

**SPECIALIST REPORT:**

**Assessment of the possible impact of the Proposed 2 x 500 kV  
Transmission Power lines from the Nzhelele Substation (South  
Africa) to Zimbabwe on the game farming industry**

**Commissioned by  
Baagi Environmental Consultancy**



**Compiled by**



**May 2016**



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## EXECUTIVE SUMMARY

Baagi Environmental Consultancy (Baagi EC) was appointed by Eskom Holdings Limited to manage the EIA process for the proposed construction of 2 x 500 kV transmission power lines from the Nzhelele substation (still to be constructed) to the south of Musina (Messina) in Limpopo Province to an unknown substation on the Zimbabwe/South Africa border, north of Musina

During the public participation process concerns were raised as to the impacts of the transmission power lines on the game ranching industry in the area. Baagi EC subsequently appointed **Wild Route Environmental Consultants CC** as independent consultants to perform an assessment of the possible impact of the proposed transmission power lines on the game farming industry in the area.

A site visit was conducted during the week of 16 – 20 May 2016, during which the different alternative corridors, as identified by the EIA process (Figure 2) were travelled following the closest roads. In order to determine the current extend of game ranching, game farms were identified by the type of fencing around the properties (although some cattle farms also had 1.8meter game fencing). The assumption was made that any farm without game fencing does not use game as a primary source of income.

Personal interviews were conducted on farms where the owner/manager could be located. A questionnaire was used for this purpose in order to determine the extent of hunting and the methods and species of game being hunted in the area and possible concerns regarding the transmission power lines planned for the area

The alternative corridors are between 57km and 64km long. Approximately 30% – 40% of corridor 1, 60% of corridor 2,2A and 65% of corridor 2,2B traverses over game farms. From the site visits and interviews it is apparent that the main activity on most of the game farms in the area is hunting (60% on average), but non-hunting eco-tourists make up approximately 40% of the clients.

All the farms visited offer rifle and bow hunting and the general methods of hunting is walk and stalk and hides. Main species hunted include browsers like kudu, nyala and bushbuck, grazers like gemsbok, blue wildebeest and zebra, and mixed feeders like impala and eland as well as warthog and bushpigs. The hunting season is from April till September, which was indicated as the buzziest time of the year. Main concerns regarding the Transmission Power Line were that it is aesthetically ugly. Large reserves (Marimane Nature Reserve in this case), make use of helicopters or aircrafts to count and catch game. The Transmission

Power Line is a big concern to them for this reason and will pose a big safety risk due to the danger of colliding with the power lines.

The main income generating approaches on game ranches in general are 1) Eco-tourism, 2) hunting and 3) intensive breeding/live sales of game. The main impacts investigated are discussed separately for these approaches. Under each approach, the impacts investigated are:

- Visual impact / change to the aesthetic value,
- Loss/degradation of vegetation,
- Increase or spread of alien vegetation,
- Increase in soil erosion,
- Effect on general farm management/security, and
- The effect on animal behavior and diversity

In terms of the alternative corridors investigated, alternative 1 will be the preferred route and will have the lowest impact on game farming in the area. Alternative 2, 2B will have the most significant impact on game farming and the environment being the furthest from any existing infrastructure and no possibility of corridor sharing.

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## INTRODUCTION

Baagi Environmental Consultancy (Baagi EC) was appointed by Eskom Holdings Limited to manage the EIA process for the proposed construction of 2 x 500 kV transmission power lines from the Nzhelele sub station (still to be constructed) to the south of Musina (Messina) in Limpopo Province to an unknown substation on the Zimbabwe/South Africa border, north of Musina (**Figure 1**). The project is currently in the EIA phase, preparing the Draft Environmental Impact Report (DEIR) for public review

During the public participation process concerns were raised as to the impacts of the proposed transmission power lines on the game ranching industry in the area. Baagi EC subsequently appointed **Wild Route Environmental Consultants CC** as independent specialist to perform an assessment of the possible impacts of the proposed transmission power lines on the game farming industry in the area.

The main impacts investigated in this report are:

- Visual impact / change to the aesthetic value,
- Loss/degradation of vegetation,
- Increase in soil erosion,
- Increase or spread of alien vegetation,
- The effect on animal behavior and diversity,
- Effect on general farm management/security

The main income generating approaches on game ranches in general are:

- 1) Eco-tourism,
- 2) Hunting
- 3) Intensive breeding/live sales of game.

The different impacts are discussed for these income generating approaches.

## SCOPE OF WORK/ TERMS OF REFERENCE

The scope of the work includes the following:

- ✦ Determine the extent of commercial game farming/ranching in the study area
- ✦ Determine the impact of the proposed transmission power lines on the game industry in the study area
- ✦ Discuss the impacts on the alternatives corridors and propose mitigation measures for the identified impacts

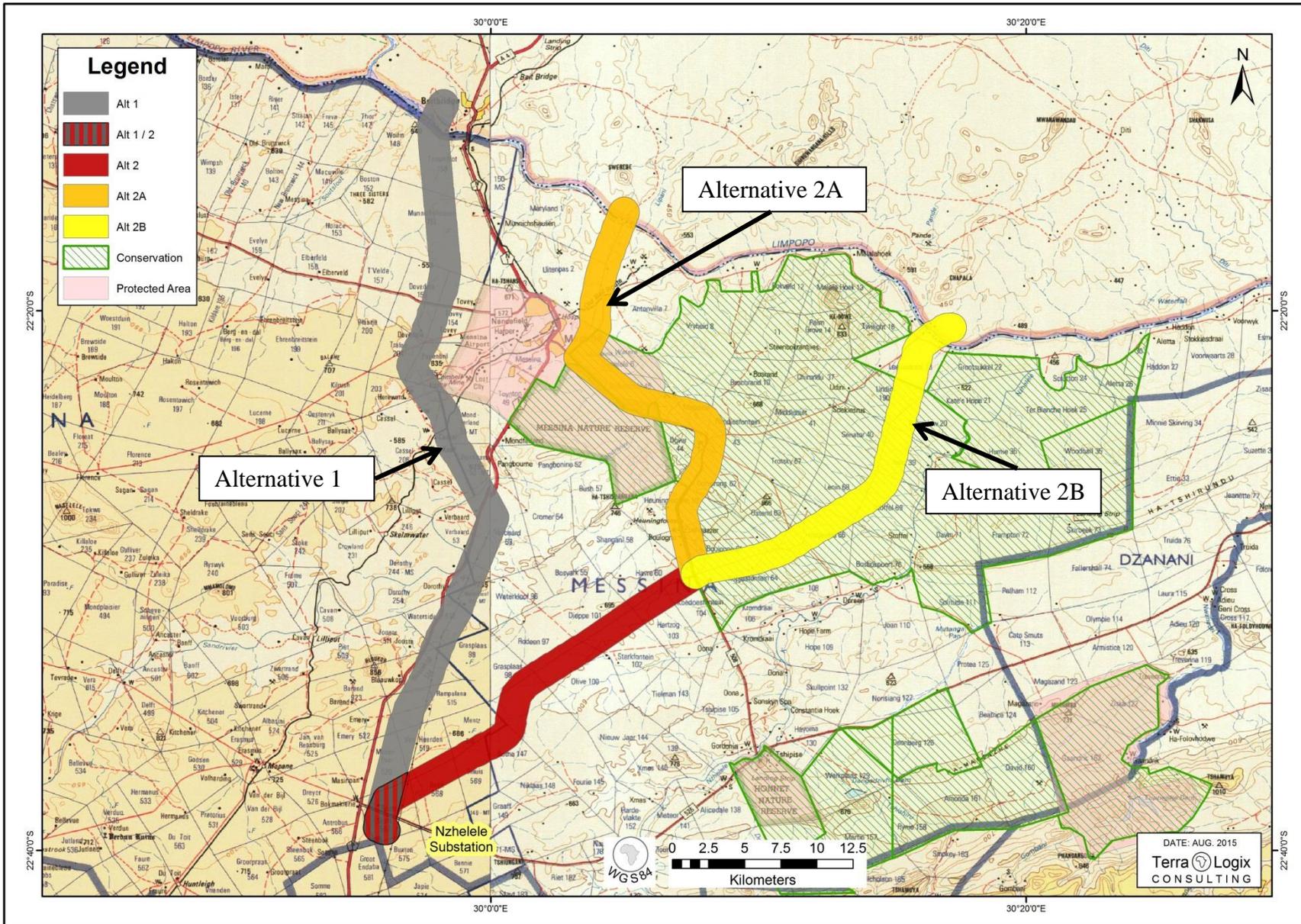


Figure 1: Nzelele Triangle Project alternative routes

## **METHODOLOGY**

The methodology followed included a literature study to identify possible impacts of transmission power lines on different aspects of the game farming/ranching industry. Background information was gathered from other specialist studies done for this project (social impact, visual impact, vegetation impact).

A site visit was conducted during the week of 16 – 20 May 2016, during which the different alternative corridors, as identified by the EIA process (Figure 1) were travelled following the closest roads. In order to determine the current extend of game ranching, game farms were identified by the type of fencing around the properties (although some cattle farms also had 1.8meter game fencing). The assumption was made that any farm without game fencing does not use game as a primary source of income. Currently, a wildlife ranch with suitable fencing (based on minimum specifications set by relevant conservation authority) can qualify for an exemption period of 3 years. The exemption permit then entitles the holder to hunt, capture and sell wild animals year-round.

Personal interviews were conducted on farms where the owner/manager could be located. A questionnaire (Appendix 1) was used for this purpose in order to determine

- Whether hunting takes place on the farm
- What type of hunting takes place
- General hunting methods used
- Main type of game being hunted
- Duration of the hunting season
- Contribution of hunting clients vs ecotourism clients
- Possible concerns regarding the transmission power lines planned for the area

Gathered data was analysed and is presented below.

## IMPACT ANALYSIS

The possible impacts have subsequently been identified and were rated according to the rating system specified by Baagi EC as given below.

Aspect		Definition
Probability		This describes the likelihood of the impact actually occurring
	Description	Definition
	Improbable	The possibility of the impact occurring is very low, due to the circumstances, design or experience.
	Probable	There is a probability that the impact will occur to the extent that provision must be made therefore.
	Highly Probable	It is most likely that the impact will occur at some stage of the development.
	Definite	The impact will take place regardless of any prevention plans and there can only be relied on mitigatory measures or contingency plans to contain the effect.

Aspect		Definition
Duration		The lifetime of the impact
	Description	Definition
	Short Term	The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
	Medium Term	The impact will last up to the end of the phases, where after it will be negated.
	Long Term	The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
	Permanent	The impact is non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Aspect		Definition
Scale		The physical and spatial size of the impact
	Description	Definition
	Local	The impacted area extends only as far as the activity, e.g. footprint
	Site	The impact could affect the whole, or a measurable portion of the above mentioned properties.
	Regional	The impact could affect the area including the neighbouring residential areas.

Aspect		Definition
Magnitude/ Severity		Does the impact destroy the environment, or alter its function
	Description	Definition
	Low	The impact alters the affected environment in such a way that natural processes are not affected.
	Medium	The affected environment is altered, but functions and processes continue in a modified way.
	High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Aspect		Definition
Significance		This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.
	Description	Definition
	Negligible	The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
	Low	The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
	Moderate	The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
	High	The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude/Severity	Low	2
	Medium	6
	High	8
Significance	Sum (Duration, Scale, Magnitude) x Probability	
	Negligible	≤20
	Low	>20 ≤40
	Moderate	>40 ≤60
	High	>60

## STUDY AREA

Today, wildlife ranches are a common sight in South Africa, covering an estimated 22.5 million hectares (Du Toit, 2007). One of the main reasons for this rapid growth in the industry was the introduction of the concept of exempted wildlife ranches by some of the conservation authorities, followed by the transfer of ownership of the wildlife from the state to the ranch owner. The exemption permit then entitles the holder to hunt, capture and sell wild animals year-round.

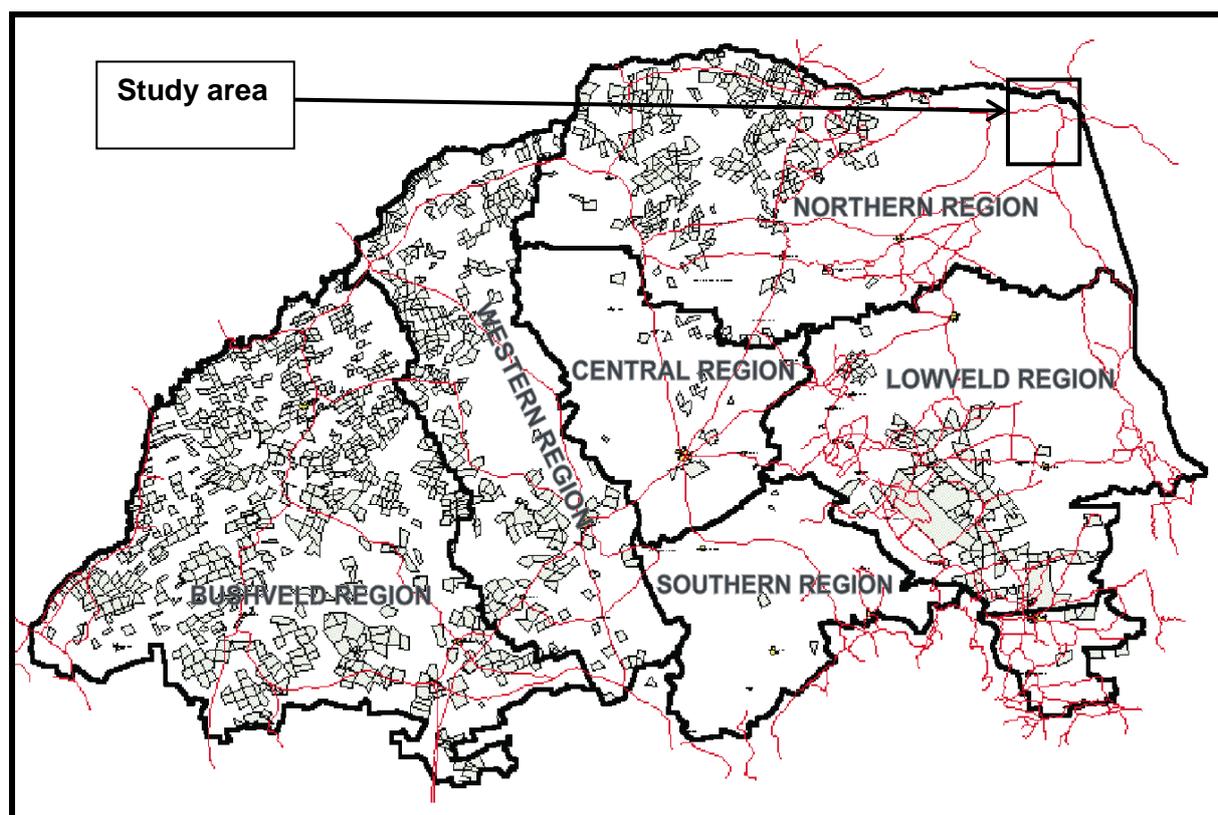
Game ranch management and the management of nature reserves are the two facets of wildlife management. The intensity of management in nature reserves and game ranches depends upon the size of the area. The smaller the game ranch, the greater the intensity of wildlife management required. While the primary goal in nature reserves is to conserve the biodiversity of the area, private ranches are profit seeking businesses in their own right. The majority of such ranches have been converted from livestock farms after it became more economically viable to keep and use wildlife for commercial purposes. Wildlife ranching covers four main subsectors, often referred to as 'pillars', including live game sales, hunting, game meat production and ecotourism. Most ranchers include more than one land use practice in order to diversify and make their operations more profitable. The Endangered Wildlife Trust (EWT, 2016) has recently completed an 18 month national study on the wildlife ranching sector of South Africa, and estimated the economic contribution of these pillars as follows:

- ✦ Live sales generated R4.3 billion during 2014, of which R2.5 billion was generated by private game sales between ranchers (these figures only represented the value of the animals and exclude multiplier effects);
- ✦ Hunting generated R2.6 billion during 2014 (this figure only represents the value of the animals and excludes money spent by hunters on lodging, food and professional hunting fees);
- ✦ Game meat production generated around R610 million; and
- ✦ No estimate was made for ecotourism (previous estimate in 2000 were R40 million)

The Limpopo Province have by far the bulk of these game ranches (almost 50% according to Bothma, 2002) (**Table 1**), although the distribution was more to the west, in the bushveld region of the province, with very few game farms in close proximity of the current study area in the year 2000 (**Figure 2**).

**Table 1:** The mean size (ha), number and regional distribution of the exempted wildlife ranches in South Africa in 2000 (Bothma, 2002)

PROVINCE	MEAN SIZE	NUMBER OF RANCHES	PERCENTAGE OF RANCHES
Limpopo	1339.9	2480	49.0
Northern Cape	4921.0	986	19.5
Eastern Cape	1412.9	624	12.3
North West	1073.7	340	6.7
Mpumalanga	1346.4	205	4.1
Free State	820.8	180	3.6
KwaZulu-Natal	1876.0	92	1.8
Western Cape	3234.2	82	1.6
Gauteng	1139.9	72	1.4
All provinces	2047.8	5061	100.0



**Figure 2:** Geographical distribution of game ranches with exemption permits in relation to sub regions in the Limpopo Province in 2000 (van der Waal & Dekker, 2000)

## Physical geography, fauna and flora of study area

The study area is located in the Savanna Biome. The Savanna Biome is the largest Biome in southern Africa, occupying 46% of its area, and over one-third of South Africa (Low & Rebelo, 1998). Savanna is characterised by a grassy ground layer and a distinct upper layer of woody plants. Where the upper layer is near the ground the vegetation is sometimes referred to as Shrubveld, where it is dense, as Woodland, and the intermediate stages are locally known as Bushveld.

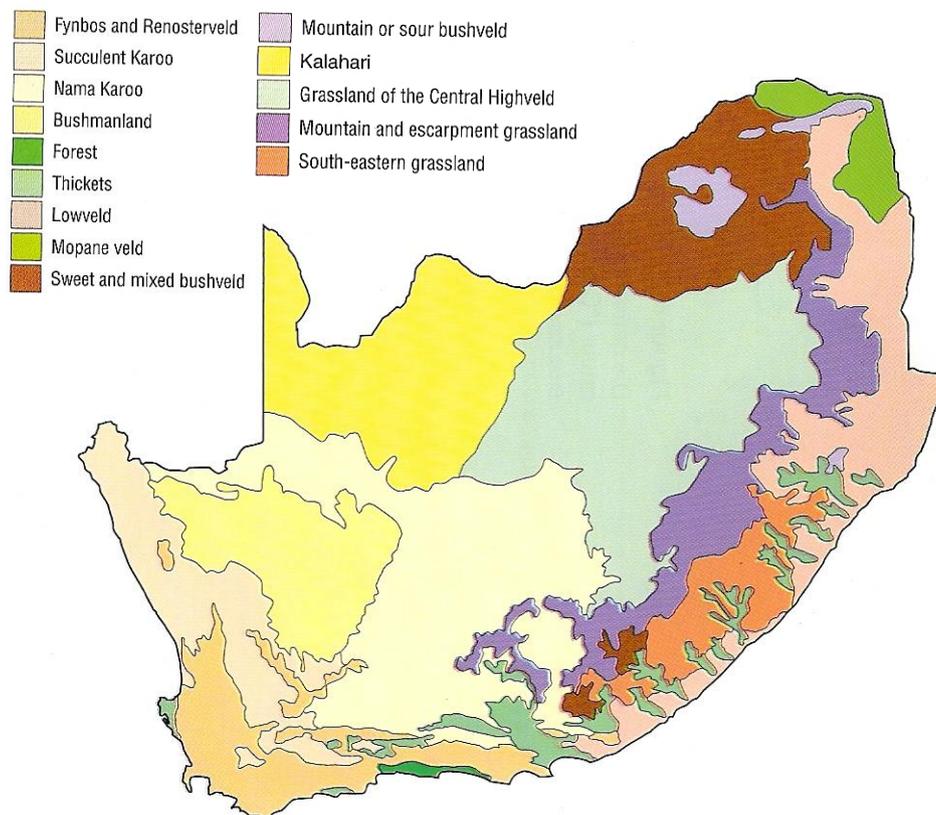
Altitudes ranges from sea level to 2000 meters above sea level, and rainfall are from 235 mm to 1000 mm per year. A major factor delimiting the biome is the lack of sufficient rainfall, which prevents the upper layer from dominating. Fires and grazing furthermore keeps the grass layer dominant and almost all species are adapted to survive fires, usually with less than 10% of plants killed by fire (Low & Rebelo, 1998).

In general, the savanna regions of South Africa are the best game ranching area because of the large diversity of geology, soil, and vegetation types that can support a large diversity of grazers and browsers (Bothma, 2002). In South Africa, the savanna vegetation type can be subdivided into four main types based on the floristic composition, namely:

- ✦ A fine-leaved or microphyllous type of savanna, which is dominated by *Acacia* species. It is found mostly on clayey soils, but also on the sands of the arid Kalahari region. These areas are generally known as sweetveld.
- ✦ A broad-leaved type of savanna, which is dominated by *Combretum* species and occurs mostly on sandy-loam soils of granitic origin. It is generally known as mixed or sourish-mixed bushveld.
- ✦ A mountain or sour bushveld type of savanna, which is dominated by broad-leaved species such as the wild seringa *Burkea Africana*, silver cluster-leaf *Terminalia sericea*, and Transvaal beech *Faurea saligna*.
- ✦ The mopane veld of Limpopo, which is dominated by the mopane *Colophospermum mopane*, the Lowveld cluster-leaf *Terminalia prunioides* and by species of the corkwood genus *Commiphora*.

The study area falls within the mopane veld of Limpopo (**Figure 3**). Mopane veld occurs on the granitic, shale and basaltic plains of the northern parts of the Kruger National Park and the undulating landscapes of the Limpopo River Valley north of the Soutpansberg mountain range in Limpopo. The growth form of mopane can vary from stunted and multistemmed shrubs on clayey soils derived from basalt, to tall mopane tree forests on alluvial or sandy-loam soils of shale or granitic origin. The dominant woody plants in this area is usually the mopane, with associated species like the knob thorn *Acacia nigrescens*, leadwood

*Combretum imberbe*, red bushwillow *Combretum apiculatum*, Lowveld cluster-leaf *Terminalia prunioides*, white seringa *Kirkia acuminata*, baobab *Adansonia digitata* and various species of the corkwood genus *Commiphora* and the raisin-bush genus *Grewia*. The dominant grasses include red grass *Themeda triandra*, common finger grass *Digitaria eriantha*, small buffalo grass *Panicum coloratum*, stinking grass *Bothriochloa radicans*, nine-awn grass *Enneapogon cenchroides*, tassel three-awn *Aristida congesta* and sand quick *Schmidtia pappophoroides* (Bothma, 2002). This area is highly suitable for game ranching, with a whole host of herbivores occurring in the region. The herbivores that occur naturally in this region are indicated in **Table 2**.



**Figure 3:** The major game ranching regions of South Africa (Source: Bothma, 2002)

**Table 2:** Historical and present distribution of herbivores in the Mopane veld of South Africa.

HERBIVORE	HISTORICALLY	PRESENT
Blue wildebeest	√	√
Buffalo	√	√
Burchell's zebra	√	√
Bushbuck	√	√
Bushpig	√	√
Common duiker	√	√
Eland	√	√
Elephant	√	√
Gemsbok	√	√
Giraffe	√	√
Grey rhebok	√	X
Hippopotamus	√	√
Impala	√	√
Klipspringer	√	√
Kudu	√	√
Mountain reedbuck	√	√
Nyala	√	√
Ostrich	√	√
Reedbuck	√	√
Red hartebeest	X	√
Rhinoceros: black	√	X
Rhinoceros: white	√	X
Roan antelope	√	√
Sable antelope	√	√
Sharpe's grysbok	√	√
Steenbok	√	√
Tsessebe	√	√
Warthog	√	√
Waterbuck	√	√

## Land use of alternative corridors

The predominant land-use was determined by following the closest roads to the proposed alternative corridors by vehicle. Current land use was determined by recording the type of fencing present. Farms with normal cattle fences were recorded as cattle farms and farms with game fencing as game farms (**Figure 4**). Where cattle were observed on a farm, it was also recorded as a cattle farm even if game fencing was present. Predominant land use was also confirmed during interviews where someone on the farm could be reached for an interview.

The alternative corridors are between 57km and 64km long (**Table 3**). Alternative 1 is 57km long with the first 12km being cattle farms, followed by 10km of game farms, 11km that could not be established, another 7km of game farms and the last 8km the site of the planned Limpopo Eco-Industrial Park planned for the area (**Figure 5**). Approximately 30% – 40% of this corridor thus traverses over current game farms (**Figure 6**).

Alternative 2, 2A is the longest at 64km long. The first approximate 30km traverses over about 20km of cattle farms and 10km of game farms, followed by 27km of game farms (and the Musina Nature Reserve) with the last 7km being residential areas and the planned Limpopo Eco Industrial Park. Approximately 60% of this corridor thus traverses over current game farms / reserves (**Figure 6**).

Alternative 2, 2B is 59km long. The first approximately 30km of this corridor also traverses over about 20km of cattle farms and 10km of game farms, followed by approximately 28km of game farms, mainly the Marimane Nature Reserve. Approximately 65% of this corridor thus traverses over current game farms / reserves (**Figure 6**).

From the site visit and interviews (**Appendix 1**) it was gathered that the main activity on most of the game farms in the area are hunting (60% on average), but non hunting eco-tourist make up around 40% of the clients. All the farms visited offer rifle and bow hunting and the general methods of hunting is walk and stalk and hides. Main species hunted include browsers like kudu, nyala and bushbuck, grazers like gemsbok, blue wildebeest and zebra, and mixed feeders like impala and eland as well as warthog and bushpigs. The hunting season is from April till September, which was indicated as the buzziest time of the year. Main concerns regarding the proposed Transmission Power Line would be that it is aesthetically ugly. In general large reserves (Marimane Nature Reserve in this case), make use of helicopters or aircrafts to count and catch game. The Transmission Power Line is a big concern to them for this reason and will pose a big safety risk due to the danger of colliding with the power lines during the counting or catching of game.

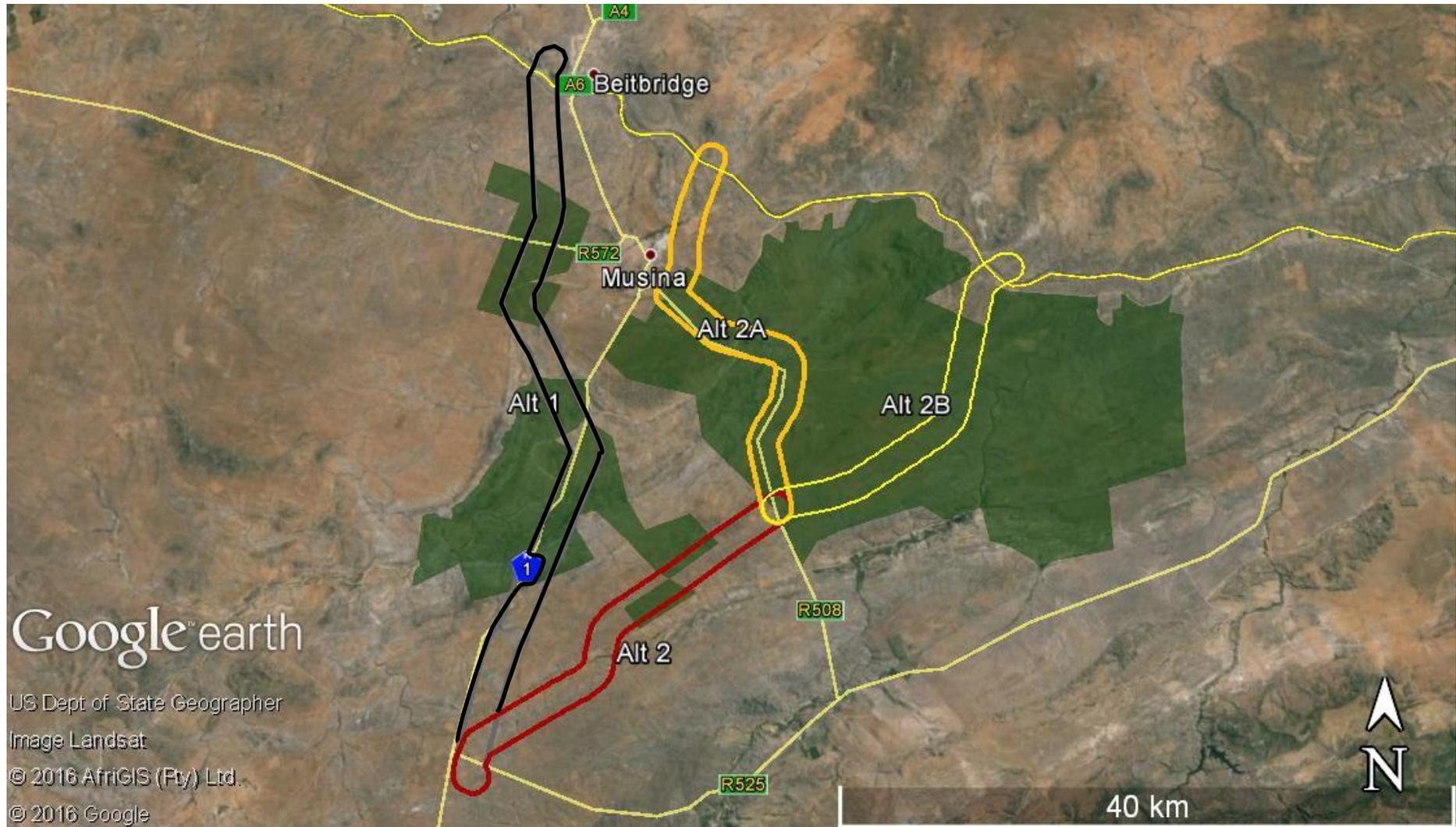
**Table 3: Overview of the surface area and distance associated with each alternative and associated deviation (De Frey 2016)**

Alternative	Surface Area (Ha)	Units (m)			Length (km)
		Area	Length	Width	
1	22 855	228 545 036	57 136	4 000	57
2, 2A	25 510	255 098 516	63 775	4 000	64
2, 2B	23 442	234 423 075	58 606	4 000	59



**Figure 4: Photos of different farms in the area. Farms with game fencing were recorded as game farms (except if cattle were observed), and farms with normal cattle fencing were recorded as cattle farms.**





**Figure 6: The alternative corridors and the extend of game farming / reserves traversed**

## Transmission Power Lines

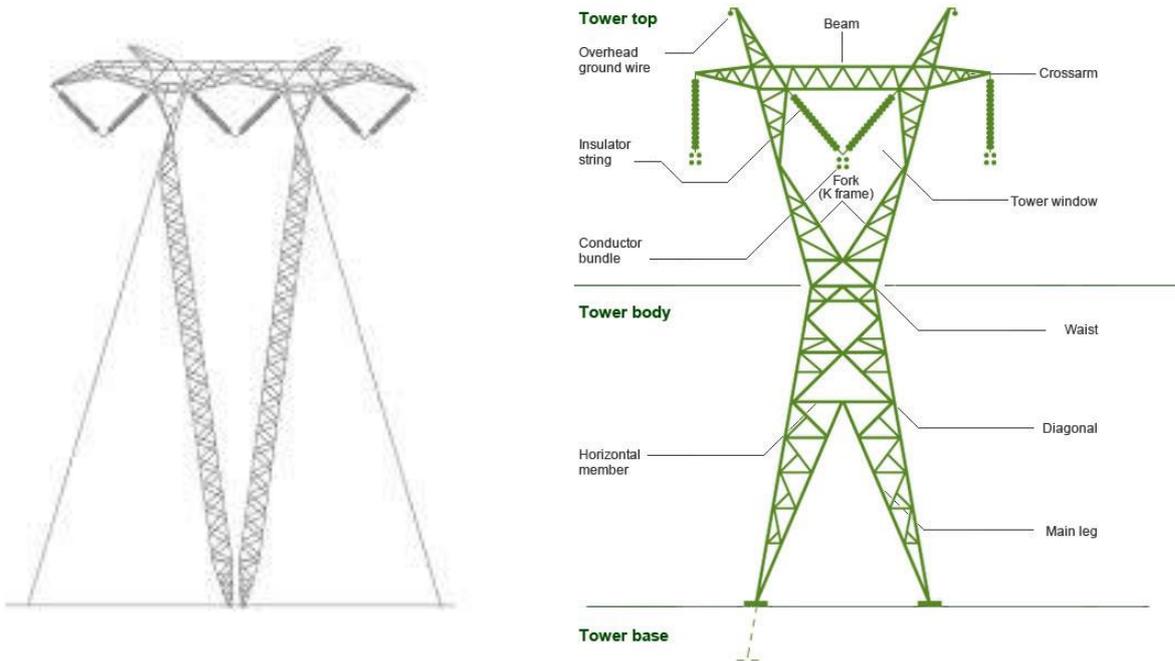
Transmission Power Lines invariably have a huge impact on the environment, both natural and human, where they are constructed. Just like roads and railways, however, they are a necessity for progress. To meet the short and long-term electrical needs of people, it is from time to time necessary to build new transmission lines or makes changes to existing transmission line facilities. New construction and changes are often needed to meet regional population growth, shifts in industrial demand, or to improve the reliability of existing systems. Various studies have been conducted on the effect of transmission power lines, especially on wildlife and the natural environment. In general the degree of impact of a proposed transmission line is determined by the quality or uniqueness of the environment along the proposed route. The following factors determine the quality of the existing environment (PSC, 2016):

- The degree of disturbance that already exists
- The uniqueness of the resources
- The threat of future disturbance

The scale of the impact will be influenced by the type of transmission line, and the type of towers being used. Examples of some of the towers that Eskom is likely to use for the proposed 500kV transmission power lines and which have been widely used in similar developments are illustrated below (**Figure 7**). The construction of a transmission line involves both long-term and short-term impacts. Long-term impacts can exist as long as the line is in place and include land use restrictions and aesthetic impacts. Short-term impacts occur during construction (**Figure 8**) or at infrequent intervals such as during line repair or general maintenance and clearing of the transmission line servitude. Temporary impacts during construction can include noise, dust, vegetation removal and security issues. In general the impact of transmission lines are thus divided in (Berger, 1995):

- construction impacts (access, servitude clearing, construction of towers, stringing of cables);
- line maintenance impacts (inspection and repair); and
- impacts related to the physical presence and operation of the transmission line.

There is an existing Transmission Power Line running along the southern section of the alternative corridor 1 (**Figure 9**).



**Figure 7: Examples of possible towers to be used**



**Figure 8: Construction phase of towers**





**Figure 9: Photos showing the existing Transmission Power Line and servitude clearing**

## POTENTIAL IMPACTS ON GAME FARMS

**Table 4** gives a summary of the main projected impacts on the different facets of the game industry in the study area. The different possible impacts are discussed separately, and each impact is discussed for eco-tourism, Hunting and Intensive breeding/live sale game ranches.

### Visual impact / Aesthetics

Because of the sheer size of transmission towers they will invariably have an aesthetic effect on any landscape. A detailed visual impact study was carried out for this project and should be consulted as well. The general effect of the visual impact on game farms will, however, be discussed here.

The overall aesthetic effect of a transmission line is likely to be negative to most people, especially where proposed lines would cross natural landscapes. According to PSC (2016) some people, however, do not notice transmission lines or do not find them objectionable from an aesthetic perspective. The lines or other utilities may be viewed as part of the infrastructure necessary to sustain our everyday lives and activities to them. New transmission lines may also be viewed in a positive light because it represents economic development. Aesthetic impacts depend on:

- ▶ The physical relationship of the viewer and the transmission line (distance and sight line)
- ▶ The activity of the viewer (living in the area, driving through or sightseeing)
- ▶ The background, or context, of the transmission line, such as whether the line stands out or blends in

A transmission line can affect aesthetics by:

- ▶ Removing a resource, such as clearing vegetation that provide visual relief in a flat landscape
- ▶ Degrading the surrounding environment (intruding on the view of a landscape)
- ▶ Enhancing a resource (evoking an image of economic strength in a developing business or industrial area)

The activities that are expected to cause landscape impacts and affect the aesthetics on game farms in the short to medium term (ie during the construction phase), are the establishment of:

- Construction camps;
- Construction of access roads; and
- Clearance of the site.

**Table 4: Summary of impacts on different game farming enterprises**

Eco-tourism								
Impact:	Management Measurement	Nature:	Probability:	Duration:	Scale:	Magnitude/Severity"	Significance	
Visual impact / aesthetics	Without management	Negative	5	5	3	6	70	High
	With management	Negative	5	5	3	6	70	High
Loss / degradation of vegetation	Without management	Negative	4	3	1	8	48	Moderate
	With management	Negative	2	3	1	6	20	Negligible
Alien vegetation (increase or spread)	Without management	Negative	4	3	2	8	52	Moderate
	With management	Negative	2	3	1	6	20	Negligible
Erosion (roads and cleared areas)	Without management	Negative	4	3	2	8	52	Moderate
	With management	Negative	2	3	1	6	20	Negligible
Farm management (game counts, game capture, security, etc.)	Without management	Negative	5	5	1	6	60	Moderate
	With management	Negative	5	5	1	6	60	Moderate
Animal behaviour and diversity	Without management	Positive	5	5	2	6	65	High
	With management	Positive	5	5	2	6	65	High
Hunting								
Impact:	Management Measurement	Nature:	Probability:	Duration:	Scale:	Magnitude/Severity"	Significance	
Visual impact / aesthetics	Without management	Negative	5	5	3	2	50	Moderate
	With management	Negative	5	5	3	2	50	Moderate
Loss / degradation of vegetation	Without management	Negative	4	3	1	6	40	Low
	With management	Negative	2	3	1	6	20	Negligible
Alien vegetation (increase or spread)	Without management	Negative	4	3	2	8	52	Moderate
	With management	Negative	2	3	1	6	20	Negligible
Erosion (roads and cleared areas)	Without management	Negative	4	3	2	6	44	Moderate
	With management	Negative	2	3	1	6	20	Negligible
Farm management (game counts, game capture, security, etc.)	Without management	Negative	5	5	1	2	40	Low
	With management	Negative	5	5	1	2	40	Low
Animal behaviour and diversity	Without management	Positive	5	5	2	6	65	High
	With management	Positive	5	5	2	6	65	High
Live sales / Intensive breeding								
Impact:	Management Measurement	Nature:	Probability:	Duration:	Scale:	Magnitude/Severity"	Significance	
Visual impact / aesthetics	Without management	Negative	4	5	3	2	40	Low
	With management	Negative	4	5	3	2	40	Low
Loss / degradation of vegetation	Without management	Negative	4	3	1	6	40	Low
	With management	Negative	2	3	1	6	20	Negligible
Alien vegetation (increase or spread)	Without management	Negative	4	3	2	8	52	Moderate
	With management	Negative	2	3	1	6	20	Negligible
Erosion (roads and cleared areas)	Without management	Negative	4	3	2	6	44	Moderate
	With management	Negative	2	3	1	6	20	Negligible
Farm management (game counts, game capture, security, etc.)	Without management	Negative	2	5	1	6	24	Low
	With management	Negative	2	5	1	6	24	Low
Animal behaviour and diversity	Without management	Positive	5	5	1	6	60	High
	With management	Positive	5	5	1	6	60	High

These activities will create surface disturbances which will result in the removal of vegetation and the exposure of bare soil. The extent of these disturbances will generally affect a relatively small footprint area. Long term, however, will be the construction of the Transmission towers which will impact the landscape permanently. The effect will be most severe for eco-tourism establishments where scenic environments are crucial, moderately severe for hunting operations and the least severe for breeding facilities where animals are confined to camps.

#### *Mitigation of Aesthetic Impacts*

Electric transmission lines can be routed to avoid areas considered scenic. Where existing eco-tourism establishments are, towers should be placed out of sight where possible. Routes can be chosen that pass through commercial/industrial areas or along land use boundaries, existing transmission lines or existing roads. Corridor sharing with existing facilities is usually encouraged because it minimizes impacts by (PSC 2016):

- Reducing the amount of new servitudes required
- Concentrating linear land uses and reducing the number of new corridors
- Creating an incremental, rather than a new impact

In this regard corridor 1 will be the best option following existing roads or transmission line servitudes for long distances and ending within the planned Limpopo Eco Industrial Park. Both corridor 2,2A and 2,2B will cut across large conservation orientated farms and create new servitudes. All visitor facilities like lookout points and accommodation within the approximately 40 000ha Marimane Nature Reserve is planned not to break the horizon. The presence of a transmission power line will defy that.

#### **Landscape degradation (degradation of vegetation, soil erosion and alien plants)**

When Transmission Power Lines are constructed there is invariably a negative effect on the landscape. During the construction phase, vegetation will be removed to construct access roads, to clear the power line servitude and for the foundations of the towers. This can also lead to erosion of the exposed soil and the establishment and multiplication of alien vegetation in the affected areas. The impact of the removal of vegetation for the current proposed project is discussed in detail in the vegetation impact assessment (de Frey 2016).

Soil erosion is a natural process that takes place extremely slowly. The dominant type of erosion over much of the land surface of South Africa is, however, not natural but man-made.

The generally high rate of soil loss in South Africa can be ascribed to a number of factors, of which the following are probably the most important (Tainton 1999):

- An often unsuitable terrain, with generally steep slopes
- Highly erodible and shallow soils
- Very high rainfall intensities over much of the summer rainfall regions
- A poor attitude to resource conservation
- The degradation of the plant cover and composition resulting from overgrazing and/or poor grazing practice
- Complex economic factors which arise from the constant struggle within the agricultural sector for the maintenance of lifestyles and living standards
- Unrealistically high land prices which encourage over-exploitation
- The use of land for purposes for which it is unsuited
- The uncontrolled use of fire in areas to which it is not suited
- Ineffective conservation legislation and/or its poor implementation
- Artificial support by the State of farmers who for one or other reason are unable to survive without such assistance, and in the process merely encouraging continued over-exploitation

The best method to control erosion is to take the utmost care to prevent it from developing in the first place. Although roads are a necessity, they are a disturbance to the natural environment and can turn into an eyesore when not planned and constructed correctly. Roads should therefore be positioned with care, with the effect and primary goal of each road being considered (Du Toit & Van Rooyen, 2002). The cause of almost all problems associated with roads is poor construction design, inappropriately routed roads, and/or insufficient attention to the drainage of run-off water (Coetzee, 2005). Even the shallowest of wheel ruts can become a channel for water, and later turn into a small gully. This can eventually lead to an impassable road and a new erosion problem that requires attention. Problems with roads are particularly acute in landscapes with steep slopes and in areas that experience heavy downpours and flash flooding.

Roads have a twofold drainage problem, one occurs above ground level and the other below it. Surface drainage involves the channelling of all rainwater from the road surface and the surrounding areas. According to Du Toit & Van Rooyen (2002), surface water should be prevented from reaching the underground drainage system by the following means:

- The design of a convex road surface
- The placement of drainage canals parallel to the slope
- By allowing stormwater to pass underneath the road

Adapting the road design to the contours of the environment will allow for easier drainage. Underground drainage deals with water that filtered into the road foundation and the surrounding material, and is essential in the following areas (Du Toit & Van Rooyen, 2002):

- ✦ Areas with a high water table
- ✦ Seepage areas under the road foundation
- ✦ Active springs
- ✦ Surface water that enters the road foundation from a high median or from side channels through a porous road surface
- ✦ Areas with dolomite

The objective of road drainage is to deflect run-off water off the road surface and into the natural vegetation alongside the road (Coetzee, 2005).

According to Coetzee (2005) the following principles can help ensure the most sensitive routing, construction and use of roads in rangelands:

1. use the landscape as a guide to routing
2. avoid sensitive areas in the landscape
3. the means must be available for maintenance
4. aesthetics is important
5. off-road drainage is critical
6. build and maintain to the required standard
7. a code of road-use ethics must be adhered to by all road users

The control of problem plants in South Africa is regulated by the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA). Problem plants are divided into three categories namely:

**Category 1a:** Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.

**Category 1b:** Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

**Category 2:** Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.

**Category 3:** Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

The most significant impact is expected to occur during the construction phase with moderate impact during maintenance thereafter. The construction of maintenance (access) roads and the clearance of the transmission line servitude will have long term impacts on game farms. Again the most significant impact will be on eco-tourism operations, with moderate to low impacts on hunting operations and negligible impacts on intensive breeding facilities.

#### *Mitigation of Landscape degradation Impacts*

Existing roads and tracks should be used where possible instead of creating new routes. Where new roads have to be constructed, proper planning and road alignment will be crucial to prevent erosion. Where encountered, declared alien vegetation should also be controlled and the spread thereof proactively managed. This will result in negligible impacts in terms of erosion and problem plants. Corridor 1 will also be the best option in this regard with existing roads and servitudes already present. Both corridor 2A and 2B will need new servitudes to be opened and construction roads to be planned and maintained. Corridor 2A will be the second best option with a long distance following the R508 north.

#### **Animal behavior and diversity**

Wildlife in general and their distinctive habitats may be impacted in several ways by transmission line facilities. The type and extent of habitat impacts depend on the characteristics of the wildlife species (Berger, 1995). A lot of work has been done on the impact of Transmission Power Lines on birds and ways to mitigate that. The positive effect of properly managed transmission line servitudes on various insect pollinators and other endangered species has also been published (Conniff, 2014). For this study, however, the focus will be on game species for the wildlife ranching industry.

The physical presence of the transmission line servitude can create better wildlife habitat for some species in the long-term (Berger 1995). Studies have shown that in some areas transmission line servitudes were preferred by various deer species (Bartzke *et al.*, 2014). If

managed to provide abundant and preferred browse and cover, forest ungulates could also benefit from transmission line servitudes. The term ungulate literally means “being hoofed” or “hoofed animal” and refers to a group of animals that use to fall within the order Ungulata. The servitudes may, however, also contribute to habitat fragmentation and produce a negative edge effect for some species, reducing the total area available for them to live (Berger, 1995). The possible factors influencing avoidance and attraction of power lines on ungulates we recently reviewed and set into a conceptual framework by Bartzke *et al.* (2014). Their conceptual framework is shown in **Figure 10**.

The vegetation in the current study area tends to be more closed woodland with very few open grassy plains. If servitudes are managed correctly, it can thus be advantages to both browsing and grazing antelope species. Impala, being a mixed feeder, are highly competitive animals and thrive in disturbed areas and fragmented habitat. They will thus also benefit from properly managed servitudes. Overall the effect of the transmission line servitudes is thus bound to be positive on the game ranching species of the area. Intensive breeding facilities will probably benefit the most if servitudes are managed to produce more grass and thus better habitat for scarce species like buffalo, sable antelope and roan antelope. Hunting farms will also benefit from the servitudes, which provide better opportunities for hunting. Studies in the USA have shown that in certain areas hunters preferred servitudes to hunt (Bartzke *et al.* 2014). In terms of eco-tourism the increase in habitat diversity as well as better visibility will also be beneficial.

#### *Mitigation of impacts on animal populations*

All attempts to minimise unnecessary disturbance and habitat loss during the construction phase should be employed and pollution should be avoided. Construction should furthermore be avoided during calving / lambing time and in the hunting season (May – September) on properties where hunting takes place. Measures should also be in place during construction and maintenance to avoid snares from being set and animals being poached. With mitigation measures in place, corridor 1 will be the preferred option. This route traverses over the least amount of hunting farms. Farms along this route are also relatively smaller in size allowing better security measures. Corridor 2, 2A is the second best option due to its proximity to the R508 road making mitigation measures easier. Corridor 2, 2B is the most remote route and presents the biggest challenge to mitigate possible negative impacts.

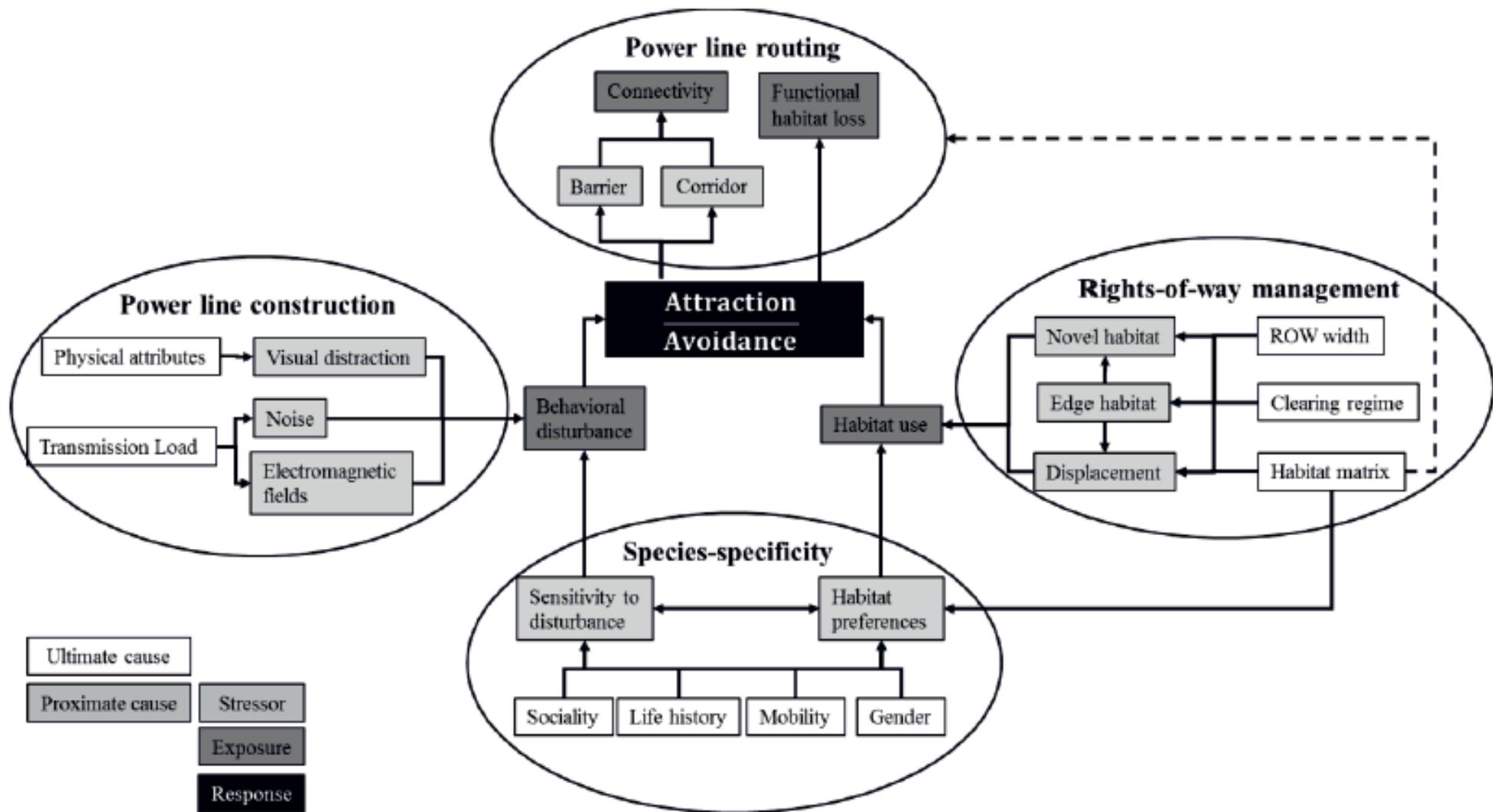


Figure 10: Possible factors influencing avoidance and attraction of power lines on ungulates (Bartzke et al. 2014)

## Farm management

Property owner issues are often raised by individuals or communities along proposed transmission line routes (PSC, 2016). There is often a feeling of unfairness between those that use electricity and those that bear the impacts of the facilities required to support that use. Nobody wishes to have power lines running across their property. The money paid to landowners for servitude easements is meant to compensate them for having a transmission line cross their property but although these easement payments are negotiated between the landowner and the utility some landowners do not regard the payments as sufficient to truly compensate them for the aesthetic impacts and the loss of full rights to their own land. Neighbouring properties are also usually affected by the aesthetic impact but do not receive an easement payment.

Corridor sharing is often proposed to minimize impacts of transmission lines. New transmission lines are then placed within or next to existing infrastructure, burdening the landowner with multiple easements. This should be balanced against the potential to reduce environmental impacts caused by the development of new transmission corridors. Security and other management issues are also escalated and the risk for poaching, erosion or alien plant infestations increased.

The potential change in property values due to the proximity to a new transmission line is another hot topic and has been studied since the 1950s by appraisers, utility consultants, and academic researchers (PSC, 2016). Data from these studies is often inconclusive and has not been able to provide a basis for specific predictions in other locations for other projects. A review of the studies indicates that transmission lines have the following effects on property values.

- The estimated reduction in sale price for single-family homes has ranged from 0 to 15 %.
- Adverse effect on the sale price of smaller properties could be greater than effects on larger properties.
- Other factors, such as schools, jobs, lot size, house size, neighbourhood characteristics, and recreational facilities tend to have a greater effect on sale price than the presence of a transmission line.
- Sale prices can increase where the transmission servitude is attractively landscaped or developed for recreation (i.e., hiking or hunting).
- Effects on price and value appear to be greatest immediately after a new transmission line is built or an existing servitude is expanded. These effects appear to diminish over time and over generations of property owners.

- Effects on sale price have most often been observed on property crossed by or adjacent to a transmission line, but effects have been observed for properties farther away from a line
- Agricultural values are likely to decrease if the transmission line poles are in a location that inhibits farm operations

Although difficult to calculate, there is the possibility that the transmission lines may have a negative effect on occupation rates of eco-tourism and hunting establishments due to the negative effect on aesthetics. This should be measured over a long period (5years). With increased development as a result of the transmission lines, as well as the need for skilled labor during construction and maintenance it is also possible that the need for accommodation might rise and increase occupation rates.

In terms of security there will invariably be a negative impact over the long term, but especially during the construction phase. Workers will need access to the property which could lead to poaching, setting of snares and the theft of wood and medicinal plants without proper supervision. The presence and resultant noise associated with workers will also impact on the running of eco-tourism and hunting operations and should be avoided if there are paying client present on the farm. During the site visit workers were busy with servitude clearing on one of the existing transmission lines and piles of wood were observed presumably to be collected for fire wood (**Figure 11**). The owner also mentioned that snaring is sometimes a problem during these maintenance clearing activities. On properties with game species of high value (ie elephant, rhinoceroses, buffalo) there is also an increased poaching risk. Dangerous game furthermore also poses a threat to casual workers on the farm.



**Figure 11: Maintenance team busy clearing a transmission line servitude**

### *Mitigation of impacts on property owners*

There are no mitigation measurements to prevent the effect of the transmission power lines on property value, but the effect should be measured and compensation can then be negotiated based on the outcomes. Construction activities should be conducted within the off-peak tourism seasons and outside of the hunting season which is between April and September for the study area. Should construction be necessary within this period establishments should be compensated for the loss of business. Booklets that interpret the project and explain where the power is going and what value the project is adding to the local and provincial economy should be compiled and distributed. Very often, when eco-tourists (or hunters) see the value in a development project, they are willing to accept the associated impact on the environment.

## **CONCLUSION AND RECOMMENDATION**

**Table 4** gives a summary of the main projected impacts on the different facets of the game industry in the study area. Transmission Power Lines will always have an impact on the environment due to the sheer size of the structures. The biggest negative impact will be aesthetically and this impact will be of high significance over the long term for eco-tourism operations, moderate significance for hunting operations and low significance for breeding facilities.

Loss or degradation of vegetation will take place mainly during the construction phase, but also during routine maintenance of the servitude. This impact will be of moderate significance on eco-tourism operations and low significance to hunting and breeding operations. With mitigation the impact could become negligible over the long term. Both during the construction phase and as a result of maintenance and clearing of the servitude there could be an increase in alien vegetation and erosion. This could have a moderate significant impact on all game farms in the area but with proper mitigation plans in place the impact should be negligible over the long term.

In terms of daily management operations there will be a moderate significant impact on eco-tourism operations and low significant impact on hunting and breeding operations, with or without mitigation plans over the long term. This will include security issues with workers that need access to the property and the possible poaching risks associated. The significance of this impact will increase as the size of the property increases and as the value of the game species found on the property increases. Transmission lines will also have a significant impact on operations on large properties where game counting and capturing is done with helicopters or low flying aircraft.

In terms of animal behavior and diversity there will be a highly significant positive impact on all types of game farms. In general diversity in habitats invariably leads to an increase in biodiversity. In terms of game ranching, more grass (kg biomass) leads to more kilograms of animals that can be kept per hectare. By maintaining trees and shrubs at lower heights, the available browse for animals is also increased. Cleared servitudes will thus increase the amount and availability of food for game, if properly managed.

In terms of the alternative corridors investigated, alternative 1 will be the preferred route and will have the lowest impact on game farming in the area. Alternative 2, 2B will have the most significant impact on game farming and the environment being the furthest from any existing infrastructure and no possibility of corridor sharing.

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### APPENDIX 1: Questionnaire used during interviews

Name:		Farm:					
Do you get hunting clients on the farm?			Yes		No		
What type of hunting takes place?		Rifle	Bow		Shotgun		Handgun
What is the general hunting method?		Vehicle	Walk & Stalk		Hides		Other
What is the main type of game being hunted?							
Do you have a P3 Exemption permit?			Yes		No		
Which month is the busiest?							
Which month is the quietest?							
What is the span of the hunting season in your area?							
Do you get normal tourist as well (Not hunters)			Yes		No		
If yes, what % of your business do they cover?		%					
Are you aware of the planned Eskom power line in the area?			Yes		No		
What is your main concern regarding the Power line?							

## APPENDIX 2 CURRICULUM VITAE OF PRINCIPAL CONSULTANT

### PERSONAL DETAILS

**SURNAME:** VAN EEDEN  
**NAME:** DANIEL GREYLING  
**IDENTITY NUMBER:** 76 06 14 5129 083  
**CITIZENSHIP:** SOUTH AFRICAN.  
**GENDER:** MALE  
**MARITAL STATUS:** MARRIED  
**DEPENDANTS:** 2 DAUGHTERS (Nina & Lianie)  
**POSTAL ADDRESS:** P.O. BOX 38328  
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**E-mail:** [wildroutecc@gmail.com](mailto:wildroutecc@gmail.com)

**DRIVER'S LICENCE:** CODE 08 (EB)

**LANGUAGE:** **AFRIKAANS**  
SPEAK, WRITE AND READ - FLUENT  
**ENGLISH**  
SPEAK, WRITE AND READ – FLUENT

Mr van Eeden did his undergraduate studies in a multi- disciplinary field incorporating zoology, botany and geography. Other supplementary subjects included anthropology, economics, sociology, psychology and agrarian extension.

He then proceeded to do an honours degree in wildlife management with emphasis on vegetation surveys and the monitoring of change in vegetation, especially looking at the management of wildlife and other natural resources. As part of the requirements for this course, a management plan was compiled for a private game ranch in the Dullstroom district, Mpumalanga.

After the completion of his honours degree, he was awarded a scholarship by the University of Pretoria to work as a technical research assistant at the Rob and Bessie Welder Wildlife Foundation in Sinton, Texas. During that time he assisted postgraduate students with research in mammal-invertebrate interactions, mammal ecology, habitat ecology and bird ecology. As part of the scholarship the recipient was required to register for a master's degree in Wildlife Management on his/her return to South Africa.

Mr van Eeden wrote his thesis for his master's degree on aspects of the ecology and conservation status of selected wildlife in and around Tembe Elephant Park, KwaZulu-Natal, South Africa, where he was part of the Maputaland conservation-based and integrated rural development programme as representative of the Centre for Wildlife Management from the University of Pretoria. The focus of his studies were firstly to determine the biological importance of a community-based natural resource

management project in the area towards the conservation of the regionally rare sand forest habitat type, and secondly to determine the habitat selection and conservation status of selected herbivores in the Tembe Elephant Park.

During 2003 he founded Wild Route Environmental Consultants. The main focus is to help with the planning of game ranches and reserves by helping with the planning of infrastructure, the determining of the ecological carrying capacity and stocking rates, general veld management and general wildlife management recommendations and the compilation of management plans. Wild Route is also involved in urban greening and habitat restoration programs in the Tshwane municipal area and has a small nursery where they propagate indigenous trees.

Mr van Eeden has more than 12 years teaching experience in wildlife management and related fields and has taught at institutions like the University of Pretoria, the Damelin Education Group, Centurion Academy and the Grootfontein Agricultural College in Middelburg EC. He has also supervised more than 100 3<sup>rd</sup> year Nature Management students during their 3<sup>rd</sup> year for the Diploma in Nature Management from Centurion Academy. He has surveys/visited more than 100 game farms to date.

He is registered with the South African Council for Natural Scientific Professions (SACNASP) in the field of Ecological Science (Reg no 400109/08).

## QUALIFICATIONS

- ✦ **BSc Zoology** (1999-09-10) (University of Pretoria)
- ✦ **BSc (Hons) Wildlife management** (Cum Laude) (2001-03-28) (University of Pretoria)
- ✦ **MSc Wildlife management** entitled “Aspects of the ecology and conservation status of selected wildlife in and around Tembe Elephant Park, South Africa” (2006-09-07)
- ✦ **Unit standards 9940 and 9956. Train-the-trainer Certificate in educational training and development** (Cum Laude) (2005)(Damelin Education Group)
- ✦ **Unit standard 115753 ‘conducting outcomes-based assessment’** (2006) )(Damelin Education Group)
- ✦ **Environmental Impact Assessment: The National Environmental Management Act Regulations: A Practical Approach** short course (**CEM-05.1**) (23-27 Nov 2009)( Centre for Environmental Management, North-West University)

## ASSOCIATIONS

- ✦ FELLOW OF THE **ENDANGERED WILDLIFE TRUST** SINCE APRIL 1999
- ✦ MEMBER OF THE **SOUTHERN AFRICAN WILDLIFE MANAGEMENT ASSOCIATION** SINCE 2003.
- ✦ MEMBER OF THE **SA HUNTERS AND GAME CONSERVATION ASSOCIATION** SINCE 2008.
- ✦ REGISTERED AS A PROFESSIONAL NATURAL SCIENTIST IN THE FIELD OF **ECOLOGICAL SCIENCE** WITH THE SOUTH AFRICAN COUNCIL FOR NATURAL SCIENTIFIC PROFESSIONS (**SACNASP**)(Reg no 400109/08)

## AWARDS

- ✦ **VAN SCHAIK AWARD IN WILDLIFE MANAGEMENT:** FOR THE BEST ACHIEVEMENT BY A BSc (Hons) STUDENT IN THE FINAL EXAMINATION WITH SPECIALISATION IN WILDLIFE MANAGEMENT (2001-03-28)
- ✦ **ACADEMIC HONORARY COLOURS:** FOR ACHIEVING AN AVERAGE OF 75 PERCENT OR MORE FOR A DEGREE (2001-03-28)

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VAN EEDEN, D.G., VAN RENSBURG, B.J., DE WIJN, M. & BOTHMA, J. DU P. 2005. The value of community-based conservation in a heterogeneous landscape: a case study from the Maputaland centre of plant endemism, South Africa. In: R.J. KLOPPERS (Ed), ***Conservation without Boundaries***, Department of Environmental affairs and tourism & Ezemvelo KZN Wildlife.

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