 742	5 801	6 804	11 191	9 201
MP304: Pixley Ka Seme	5 344	6 438	1 326	1 495	6 759	5 972	4 575	5 446
MP305: Lekwa	7 353	12 200	2 901	3 326	6 720	8 915	8 226	5 846
MP306: Dipaleseng	5 071	6 518	661	688	1 669	2 569	2 073	2 678
MP307: Govan Mbeki	21 501	32 204	10 141	11 389	20 144	30 029	9 928	8 149
DC31: Nkangala	122 297	178 878	30 611	30 394	33 688	82 184	58 861	53 246
MP311: Victor Khanye	5 761	9 383	1 144	1 653	2 197	4 708	4 325	4 059
MP312: Emalahleni	25 552	38 519	15 492	15 798	16 216	39 463	17 657	22 874
MP313: Steve Tshwete	13 262	20 877	7 572	9 010	10 941	27 038	4 455	7 254
MP314: Emakhazeni	3 181	6 090	1 838	1 148	1 925	3 881	2 779	1 894
MP315: Thembisile	37 713	55 574	2 772	2 017	1 265	4 400	15 798	10 686
MP316: Dr JS Moroka	36 828	49 437	1 794	1 769	1 124	2 702	13 838	6 478
DC32: Ehlanzeni	186 266	288 257	23 111	22 823	26 316	63 098	83 686	79 336
MP321: Thaba Chweu	6 797	10 756	2 572	1 715	7 201	15 137	4 688	4 511
MP322: Mbombela	70 344	95 150	9 960	12 318	12 112	28 046	19 904	23 241
MP323: Umjindi	4 312	8 899	2 308	1 296	2 344	5 070	5 494	3 898
MP324: Nkomazi	33 487	58 432	4 060	4 682	2 851	9 936	31 442	18 500
MP325: Bushbuckridge	80 325	95 019	4 212	2 812	1 806	4 909	22 157	29 185
Mpumalanga	388 248	668 786	76 382	80 963	111 786	218 276	189 000	186 002

Source: Census 2011 Municipal report – Mpumalanga

Table 20: Distribution of households with a radio, television, refrigerator, computer, cellphone, landline/telephone and access to internet by municipality – 2001 and 2011

	Radio		Television		Refrigerator		Cellphone		Landline		Computer		Internet
Municipalities	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2011
DC30: Gert Sibande	**160 606**	**192 949**	**102 250**	**206 966**	**90 700**	**183 289**	**82 070**	**246 433**	**34 008**	**20 703**	**10 828**	**44 763**	**86 728**
MP301: Albert Luthuli	29 779	33 529	15 896	34 262	15 668	31 114	10 015	42 616	3 590	1 284	586	4 321	11 339
MP302: Msukaligwa	23 646	30 871	15 146	30 179	12 591	25 800	9 094	36 894	4 782	2 715	1 521	6 769	14 158
MP303: Mkhondo	21 322	26 604	11 231	23 993	9 336	19 738	7 113	32 198	2 475	1 640	702	3 431	9 748
MP304: Pixley Ka Seme	14 278	14 994	8 679	15 254	7 508	13 227	4 205	17 761	2 959	1 658	801	2 673	5 600
MP305: Lekwa	19 047	21 917	13 831	25 286	11 713	23 342	7 956	28 487	5 625	2 815	1 573	5 406	10 832
MP306: Dipaleseng	6 883	8 209	4 950	9 432	4 373	8 338	2 017	10 970	1 507	841	340	1 799	3 414
MP307: Govan Mbeki	45 552	56 824	32 316	67 561	29 510	61 730	21 670	77 507	13 070	9 749	5 304	20 353	31 637
DC31: Nkangala	**190 035**	**268 222**	**144 628**	**271 778**	**143 826**	**266 720**	**87 374**	**329 340**	**48 168**	**26 947**	**12 917**	**68 089**	**120 667**
MP311: Victor Khanye	9 750	11 783	6 772	15 423	5 707	13 017	4 146	18 343	1 844	1 201	743	3 094	5 715
MP312: Emalahleni	57 304	82 859	43 023	83 955	41 806	76 634	32 169	111 954	20 215	11 956	6 559	27 189	46 323
MP313: Steve Tshwete	29 290	49 780	22 742	53 281	21 989	48 539	15 199	61 115	10 066	8 322	3 542	17 095	24 234
MP314: Emakhazeni	7 973	10 183	5 272	9 779	5 121	9 192	3 013	12 597	2 438	1 093	504	2 303	4 562
MP315: Thembisile	44 698	58 245	33 914	59 521	34 588	57 927	18 651	70 166	6 030	1 801	883	10 793	23 608
MP316: Dr JS Moroka	41 020	45 371	32 804	49 820	34 415	50 412	14 196	55 164	5 564	1 573	686	7 624	16 226
DC32: Ehlanzeni	**226 382**	**290 187**	**138 603**	**329 048**	**163 993**	**323 368**	**94 881**	**404 170**	**32 781**	**21 649**	**10 022**	**62 084**	**130 691**
MP321: Thaba Chweu	14 808	20 172	9 642	21 249	10 372	19 238	6 204	30 115	4 102	2 373	1 209	5 321	9 322
MP322: Mbombela	80 988	115 278	55 723	125 937	62 970	125 675	39 723	149 084	14 907	12 578	5 994	32 649	57 690
MP323: Umjindi	10 460	13 383	6 866	13 395	6 844	12 625	3 992	17 449	2 275	1 379	782	3 348	6 534
MP324: Nkomazi	44 016	59 553	18 750	64 213	26 401	63 344	17 045	86 101	4 585	2 379	1 058	9 169	23 955
MP325: Bushbuckridge	75 119	81 800	47 622	104 255	47 406	102 477	27 718	121 419	6 912	2 839	979	11 607	33 090
Mpumalanga	**576 933**	**741 358**	**386 381**	**806 784**	**388 318**	**782 369**	**244 125**	**979 942**	**112 943**	**68 186**	**33 767**	**174 946**	**337 986**

Source: Census 2011 Municipal report – Mpumalanga

Table 21, Table 22, Table 23 and Table 24 indicate the extent in which residents of Bushbuckridge have access to services (electricity, piped water, refuse removal and different types of toilet facilities). The number of households with access to all these services has increased from 1996 till 2011, indicating that progress in being made by the municipality in increasing the supply of services to residents.

Table 21: Distribution of households using electricity for lighting, cooking and heating by municipality – 1996, 2001 and 2011

	Lighting			Cooking			Heating		
Municipalities	1996	2001	2011	1996	2001	2011	1996	2001	2011
DC30: Gert Sibande	**70 489**	**121 282**	**227 886**	**64 388**	**82 972**	**172 084**	**62 048**	**57 671**	**136 229**
MP301: Albert Luthuli	8 814	19 987	41 734	4 591	8 361	24 256	4 014	7 523	18 297
MP302: Msukaligwa	10 582	15 741	30 561	9 241	8 684	20 092	8 949	7 917	17 484
MP303: Mkhondo	6 848	9 595	24 997	3 488	4 882	15 458	3 361	4 305	12 494
MP304: Pixley Ka Seme	9 309	12 050	16 907	3 879	4 127	10 379	3 644	4 298	7 767
MP305: Lekwa	9 322	14 953	27 538	8 189	10 821	25 025	7 798	9 716	18 812
MP306: Dipaleseng	6 019	6 379	10 507	2 731	2 676	9 271	2 747	2 554	7 283
MP307: Govan Mbeki	25 576	42 556	75 743	22 270	23 422	67 603	21 536	21 357	53 093
DC31: Nkangala	**161 196**	**194 862**	**306 871**	**88 370**	**117 263**	**281 260**	**81 672**	**116 000**	**216 689**
MP311: Victor Khanye	7 716	8 718	17 437	3 971	3 648	13 052	3 908	3 598	9 018
MP312: Emalahleni	39 554	51 534	88 032	35 239	45 567	84 813	33 283	42 881	75 577
MP313: Steve Tshwete	23 759	27 059	59 026	20 026	19 049	53 113	19 679	19 136	40 953
MP314: Emakhazeni	5 043	6 984	11 474	2 134	3 271	6 794	2 007	3 320	5 088
MP315: Thembisile	39 585	51 048	69 812	10 467	22 314	60 455	9 193	20 735	45 517
MP316: Dr JS Moroka	35 538	49 309	60 091	16 534	23 403	43 024	13 503	25 329	39 536
DC32: Ehlanzeni	**116 810**	**226 236**	**386 616**	**72 312**	**118 658**	**312 483**	**84 681**	**121 056**	**268 338**
MP321: Thaba Chweu	13 617	16 170	28 117	6 860	8 632	23 927	6 283	8 065	20 639
MP322: Mbombela	44 910	81 231	145 922	35 548	59 344	135 542	31 852	55 878	118 202
MP323: Umjindi	5 671	8 222	15 275	4 738	6 592	13 540	4 811	6 701	11 557
MP324: Nkomazi	13 455	34 003	80 153	9 247	18 842	61 940	7 734	18 810	48 694
MP325: Bushbuckridge	38 257	85 609	126 047	15 919	25 246	77 535	14 001	31 602	69 245
Mpumalanga	**343 673**	**541 149**	**829 372**	**216 070**	**288 881**	**746 817**	**198 302**	**293 727**	**619 256**

Source: Census 2011 Municipal report – Mpumalanga

Table 22: Distribution of households by access to piped water and municipality – 1996, 2001 and 2011

	Piped (tap) water in a dwelling or yard			Piped (tap) water on a communal stand			No access to piped (tap) water		
Municipalities	1996	2001	2011	1996	2001	2011	1996	2001	2011
DC30: Gert Sibande	**103 703**	**128 297**	**222 242**	**35 168**	**54 866**	**28 983**	**32 149**	**28 468**	**24 286**
MP301: Albert Luthuli	14 251	18 507	33 510	8 977	11 589	5 506	11 807	9 556	8 690
MP302: Msukaligwa	16 930	20 060	31 955	3 599	6 554	5 135	4 151	3 074	3 841
MP303: Mkhondo	7 096	10 081	21 927	5 460	8 549	7 467	5 923	9 258	8 039
MP304: Pixley Ka Seme	8 842	11 119	16 737	1 055	3 733	1 691	4 486	3 151	0
MP305: Lekwa	14 336	16 948	28 146	3 227	7 455	2 194	2 677	796	731
MP306: Dipaleseng	5 352	7 241	10 679	2 579	1 632	1 270	1 464	601	688
MP307: Govan Mbeki	36 896	44 340	79 289	10 262	15 354	3 700	1 641	2 020	885
DC31: Nkangala	**144 770**	**188 044**	**281 414**	**32 103**	**48 828**	**39 288**	**25 246**	**27 468**	**28 200**
MP311: Victor Khanye	8 412	9 503	17 100	1 880	3 055	2 565	2 045	869	882
MP312: Emalahleni	44 805	54 707	96 241	8 472	15 154	17 361	1 948	5 056	6 273
MP313: Steve Tshwete	27 231	28 094	55 680	2 477	6 643	8 098	2 531	1 492	1 194
MP314: Emakhazeni	6 383	7 539	12 058	635	1 263	1 022	2 095	922	642
MP315: Thembisile	31 699	41 461	66 860	10 388	11 929	5 315	4 743	4 158	3 459
MP316: Dr JS Moroka	26 239	27 740	43 475	8 250	10 884	4 937	11 882	14 959	13 750
DC32: Ehlanzeni	**139 000**	**148 088**	**267 116**	**86 167**	**125 908**	**103 267**	**48 853**	**58 401**	**84 716**
MP321: Thaba Chweu	14 067	15 511	26 604	4 261	4 547	5 018	1 509	1 200	1 730
MP322: Mbombela	59 501	60 887	104 779	17 468	36 226	21 272	11 446	15 208	35 723
MP323: Umjindi	6 908	8 876	14 615	2 791	3 550	3 851	1 657	2 033	1 096
MP324: Nkomazi	24 709	26 708	55 528	15 417	35 320	22 631	11 761	9 812	18 042
MP325: Bushbuckridge	33 816	34 087	55 588	56 220	46 265	50 485	20 479	28 149	28 124
Mpumalanga	**387 474**	**443 409**	**770 770**	**163 419**	**229 701**	**169 518**	**104 248**	**112 313**	**135 200**

Source: Census 2011 Municipal report – Mpumalanga

Table 23: Distribution of households by type of refuse removal and municipality – 1996, 2001 and 2011

	Removed by local authorities			Communal/ own refuse dump			No rubbish disposal		
Municipalities	1996	2001	2011	1996	2001	2011	1996	2001	2011
DC30: Gert Sibande	**80 743**	**116 631**	**178 690**	**86 088**	**74 384**	**73 221**	**14 169**	**20 603**	**21 787**
MP301: Albert Luthuli	4 514	5 453	9 695	25 512	27 579	31 060	4 762	6 620	6 515
MP302: Msukaligwa	16 190	19 454	27 395	7 057	8 524	9 819	1 195	1 711	3 313
MP303: Mkhondo	5 667	9 272	12 916	9 769	12 461	17 191	3 071	6 155	6 705
MP304: Pixley Ka Seme	7 501	9 335	12 528	5 689	6 507	5 240	1 127	2 160	2 015
MP305: Lekwa	11 736	14 885	25 808	7 307	8 500	3 961	1 093	1 814	1 223
MP306: Dipaleseng	5 956	6 270	10 376	3 263	2 926	1 493	108	278	699
MP307: Govan Mbeki	39 180	51 963	77 873	6 488	7 886	4 458	2 805	1 865	1 296
DC31: Nkangala	**90 414**	**108 322**	**177 420**	**100 221**	**114 826**	**154 804**	**13 683**	**24 281**	**22 348**
MP311: Victor Khanye	7 986	8 591	15 558	3 480	4 211	4 137	773	625	717
MP312: Emalahleni	40 316	50 013	82 287	12 453	20 418	28 493	2 771	4 486	8 154
MP313: Steve Tshwete	25 441	30 890	56 071	6 668	4 391	7 138	1 187	949	1 568
MP314: Emakhazeni	4 629	6 417	10 092	3 031	2 623	2 849	1 428	683	588
MP315: Thembisile	5 216	2 393	3 860	37 065	45 090	64 386	4 498	10 065	6 873
MP316: Dr JS Moroka	6 827	8 018	9 552	37 524	38 092	47 902	2 927	7 473	4 446
DC32: Ehlanzeni	**63 281**	**87 287**	**116 124**	**191 654**	**223 147**	**283 630**	**39 488**	**37 943**	**40 886**
MP321: Thaba Chweu	11 747	12 878	21 490	6 121	6 965	9 815	1 804	1 415	1 770
MP322: Mbombela	23 210	29 806	49 593	59 931	74 395	99 202	6 895	8 119	11 613
MP323: Umjindi	6 569	9 981	13 604	2 994	3 876	5 066	1 902	601	805
MP324: Nkomazi	6 247	7 732	20 604	36 737	54 330	63 056	9 318	9 779	10 821
MP325: Bushbuckridge	5 508	6 890	10 833	85 871	83 581	106 391	19 568	18 030	15 856
Mpumalanga	**234 437**	**280 240**	**470 136**	**368 981**	**412 357**	**511 655**	**87 228**	**82 827**	**84 979**

Source: Census 2011 Municipal report – Mpumalanga

Table 24: Distribution of households by type of toilet facility and municipality – 1996, 2001 and 2011

	Flush/ chemical toilets			Pit latrines			Bucket toilets			No toilets		
Municipalities	**1996**	**2001**	**2011**	**1996**	**2001**	**2011**	**1996**	**2001**	**2011**	**1996**	**2001**	**2011**
DC30: Gert Sibande	**83 445**	**107 882**	**183 521**	**64 430**	**84 197**	**88 783**	**17 391**	**15 607**	**2 152**	**18 681**	**23 932**	**13 758**
MP301: Albert Luthuli	4 494	6 990	10 747	26 923	28 146	32 796	1 308	1 425	473	2 627	3 090	2 476
MP302: Msukaligwa	15 320	20 447	30 143	4 659	6 017	6 139	2 959	794	457	1 854	2 430	1 987
MP303: Mkhondo	5 162	8 869	16 621	8 109	12 011	13 962	1 861	1 059	210	3 492	5 950	4 823
MP304: Pixley Ka Seme	6 609	9 434	13 048	4 064	5 639	5 533	2 453	828	109	1 339	2 102	907
MP305: Lekwa	12 383	14 547	26 900	3 386	3 689	1 980	1 652	3 036	316	2 961	3 927	1 280
MP306: Dipaleseng	3 902	5 384	9 791	2 448	1 517	1 857	2 696	1 828	101	361	745	766
MP307: Govan Mbeki	35 575	42 312	76 270	4 842	7 177	4 495	4 463	6 537	485	4 047	5 688	1 519
DC31: Nkangala	**89 884**	**110 713**	**185 818**	**104 780**	**119 693**	**162 638**	**3 678**	**3 288**	**4 668**	**8 168**	**11 866**	**8 904**
MP311: Victor Khanye	7 839	9 150	16 806	3 086	2 695	2 072	1 206	1 001	705	306	581	465
MP312: Emalahleni	42 943	53 595	85 715	9 848	14 936	28 034	879	1 171	726	2 344	5 215	2 987
MP313: Steve Tshwete	26 658	29 592	55 191	4 119	3 773	5 766	544	439	2 050	2 149	2 425	1 381
MP314: Emakhazeni	5 259	7 079	10 781	2 460	1 287	1 476	59	127	178	1 406	1 231	894
MP315: Thembisile	2 452	4 250	7 613	43 796	51 741	64 429	150	200	678	817	1 358	1 963
MP316: Dr JS Moroka	4 533	7 048	9 712	41 471	45 162	50 861	740	330	221	1 134	1 044	1 215
DC32: Ehlanzeni	**61 658**	**71 088**	**116 463**	**193 663**	**195 870**	**274 483**	**1 167**	**2 001**	**2 655**	**41 340**	**58 407**	**46 287**
MP321: Thaba Chweu	12 281	13 522	22 945	6 610	6 515	8 788	122	81	180	875	1 140	980
MP322: Mbombela	24 450	30 314	54 649	60 343	69 585	92 000	304	807	1 239	6 005	11 613	11 623
MP323: Umjindi	6 092	8 766	12 732	2 873	4 106	5 515	29	101	118	2 662	1 487	845
MP324: Nkomazi	4 030	6 789	13 924	33 639	41 688	64 696	193	448	499	14 970	20 914	14 873
MP325: Bushbuckridge	4 806	9 707	12 203	90 187	73 976	103 465	508	564	618	16 927	24 253	16 966
Mpumalanga	**224 788**	**289 783**	**485 781**	**362 883**	**379 660**	**493 864**	**22 127**	**20 778**	**9 386**	**68 177**	**85 184**	**67 948**

Source: Census 2011 Municipal report – Mpumalanga

Table 25: Distribution of average household income by municipality – 2001 and 2011

Municipalities	**2001**	**2011**
DC30: Gert Sibande	**33 662**	**84 177**
MP301: Albert Luthuli	22 832	48 790
MP302: Msukaligwa	31 461	82 167
MP303: Mkhondo	26 935	53 398
MP304: Pixley Ka Seme	23 399	64 990
MP305: Lekwa	38 113	88 440
MP306: Dipaleseng	19 454	61 492
MP307: Govan Mbeki	47 983	125 480
DC31: Nkangala	**36 177**	**89 006**
MP311: Victor Khanye	35 281	80 239
MP312: Emalahleni	51 130	120 492
MP313: Steve Tshwete	55 369	134 026
MP314: Emakhazeni	36 170	72 310
MP315: Thembisile	18 229	45 864
MP316: Dr JS Moroka	17 328	40 421
DC32: Ehlanzeni	**28 606**	**64 403**
MP321: Thaba Chweu	35 795	82 354
MP322: Mbombela	37 779	92 663
MP323: Umjindi	35 244	81 864
MP324: Nkomazi	19 195	45 731
MP325: Bushbuckridge	17 041	36 569
Mpumalanga	**31 188**	**77 587**

Source: Census 2011 Municipal report – Mpumalanga

53.3% of households in Bushbuckridge are headed by females. This is higher than all the other local municipalities in the province.

Table 26: Distribution of female headed households by municipality – 1996, 2001 and 2011

	Number of households headed by women			Total Number of Households			% of female headed households		
Municipality	1996	2001	2011	1996	2001	2011	1996	2001	2011
DC30: Gert Sibande	**66 404**	**84 061**	**108 211**	**173 063**	**211 618**	**273 490**	**32,0**	**39,7**	**38,8**
MP301: Albert Luthuli	16 828	20 783	23 527	35 543	39 652	47 705	47,3	52,4	49,3
MP302: Msukaligwa	6 452	10 843	15 453	24 876	29 689	40 932	25,9	36,5	37,8
MP303: Mkhondo	5 933	12 752	16 944	18 697	27 888	37 433	31,7	45,7	45,3
MP304: Pixley Ka Seme	4 727	8 079	8 956	14 538	18 002	19 838	32,5	44,9	45,1
MP305: Lekwa	5 270	8 601	11 089	20 463	25 199	31 071	25,8	34,1	35,7
MP306: Dipaleseng	2 337	3 336	4 446	9 450	9 474	12 637	24,7	35,2	35,2
MP307: Govan Mbeki	13 856	19 657	25 797	49 487	61 714	83 874	28,0	31,9	30,8
DC31: Nkangala	**73 860**	**103 147**	**128 234**	**207 290**	**245 429**	**368 911**	**35,6**	**42,0**	**34,2**
MP311: Victor Khanye	2 747	3 893	6 213	12 471	13 428	20 548	22,0	29,0	30,2
MP312: Emalahleni	12 542	24 583	33 468	56 290	74 917	119 874	22,3	32,8	27,9
MP313: Steve Tshwete	7 611	10 705	19 101	33 619	36 229	64 971	22,6	29,5	29,4
MP314: Emakhazeni	2 635	3 598	4 921	9 272	9 723	13 722	28,4	37,0	35,9
MP315: Thembisile	23 304	30 124	34 896	47 472	57 548	75 634	49,1	52,3	46,1
MP316: Dr JS Moroka	24 810	30 245	30 635	48 165	53 583	62 162	51,5	56,4	49,3
DC32: Ehlanzeni	**121 788**	**160 735**	**196 268**	**289 468**	**328 377**	**445 087**	**42,1**	**45,9**	**44,1**
MP321: Thaba Chweu	6 559	7 995	11 078	20 071	21 257	33 352	32,7	37,6	33,2
MP322: Mbombela	31 780	44 919	62 986	91 584	112 321	161 773	34,7	40,0	38,9
MP323: Umjindi	2 540	4 448	6 836	11 613	14 458	19 563	21,9	30,8	34,9
MP324: Nkomazi	23 192	33 058	43 860	53 043	71 840	96 202	43,7	46,0	45,6
MP325: Bushbuckridge	57 697	60 314	71 509	113 147	108 500	134 197	51,0	55,6	53,3
Mpumalanga	**250 822**	**337 933**	**431 712**	**668 801**	**785 424**	**1 076 488**	**37,4**	**43,0**	**40,1**

Source: Census 2011 Municipal report – Mpumalanga

2% (2 629) of households in Bushbuckridge are headed by children. This is significantly higher than in the rest of the province.

Table 27: Distribution of child headed households by municipality – 1996, 2001 and 2011

	Child headed households			Total Number of Households			% of households headed by children		
Municipality	1996	2001	2011	1996	2001	2011	1996	2001	2011
DC30: Gert Sibande	**1 782**	**1 884**	**1 886**	**173 063**	**211 618**	**273 490**	**1,0**	**0,9**	**0,7**
MP301: Albert Luthuli	692	630	547	35 543	39 652	47 705	1,9	1,6	1,1
MP302: Msukaligwa	189	185	245	24 876	29 689	40 932	0,8	0,6	0,6
MP303: Mkhondo	190	311	394	18 697	27 888	37 433	1,0	1,1	1,1
MP304: Pixley Ka Seme	139	256	246	14 538	18 002	19 838	1,0	1,4	1,2
MP305: Lekwa	141	171	107	20 463	25 199	31 071	0,7	0,7	0,3
MP306: Dipaleseng	73	93	56	9 450	9 474	12 637	0,8	1,0	0,4
MP307: Govan Mbeki	338	248	300	49 487	61 714	83 874	0,7	0,4	0,4
DC31: Nkangala	**3 612**	**3 486**	**2 012**	**207 290**	**245 429**	**368 911**	**1,7**	**1,4**	**0,6**
MP311: Victor Khanye	71	48	89	12 471	13 428	20 548	0,6	0,4	0,4
MP312: Emalahleni	264	383	357	56 290	74 917	119 874	0,5	0,5	0,3
MP313: Steve Tshwete	189	99	219	33 619	36 229	64 971	0,6	0,3	0,3
MP314: Emakhazeni	98	42	66	9 272	9 723	13 722	1,1	0,4	0,5
MP315: Thembisile	1 391	1 336	644	47 472	57 548	75 634	2,9	2,3	0,9
MP316: Dr JS Moroka	1 499	1 578	637	48 165	53 583	62 162	3,1	2,9	1,0
DC32: Ehlanzeni	**6 276**	**6 748**	**6 406**	**289 468**	**328 377**	**445 087**	**2,2**	**1,8**	**1,2**
MP321: Thaba Chweu	235	187	157	20 071	21 257	33 352	1,2	0,9	0,5
MP322: Mbombela	1 091	1 134	1 047	91 584	112 321	161 773	1,2	1,0	0,6
MP323: Umjindi	47	60	110	11 613	14 458	19 563	0,4	0,4	0,6
MP324: Nkomazi	1 068	1 154	1 463	53 043	71 840	96 202	2,0	1,6	1,5
MP325: Bushbuckridge	3 835	3 213	2 629	113 147	108 500	134 197	3,4	3,0	2,0
Mpumalanga	**11 660**	**11 127**	**9 311**	**668 801**	**785 424**	**1 076 488**	**1,7**	**1,4**	**0,9**

Source: Census 2011 Municipal report – Mpumalanga