ASSESSMENT OF IMPACTS: SUBSTATION AND TURN-IN LINES CHAPTER 6

In order to strengthen the supply of electricity to the Mokopane and Polokwane areas, a new transmission substation is proposed to be established in the Mokopane area. The total footprint required for the new substation site is estimated at an area of approximately 500 m x 500 m.

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed sites for the development of the new substation and associated turn-in lines, and to make recommendations for the management of these impacts for inclusion in the draft Environmental Management Plan (refer to Appendix O).

6.1. Assessment of Potential Impacts on Ecology

The proposed substation site alternatives are situated within areas of moderate or moderate-high biophysical habitat sensitivity. Potential impacts on biodiversity associated with the construction and operation of the substation and associated turn-in lines include the following:

- Direct impacts:
  - Destruction of threatened flora species
  - Destruction of protected tree species
  - Direct impacts on threatened fauna species
  - Direct impacts on common fauna species
  - Destruction of sensitive/pristine regional habitat types
- Indirect Impacts:
  - Floristic species changes within the servitudes
  - Faunal interactions with structures, servitudes and personnel
  - Impacts on surrounding habitat/species
- Cumulative Impacts:
  - Impacts on South Africa's conservation obligations and targets
  - Increase in local and regional fragmentation/isolation of habitat
  - Increase in environmental degradation

These are described in more detail within the specialist biodiversity study (refer to Appendix F) and are assessed below for each identified substation site and associated turn-in lines. No impacts that could lead to a beneficial impact on the ecological environment were identified.

Proposed substation sites and associated turn-in lines were comparatively assessed by means of visual observations and GIS analysis of available data, as well as visual observations from ground truthing.

Impact tables summarising the significance of Substation Impacts on Ecology (with and without mitigation)

Nature: Biodiversity Impacts at Substation Site Option 1 & Turn-in Lines		
	Without Mitigation	**With Mitigation**
Extent	2 (Local)	2 (Local)
Duration	4 (Long term)	3 (Medium, 3-15 yrs)
Magnitude	3 (Moderate)	2 (Low)
Reversibility	3 (Recoverable, needs input)	3 (Recoverable, needs input)
Probability	3 (Medium probability)	2 (Low probability)
Significance	**36 (Moderate)**	**20 (Low)**
Status	Negative	Negative
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation Refer to Section 12, 13 and 14 of the Specialist Ecology Report (Appendix F) and to the draft EMP (Appendix O)		
Cumulative Impacts » Slight increase in fragmentation and isolation of remaining natural habitat. » Slight increase in general environmental degradation		
Residual Impacts » Cleared servitudes of turn-in lines are likely to become infested with increaser and invasive plant species. » Decommissioning of substation will result in transformed habitat.		

Nature: Biodiversity Impacts at Substation Site Option 3 & Turn-in Lines		
	Without Mitigation	**With Mitigation**
Extent	3 (Regional)	2 (Local)
Duration	4 (Long term)	3 (Medium, 3-15 yrs)
Magnitude	4 (High)	3 (Moderate)
Reversibility	3 (Recoverable, needs input)	3 (Recoverable, needs input)
Probability	4 (High probability)	3 (Medium probability)
Significance	**56 (Moderate)**	**33 (Moderate)**
Status	Negative	Negative
Irreplaceable loss of resources?	No	

Can impacts be mitigated?	Yes	
Mitigation Refer to Section 12, 13 and 14 of the Specialist Ecology Report (Appendix F) and to the draft EMP (Appendix O)		
Cumulative Impacts » Moderate increase in fragmentation and isolation of remaining natural habitat. » Slight increase in general environmental degradation. » Increased impact on nearby riparian and ridge habitat.		
Residual Impacts » Cleared servitudes of turn-in lines are likely to become infested with increaser and invasive plant species. » Decommissioning of substation will result in transformed habitat in otherwise untransformed area.		

Nature: Biodiversity Impacts at Substation Site Option 4 & Turn-in Lines		
	Without Mitigation	**With Mitigation**
Extent	3 (Regional)	2 (Local)
Duration	4 (Long term)	3 (Medium, 3-15 yrs)
Magnitude	4 (High)	3 (Moderate)
Reversibility	3 (Recoverable, needs input)	3 (Recoverable, needs input)
Probability	4 (High probability)	3 (Medium probability)
Significance	**56 (Moderate)**	**33 (Moderate)**
Status	Negative	Negative
Irreplaceable loss of resources?	No	
Can impacts be mitigated	Yes	
Mitigation Refer to Section 12, 13 and 14 of the Specialist Ecology Report (Appendix F) and to the draft EMP (Appendix O)		
Cumulative Impacts » Slight increase in fragmentation and isolation of remaining natural habitat, presence of existing lines are noted. » Slight increase in general environmental degradation.		
Residual Impacts » Cleared servitudes of turn-in lines are likely to become infested with increaser and invasive plant species. » Decommissioning of substation will result in transformed habitat in otherwise untransformed area, unless adequate rehabilitation is undertaken.		

6.1.1. Comparative Assessment of Substation Sites

The substation site options are situated within areas of moderate or moderate-high biophysical habitat sensitivity. No environmental fatal flaws from a biodiversity perspective were identified to be associated with the identified substation site options. However, the proximity of Substation Site Option 1 to transformed and degraded areas renders this site the least sensitive in terms of biophysical habitat sensitivity. Site Options 3 and 4 are situated in areas where the vegetation is regarded as natural and are therefore regarded less suitable for the proposed development. Substation Site Option 4 is regarded the least suitable option as the required turn-in lines will inevitably result in localised impacts on natural vegetation.

On the basis of the comparative assessment undertaken, **Substation Site Option 1** is nominated as the preferred alternative from a biodiversity perspective. Site Option 4 is the least preferred option.

6.1.2. Conclusions and Recommendations

From a biodiversity perspective, **Substation Site Option 1** is nominated as the preferred alternative from a biodiversity perspective. Site Option 4 is the least preferred option.

Mitigation measures are required to be implemented in order to eliminate or reduce the significance of potential impacts on biodiversity. In this regard, mitigation measures specified in the specialist biodiversity study (refer to Appendix I) are mainly aimed at limiting the effects of construction and servitude maintenance activities.

Generic mitigation measures and recommendations with regard to impacts on biodiversity are included within the draft EMP (refer to Appendix O). Specific mitigation measures include:

» Conduct a final walkthrough prior to commencement of construction activities. Responsibilities should be ensuring absence of Red Data species from construction sites, marking of protected tree species, identification of localised areas of significance, etc.
» Identify areas of high ecological sensitivity during final walk-through and recommend localised deviations in the power line alignment.
» Obtain permits for pruning, cutting or removal of protected trees. Protected trees should be identified and marked by the ECO/ecologist during a final walk-through prior to commencement of construction.

» Demarcate construction areas in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit dilution or spread of peripheral impacts.
» Limit damage/ pruning/ cutting of trees to a minimum in accordance to Eskom guidelines. The pruning of the woody layer is recommended instead of complete removal of all woody plants. Leaving a significant portion of the woody structure intact will prevent the establishment of an atypical habitat, limiting adverse impacts to a large extent.
» Prohibit construction of new access roads in areas of high environmental sensitivity. Use should be made of existing roads, ensuring proper maintenance/upgrade. Alternative methods of construction/access to sensitive areas are recommended.
» Construction of new/temporary bridges as part of access roads to the substation site and turn-in lines across non-perennial streams and larger rivers is regarded as a prohibited activity; use should be made of existing crossings, ensuring proper maintenance/upgrade.
» Ensure surface restoration and re-sloping after construction activities are complete in order to prevent erosion, taking cognisance of local contours and landscaping.
» Ensure that riparian areas are spanned/pole structures are not placed within proximity to rivers, streams. Ensure placement of footprints outside 1:100 year flood lines. Crossing of riparian systems is only permitted at existing/ approved crossing points, taking due care to prevent additional/new impacts.
» Remove invasive and alien vegetation, particularly in vicinity of riparian zones where alien and invasive trees are known to occur. The implementation of a monitoring programme in this regard is recommended, being the responsibility of the ECO/ecologist.
» Rehabilitation of disturbed areas subsequent to construction activities, taking cognisance of factors such as topsoil replacement, removal of introduced materials, local environmental factors.
» Final inspection in order to ensure adherence to EMP guidelines, completion of localised/remaining areas of impact, monitoring of rehabilitation success, etc.

6.2. Assessment of Potential Impacts on Agricultural Activities

In order to determine the agricultural potential of the proposed substation sites, each of the three substation site options was investigated on a 150 x 150 m grid, using a hand-held soil auger. The soils occurring were described and classified according to the latest edition of the South African soil classification system (Soil Classification Working Group, 1991). Similar soils were then grouped into reasonably homogeneous mapping units and the boundaries of these units were then plotted onto a map.

Samples were collected at three locations (one in each area) for analysis in the laboratories at ARC-ISCW. The soils were analysed for particle size (sand, silt and clay), exchangeable cations (Na, Mg, K, Ca), pH, organic carbon and Phosphorus. These sample sites are marked on the soil maps included within the specialist agricultural potential report (refer to Appendix H). The soils associated with the proposed substation sites were found to be generally shallow, grey-brown, often gravelly sandy loams. Only small areas of deeper soils were encountered.

6.2.1. Comparative Assessment of Substation Sites

Both Site Option 4 and Site Option 3 predominately contain soils with a low agricultural potential (shallow, gravelly, rocky in places). Site Option 1 has mixed soils, with the southern half comprising the same shallow soils and the northern half has some deeper soils, although these soils are no deeper than 900 mm, and are therefore classed as having moderate agricultural potential.

Therefore, in terms of soils, **Site Option 4** is strongly recommended (all shallow soils), followed by Site Option 3 (>90% shallow soils). Site Option 1 is not recommended (~40% shallow soils).

6.2.2. Conclusions and Recommendations

The soils at the substation site alternatives are generally shallow and only small areas of deeper soils were encountered. Site Option 4 is nominated as the preferred option, followed by Site Option 3. Site Option 1 is the least preferred.

No other recommendations or mitigation measures are applicable in terms of soils and agricultural potential for the proposed substation site options.

6.3. Assessment of Potential Impacts on Avifauna

Potential impacts on avifauna associated with the construction, maintenance and eventual decommissioning activities of the proposed substation may include:

» Habitat destruction
» Disturbance to habitats and avifauna

These potential impacts are discussed and assessed in the tables below.

Electrocutions of certain bird species within the substation during its operation, could potentially have a negative impact on a variety of bird species, particularly those species that regularly utilise the electrical infrastructure within the substation yard on which to breed and nest (e.g. crows, herons, sparrows, owls

and geese). However, the more sensitive eagle species recorded in the area do not utilise substation yards extensively and therefore the significance of the impact is considered to be negligible. This impact will therefore not be discussed further.

In general, much of the proposed study area surrounding all three of the substation site options is disturbed and degraded to some extent already. In this context, habitat destruction associated with construction of the proposed substation and 400kV lines turn-in lines at any of the sites is not anticipated to be significant from an avifaunal perspective.

None of the proposed corridors or substation sites are located within an Important Bird Area (IBA). The closest IBA's to the proposed substation sites are the Waterberg and Nyl River Floodplain systems, Blouberg Vulture Colony, Wolkberg Forest Belt and Pietersburg Nature Reserve.

Impact tables summarising the significance of Substation Impacts on Avifauna (with and without mitigation)

Nature: Habitat destruction During the construction phase and maintenance of the substations, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads and the levelling of substation yards. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the power line servitude associated with the turn-in lines, through the modification of habitat.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (4)	N/A
Reversibility	Irreversible (5)	N/A
Probability	Definite (5)	N/A
Significance	**High (80)**	N/A
Status	Negative	N/A
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	No.	
Mitigation: No mitigation available particularly with regards to substation.		
Cumulative impacts: Potential cumulative impacts associated with future development of distribution power lines from substation.		
Residual impacts: There will a residual impact as habitat that is removed will not recover fully.		

Nature: Disturbance of birds During the construction and maintenance of electrical infrastructure, a certain amount of disturbance results.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Low (3)	Minor (2)
Reversibility	Irreversible (5)	-
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (39)**	**Low (14)**
Status	Negative	Negative
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated	Yes	
Mitigation: » Identify active nests during final walk-though survey » Limit construction and unnecessary driving past nests during breeding times. Nest may need to be relocated.		
Cumulative impacts: Potential cumulative impacts associated with future development of distribution power lines from substation..		
Residual impacts: Low residual impacts.		

6.3.1. Comparative Assessment of Substation Sites

All three sites are bordered by secondary roads making them readily accessible for construction and maintenance purposes, preventing further vegetation and possible habitat loss as a result of the construction of an additional road. However, the proximity of the Groot-Sandsloot and Witrivier river systems relative to Site Options 3 (Zuid Holland) and 4 (Noord Braband) must be considered, particularly with regards to future electrical development (i.e. distribution power lines) which will inevitably extend from the new Mokopane Substation. Future construction of power lines in the areas surrounding Options 3 and 4 could potentially impact negatively on the riparian vegetation and resident bird species through habitat destruction. It must be borne in mind that through the establishment of the Mokopane Substation, future electrical infrastructure in the form of distribution power lines will undoubtedly be added to the network in and around the substation site. Although the proposed loop-in and loop-out lines may not necessarily cross any of the afore-mentioned river systems at present, there is the potential that additional power lines might just do so, increasing the likelihood of collisions occurring in these sensitive areas. It is therefore recommended that development be restricted to a minimum around these water sources.

Although Site Option 1 is bordered by cultivated fields (which is a draw card for various species), the area is already in a state of transformation through a change in land use and is also comprised almost entirely of degraded woodland, limiting the number and diversity of bird species. In addition to this, the absence of water sources and riparian vegetation within the immediate area surrounding this option further highlights its relative suitability.

From the comparative assessment of alternatives undertaken, it can be concluded that Substation Site **Option 1** (Doornfontein) presents itself as the preferred substation site from an avifauna perspective.

6.3.2. Conclusions and Recommendations

With the presence of river systems and numerous agricultural fields, the study area is particularly attractive to many species of birds, and as a result the proposed development will undoubtedly have an impact on the birdlife occurring here, as their habitat will effectively be transformed to accommodate the electrical infrastructure. However, it is believed that the key impacts (i.e. collision and habitat destruction) associated with the construction of the substation and turn-in power lines, can be minimised and mitigated with relative ease if **Site Option 1** substation site is selected.

Often pigeons, crows and sparrows roost and nest in substation yards and as a result are occasionally electrocuted on the live hardware. Since it is impossible to predict with any certainty where birds are likely to nest within the substation yard, coupled with the costs associated with insulating the entire substation, electrocutions will need to be mitigated using site specific recommendations if and when they occur.

6.4. Assessment of Potential Visual Impacts

Visual impacts are expected to be associated with the construction, operation and decommissioning phases of the proposed Mokopane Substation.

6.4.1. Potential Visual Impacts associated with the Construction and Decommissioning Phases of the Substation

The construction phase of the substation will see an increase in activities at the substation site. During this time heavy vehicles will frequent the roads in these areas and may cause, at the very least, a visual nuisance to other road users and landowners in close proximity to the construction activities. In the event of decommissioning of the infrastructure, impacts are expected to be similar to those experienced during the construction phase (i.e. as a result of increased activities on site).

Visual impacts associated with the construction phase (and eventual decommissioning phase), albeit temporary, should be managed according to the following principles:

» Reduce the construction/decommissioning period through careful planning and productive implementation of resources.
» Restrict the activities and movement of construction/decommissioning workers and vehicles to the immediate construction/decommissioning site(s).
» Ensure that the general appearance of construction activities, construction camps (if required) and lay-down areas are maintained by means of the timely removal of rubble and disused construction materials.
» Restrict construction activities to daylight hours (if possible) in order to negate or reduce the visual impacts associated with lighting.

6.4.2. Potential Visual Impacts associated with the Operational Phase of the Proposed Substation and Turn-in Lines

The construction of transmission infrastructure such as the proposed substation will impose a visual impact on the surrounding area. The lower density residential areas of the study area, with a decidedly rural character, will be more affected by the project infrastructure than high-density residential areas. This is due to the fact that the higher occurrence of structures and visual clutter within high-density residential areas tend to absorb the visual impact. Visual impact is generally determined by the visual exposure of the proposed development, viewer incidence/perception, visual distance and the visual absorption capacity of the surrounding area. Impacts are expected where sensitive visual receptors occur. Sensitive visual receptors identified within the study area for the substation and turn-in lines include:

» Villages and rural settlements in the vicinity of the proposed alternative substation sites
» Users of national roads (i.e. the N11), arterial routes and secondary access roads
» Formal/statutory conservation and protected areas within and surrounding the study area (i.e. the Witvinger Nature Reserve)

Apart from the infrastructure itself, visual impacts may also be associated with the lighting of the proposed substation. The sites proposed for the placement of the Mokopane substation are all located in relative close proximity to sensitive visual receptors that may experience night time visual impacts in the form of sky glow or glare. Careful planning and sensitive placement of security and operational light fixtures for the substation, designed to contain rather than spread the light, is therefore imperative.

Potential visual impacts are assessed in the tables which follow.

Impact tables summarising the significance of visual impacts associated with the operation of the proposed substation

Nature of Impact: **Potential visual impact on users of main roads in close vicinity of the substation site options**			
	Option 1	**Option 3**	**Option 4**
Extent	Local (4)	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)	Long term (4)
Magnitude	Low (2)	Moderate (3)	Low (2)
Probability	Improbable (1)	Medium probability (3)	Improbable (1)
Status	Negative	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)
Significance	**Low (13)**	**Moderate (42)**	**Low (13)**
Irreplaceable loss of resources?	No	No	No
Can impacts be mitigated during operational phase?	No	No	No
Mitigation: N.A.			
Cumulative impacts: N.A.			
Residual impacts: N.A.			

Nature of Impact: **Potential visual impact on residents in close vicinity of the substation site options**			
	Option 1	**Option 3**	**Option 4**
Extent	Local (4)	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)	Long term (4)
Magnitude	High (4)	High (4)	Moderate (3)
Probability	High probability (4)	High probability (4)	Medium probability (3)
Status	Negative	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)
Significance	**Moderate (60)**	**Moderate (60)**	**Moderate (42)**
Irreplaceable loss of resources?	No	No	No

Can impacts be mitigated during operational phase?	No	No	No
Mitigation: N.A.			
Cumulative impacts: N.A.			
Residual impacts: N.A.			

6.4.3. Comparative Assessment of Substation Sites

Viewshed analyses of the proposed infrastructure, based on a 5m contour interval digital terrain model of the study area, indicate the potential visual exposure (i.e. areas from where the infrastructure could theoretically be visible). The visibility analyses were undertaken at an offset of 20m in order to simulate a worst-case scenario.

From the results of the viewshed analyses, the following conclusions can be made:

» Site Option 1 has a relatively scattered pattern of visual exposure due to the undulating nature of the topography and will potentially be visible from Segoahleng, Ga-Mangou and Glen Roy (refer to Figure 6.1).
» The core area of visual exposure for Site Option 3 is indicated in Figure 6.2. This option is not expected to be visible from any major villages or settlements but it will potentially be visible from the N11 national road at a distance of 3 km at the closest.
» Option 4 is not expected to be visible, or have a significant visual influence on observers travelling along the N11 (located beyond 5km from the proposed site) (refer to Figure 6.3). It is also not in close proximity to any major settlements within the core area of visual exposure.

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed substation sites are displayed below in Figure 6.4. Here the weighted impact and the likely areas of impact are indicated as a visual impact index. An area with short distance visual exposure to the proposed substation, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index for the proposed substation sites investigated is indicated in Figure 6.4.

The visual impact index for substation **Site Option 1** indicates an area of **high to very high** visual impact within a 500m radius of the proposed substation structures. This area includes a section of one of the secondary access roads to Morwasethula/Segoahleng/Ga-Mashashane from the N11 national road. The substation is not expected to have a significant visual impact (where visible) on the aforementioned settlements, but residents will have to pass the substation to reach their homes. Potential night time lighting impacts may occur along this section of road and to a lesser degree from the abovementioned settlements. This location could have a **moderate** visual impact on north-facing slopes of the Witvinger Nature Reserve. Substation Site Option 1 is not expected to have any visual impact on observers travelling along the N11 national road.

The visual impact index for substation **Site Option 3** indicates an area of **high to very high** visual impact within a 500m radius of the proposed substation structures. This area includes a section of the secondary access road to the Suid Holland homestead and the Jupiter settlement/village from the N11 national road. The substation is expected to have a **moderate to high** visual impact on residents at Suid Holland, but is not expected to visually influence residents of Jupiter. Residents will however have to pass the substation to reach their homes and will be exposed, at short distance, to the substation infrastructure. Potential night-time lighting impacts may occur along this section of road and at the Suid Holland residence. Substation Site Option 3 is expected to have a **moderate to low** visual impact on observers travelling along the N11 national road.

The visual impact index for substation **Site Option 4** indicates an area of **high** visual impact within a 500m radius of the proposed substation structures. The relatively remote (by comparison) location of this site option, results in most of the potentially exposed areas beyond 1km from the site, experiencing a low to negligible visual impact. This includes the N11 national road, Sekuruwe (south-west of the site) and other homesteads in the area. Residents of the Noord Braband homestead (located just under 2km from the site) may experience a **moderate to high** visual impact of the substation infrastructure, which may include potential night time lighting impacts. Substation Site Option 4 substation site is not expected to have any visual impact on observers travelling along the N11 national road.

Substation **Site Option 4** appears to be an acceptable site, from a visual impact perspective. Localised visual impacts may still occur, but are envisaged to be less significant than the visual impacts that may be encountered at Site Options 1 and 3.

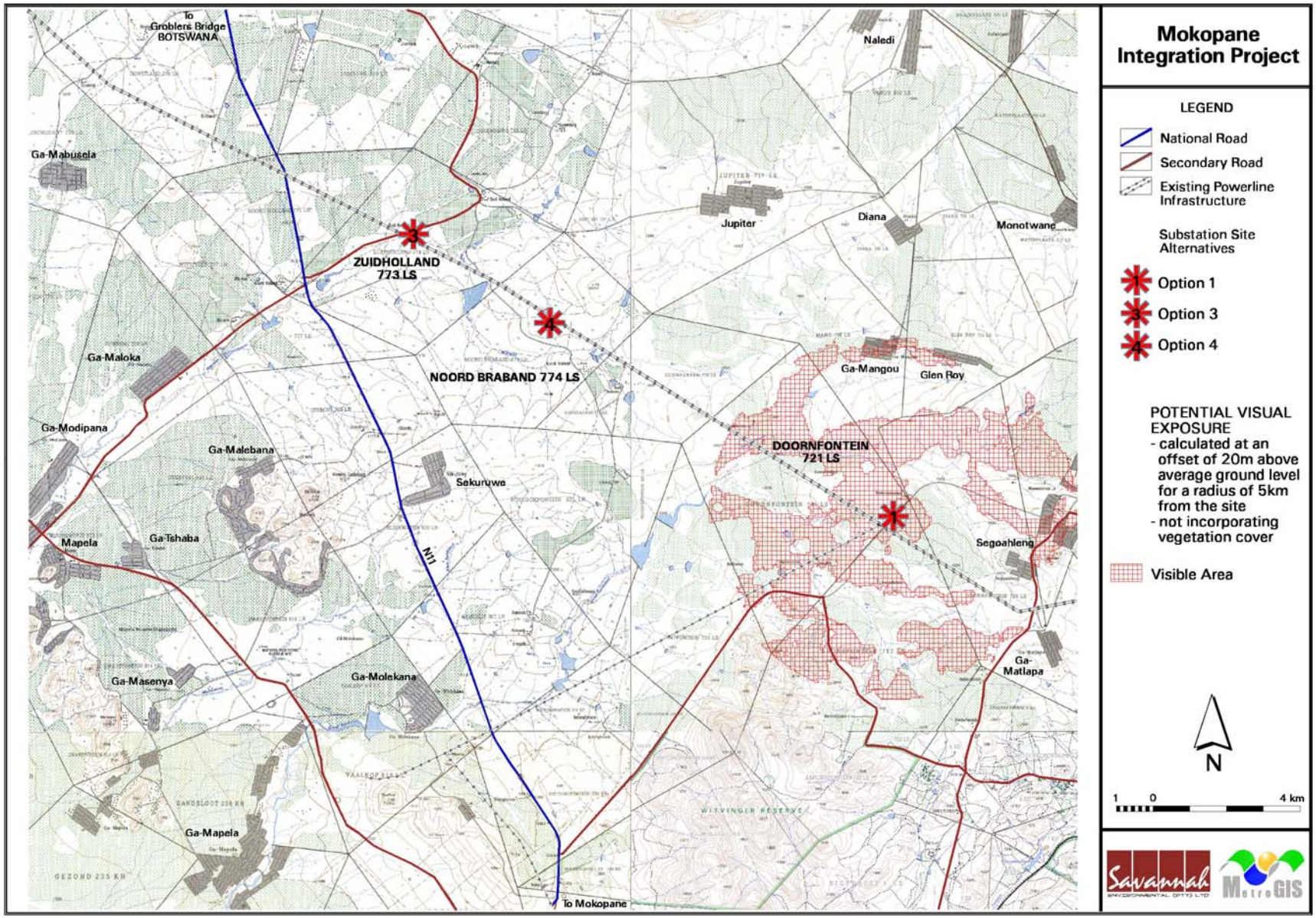

Figure 6.1: Potential visual exposure - substation Site Option 1

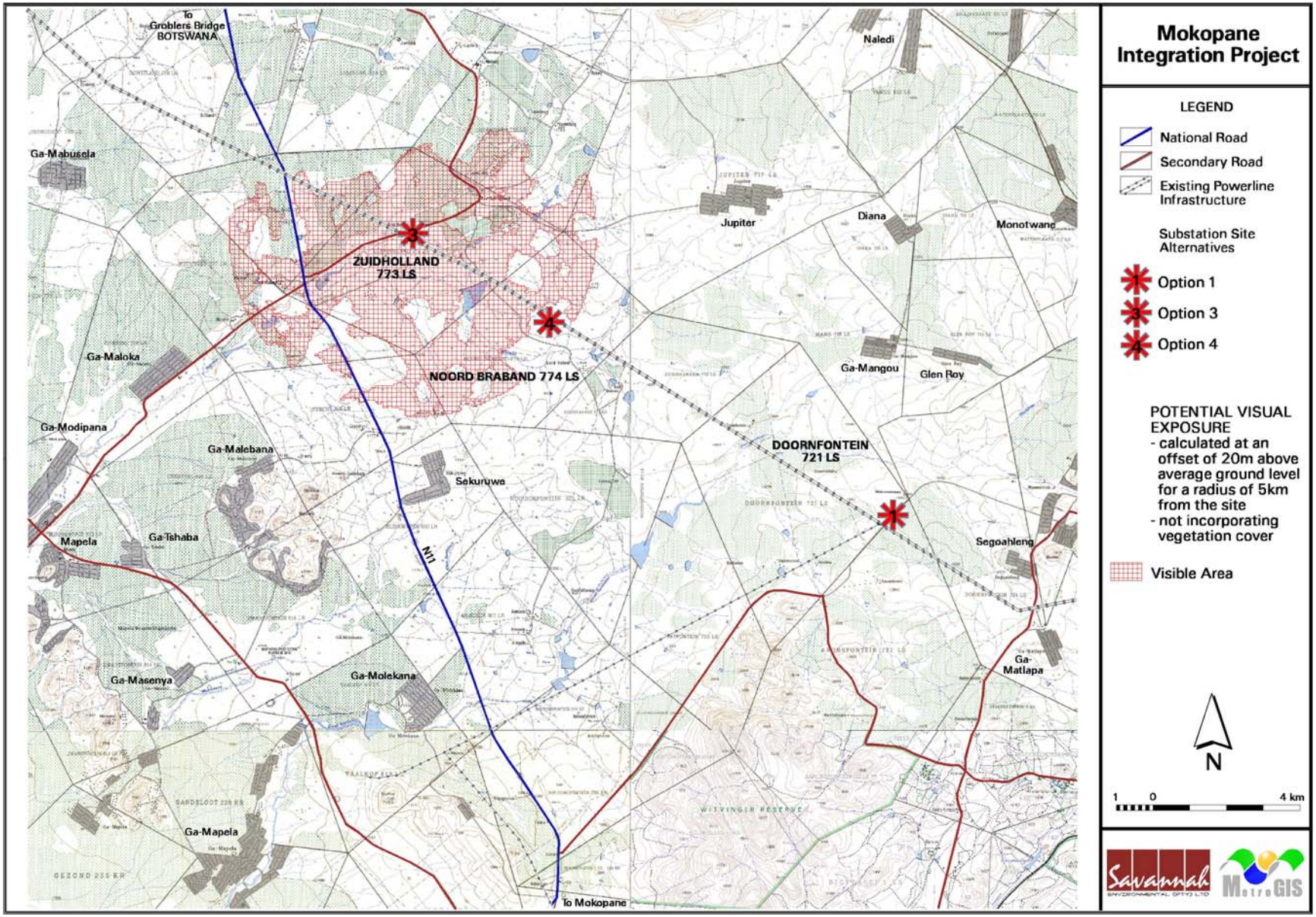

Figure 6.2: Potential visual exposure - substation Site Option 3

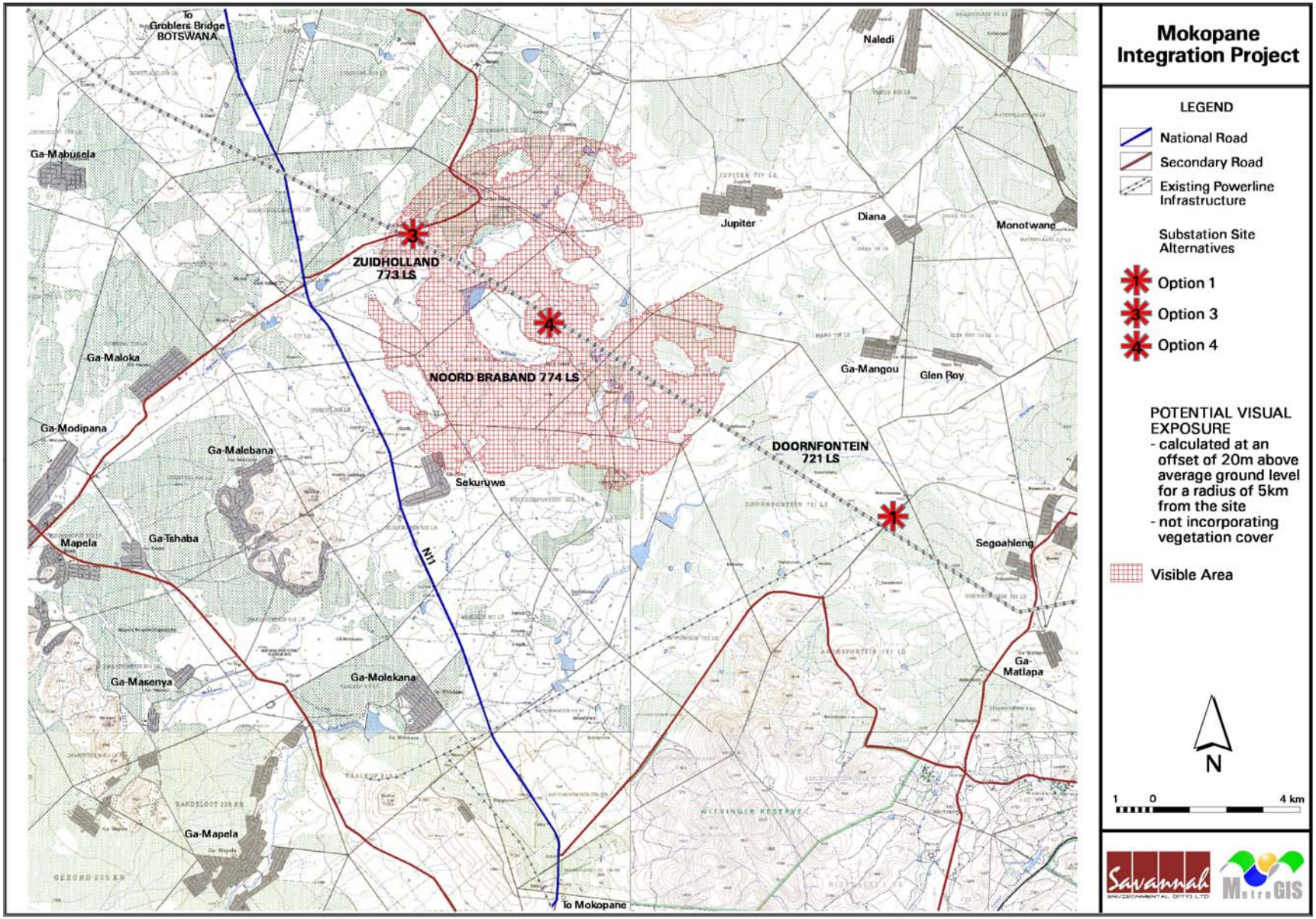

Figure 6.3: Potential visual exposure - substation Site Option 4

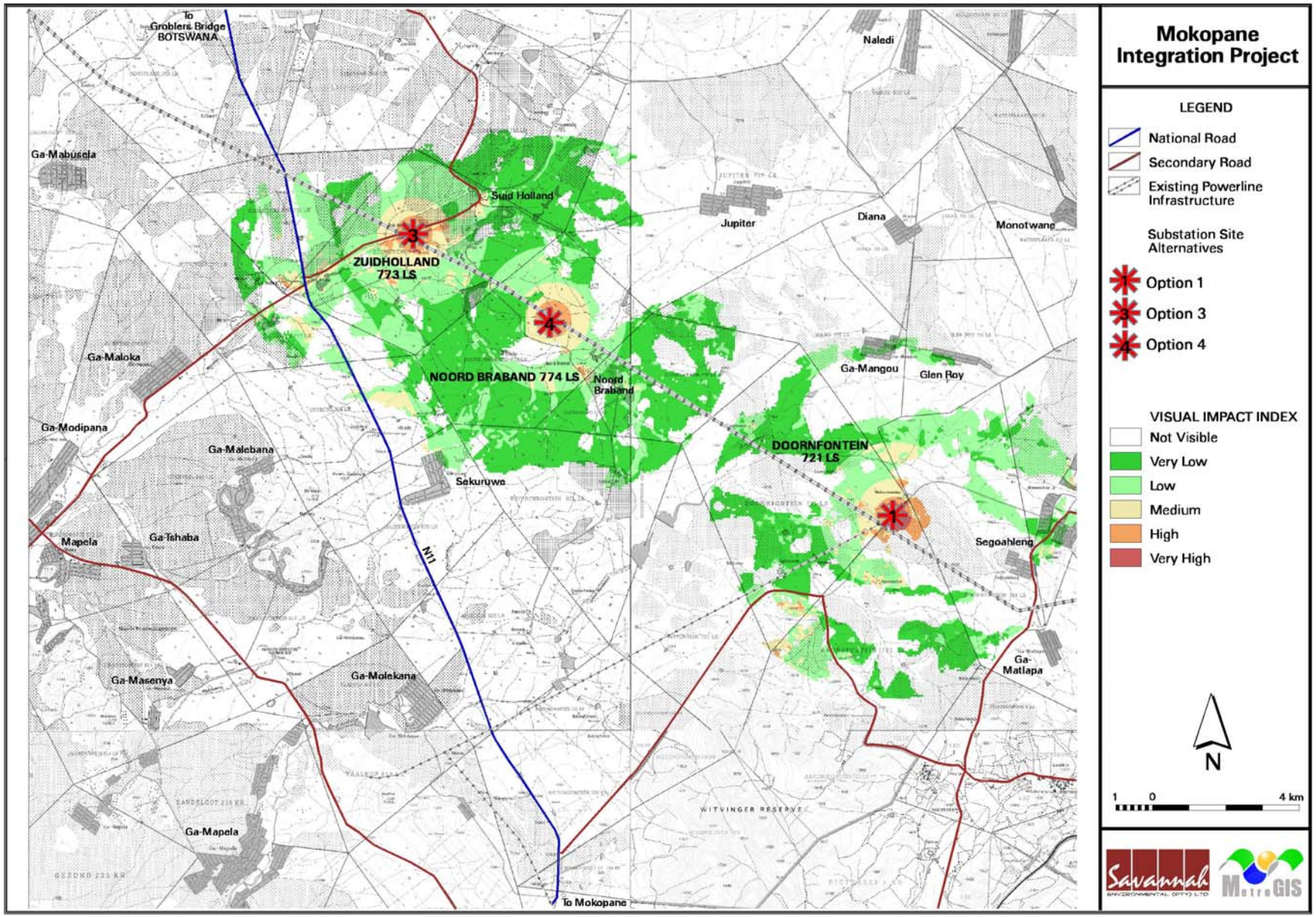

Figure 6.4: Observer proximity and viewer incidence - substation alternatives

6.4.4. Conclusions and Recommendations

Due to its relatively remote location away from major roads and sensitive visual receptors, **Site Option 4** is nominated as the preferred alternative for the placement and operation of the proposed Mokopane substation from a visual impact perspective.

The primary visual impact, namely the appearance and dimensions of the substation, is very difficult to mitigate. The broad functional design of the structures and the dimensions of the substation are unlikely to be changed in order to reduce visual impacts.

The sites proposed for the placement of the Mokopane substation are all located in relative close proximity to sensitive visual receptors that may experience night-time visual impacts in the form of sky glow or glare. Careful planning and sensitive placement of security and operational light fixtures for the substation, designed to contain rather than spread the light, is therefore imperative.

6.5. Assessment of Potential Heritage Impacts

The Ledwaba/Maune Ndebele clans, who are related to the Langa-Ndebele, live in the Bergzicht-Kalkspruit and Mašašane townships in the south-eastern part of the study area, near the proposed sites for the Mokopane Substation. Some of the types and ranges of heritage resources in or near the proposed sites for the Mokopane Substation may be impacted on by the Mokopane Integration Project.

The following known heritage resources occur near Substation Site Option 3 for the proposed Mokopane Substation:

» *Historical remains*
A historical farmstead complex composed of historical houses, associated outbuildings and a graveyard is located on the eastern shoulder of the sharp bend in the Luxemburg road, to the north-east of the proposed site for the substation. This farmstead complex incorporates a magnificent main farm residence dating from the Victorian/Edwardian period, a second farmhouse, several outbuildings and a graveyard holding the remains of the De Jager, Van der Merwe, Schoeman and De Jong families. The graves date from the middle of the 20th century. This historical farmstead complex constitutes a cultural historical landscape of smaller proportions.

» *Remains from the recent past*
Stone walls, probably the remains of a village dating from the more recent past, occur to the south-east of the proposed site for the substation. These remains are considered to be of low significance from a heritage perspective.

The dilapidated remains of a farmstead, which probably dates from the more recent past judging by the concrete rubble, occur to the south-east of Site Option 4 on the border of the farms Noord Braband 774LR and Suid Braband 719LS.

6.5.1. Comparative Assessment of Substation Sites

As no heritage resources with outstanding significance were observed near any of the proposed substation site options, all three proposed options weigh equally from a heritage perspective. Therefore, there is **no preferred alternative** in this regard.

6.5.2. Conclusions and Recommendations

No impacts on heritage resources are expected as a result of the construction of the proposed substation on any of the three identified substation site alternative. Therefore, there is no site preference in this regard.

6.6. Assessment of Potential Social Impacts

Impacts on the social environment as a result of the proposed substation are expected to occur during both the construction and operation phases (as well as during the eventual decommissioning of the infrastructure). The construction phase associated with the proposed substation is expected to last for approximately 12 months.

Potential impacts on the social environment associated with the construction, maintenance and decommissioning activities of the proposed substation are likely to include:

» Psychosocial impact on community level and on individuals as a result of different culture of construction workers, and the presence construction workers.
» Mental and physical health impact as a result of the impact of construction activities on farming.
» Inflow of workers and potential for conflict between locals and outsiders
» Local economic benefits
» Impact on job opportunities
» Impact on local and regional economy
» Impact on sense of place
» Noise pollution

Potential impacts (with and without mitigation) specific to the substation site are summarised in the tables below.

Impact Tables summarising the significance of Social Impacts associated with the proposed substation

***Nature:* Mental and physical health impacts as a result of the impact of construction & operation activities on farming**		
CONSTRUCTION		
***Category 2*[11]**	**Without Mitigation**	**With Mitigation**
Extent (Scale)	Site (1)	Site (1)
Duration	Very short (1)	Very short (1)
Magnitude		
Crop farming activities	Low (2)	Minor (1)
Cattle farming activities	Moderate (3)	Low (2)
Reversibility	Reversible (3)	Reversible (3)
Probability	High (4)	High (4)
Significance	**Medium (32)**	**Low (28)**
Status	Negative	Negative

Mitigation

Where possible, towers associated with the turn-in lines should be located on the border of grazing areas and crop fields.

» If necessary, mitigation measures should be implemented to avoid any negative impact on animals (e.g. fencing off the construction area).

» Eskom or its appointed contractor(s) should assist with the temporary relocation of livestock.

» Construction activities should be communicated and finalised with the affected property owners, and adhered to. Should this not be possible, the landowner should be informed and consulted about alternative arrangements.

» A grievances procedure should be implemented.

» Two locks on either side of one chain gate could be used to ensure that the landowner always has access to the same lock even though Eskom/construction team might change the other lock.

» The negotiation process should consider the mitigation of all relevant health and safety impacts on people and animals.

» A common, standard to compensation should be applied to all properties.

» Landowners should be aware that they can refuse to sign the release form after construction until they are satisfied with the level of rehabilitation.

» Discussions on conditions set for construction or maintenance between landowners and Eskom should involve the relevant parties from Eskom Transmission and the Regions when the need arises as *"we know what happens on site and what could be implemented."*

» Consultation between Eskom Lands & Rights and the Regions is important when conditions are set that impact on maintenance of the line.

» The process should be conducted with the necessary respect, and the negotiator

[11] Category 2 impacts are those that are expected to differ between the proposed alternatives, e.g. the number of households to be resettled increases if the development traversed densely populated areas as opposed to skirting populated areas.

should be transparent about the process and expectations (do not engage in "empty promises").

» Negotiators should record everything that is discussed with landowners.

» Infrastructure damage should be repaired to their original or a better state.

» The claim process for damage done by contractors should be simple.

» Landowners can request trees not to be cut. If this does not jeopardise safety or the operation of the line, this can be adhered to and stringing can be done by hand.

» Speed limits should be adhered to and construction vehicles marked.

» Any contact with wild animals should be avoided as far as possible.

OPERATION		
Category 2	**Before Mitigation**	**After Mitigation**
Extent (Scale)	Local (1)	Local (1)
Duration	Very short-Long (1-4)	Very short-Long (1-4)
Magnitude		
Crop farming activities	Minor (1)	Minor (1)
Cattle farming activities	Low (2)	Minor (1)
Reversibility	Reversible (3)	Reversible (3)
Probability	High (4)	High (4)
Significance	**Low-Medium (28-40)**	**Low-Medium (24-36)**
Status	Negative	Negative

Mitigation

» A grievances procedure should be implemented.

» Two locks on either side of one chain gate could be used to ensure that the landowner always have access to the same lock even though Eskom/construction team might change the other lock.

» The maintenance activities, timeframes and maintenance programme should be clearly stipulated during the negotiation process.

» Maintenance workers should not get onto the premises without the permission of the landowner – also for their own safety.

» Landowners should be allowed to carry out servitude maintenance.

» Speed limits should be adhered to and maintenance vehicles marked.

» Any contact with wild animals should be avoided as far as possible.

Cumulative Impacts

None.

Residual impacts

N/A.

***Nature :* Physical health impacts as a result of the presence of construction workers**		
***Category 1*[12]**	**Before Mitigation**	**After Mitigation**
Extent (Scale)	Site-International (1-5)	Site-International (1-5)
Duration	Short-Permanent (1-5)	Short-Permanent (1-5)
Magnitude	Moderate-Very high (3-5)	Moderate-Very high (3-5)
Reversibility	Reversible (3)	Reversible (3)
Probability	High (4)	Medium (3)
Significance	**Medium-High (32-72)**	**Low-Medium (24-54)**
Status	Negative	

Mitigation

» Aim for 30% local employment (PHS MQR 2007).
» An aggressive STD and HIV/AIDS awareness campaign should be launched, which is not only directed at construction workers but also at the community as a whole. Include training with women and focus on family planning and gender relations.
» Access at the construction site should be controlled to prevent sex workers from either visiting and/or loitering at the construction village.
» Construction workers should be clearly identifiable. Overalls should have the logo of the construction company on it and/or construction workers should wear identification cards.
» Local women should be empowered. This could be achieved by employing them to work on the project, which in turn would decrease their (financial) vulnerability.
» Regular leave should be given to workers and workers' families should be given opportunity to visit.
» A clinic should be on site/close to the village and anti retro virals available.
» Improve conditions at the construction village by providing entertainment.
» Mobilise local municipalities/authorities to do a skills audit and communicate skills levels and experience required to be employed by the project.
» Housing construction workers in communities could have more positive economic impacts (e.g. rental of room), but the potential health impacts as a result of more regular and consistent interaction with local inhabitants could be more significant. It therefore seems better to house construction workers in a village or separate housing area.

Cumulative Impacts

As a result of other projects and proposed projects in the study area it is likely that more workers from outside the study area will arrive and contribute to the impact.

Residual impacts

N/A.

[12] Category 1 impacts are those that are not expected to differ between the proposed alternatives, e.g. the number of construction workers that will be needed for the proposed project remains the same, irrespective of the chosen alternative

***Nature:* Physical health impacts as a result of the presence of maintenance workers**		
Category 1	**Before Mitigation**	**After Mitigation**
Extent (Scale)	Site-International (1-5)	Site-International (1-5)
Duration	Short-Permanent (1-5)	Short-Permanent (1-5)
Magnitude	Moderate-Very high (3-5)	Moderate-Very high (3-5)
Reversibility	Reversible (3)	Reversible (3)
Probability	Medium (3)	Low (2)
Significance	**Medium (24-54)**	**Low-Medium (16-36)**
Status	Negative	
Mitigation » Aim for 30% local employment (PHS MQR 2007). » Maintenance workers should be clearly identifiable. Overalls should have the logo of the construction company on it and/or construction workers should wear identification cards.		
Cumulative Impacts None.		
Residual impacts N/A.		

***Nature:* Physical health impacts as a result of the influx of job seekers.**		
Category 1	**Before Mitigation**	**After Mitigation**
Extent (Scale)	Site-International (1-5)	Site-International (1-5)
Duration	Short-Permanent (1-5)	Medium-Permanent (3-5)
Magnitude	Moderate-Very high (3-5)	Low (2)
Reversibility	Reversible (3)	Reversible (3)
Probability	Medium (3)	Medium (3)
Significance	**Medium (24-54)**	**Low-Medium (27-46)**
Status	Negative	
Mitigation » If the construction camp is located within an established community, employment procedures are discussed with the local leaders and followed to ensure that the community reaps the benefits from employment opportunities. » An Influx Management Plan should be developed and executed. » Have a recruitment desk away from the construction camp and construction areas. » Do not informally employ job seekers on site and at the construction village. » Mobilise local municipalities/authorities to do a skills audit and communicate skills levels and experience required to be employed by the project. » Aim for 30% local employment (PHS MQR 2007).		
Cumulative Impacts As a result of other projects and proposed projects in the study area it is likely that more workers from outside the study area will arrive and contribute to the impact.		

Residual impacts
N/A.

***Nature:* Psychosocial impact on community level and on individuals as a result of different culture of construction workers, and the presence construction workers (construction) and maintenance workers (operation)**		
CONSTRUCTION		
Category 2 Impact	**Before mitigation**	**After mitigation**
Extent (Scale)	Site (1)	Site (1)
Duration	Very short (1)	Very short (1)
Magnitude	Moderate (3)	Moderate (3)
Reversibility	Reversible (3)	Reversible (3)
Probability	High (4)	Medium (3)
Significance	**Medium (32)**	**Low (24)**
Status	Negative	Negative
OPERATION AND MAINTENANCE		
Extent (Scale)	Site (1)	Site (1)
Duration	Very short (1)	Very short (1)
Magnitude	Moderate (3)	Low (3)
Reversibility	Reversible (3)	Reversible (3)
Probability	Medium (3)	Low (2)
Significance	**Low (24)**	**Low (14)**
Status	Negative	Negative

Mitigation

» To ensure support of the project and reduce the risk of social mobilisation, Eskom should at all times be seen to care about the local community. The community members need to feel that they receive some tangible benefits from the project, e.g. direct and indirect employment. The undertakings in the EMP should also be implemented effectively and with due diligence.
» Construction workers are to be introduced to the local leaders and landowners.
» Local leaders should be made aware that only limited job opportunities will be created.
» The local leaders should also be informed about the nature of a linear project, and that labourers will probably move along the route as construction progresses.
» Educate women regarding gender issues and negotiating safe sexual behaviour.
» No firearms should be allowed on the construction site.
» Security guards should be appointed.
» Construction and maintenance workers should be clearly identifiable by wearing overalls and/or identification cards.
» Consult with local landowners prior to maintenance work taking place on the substation site and/or turn-in power lines, to inform them of when the maintenance team will be on site, for how long, and approximately how many persons the team will consist of.

Cumulative Impacts

Other Eskom projects in the study area: The simultaneous influx of appointed construction workers together with the influx of job seekers would further increase the demand on services to the detriment of the receiving environment.

Residual impacts

N/A.

***Nature:* Change in sense of place as a result of nuisance impacts.**		
CONSTRUCTION		
Category 1 Impact	**Before mitigation**	**After mitigation**
Extent (Scale)	Site (1)	Site (1)
Duration	Very short (1)	Very short (1)
Magnitude	Low (2)	Low (2)
Reversibility	Reversible (3)	Reversible (3)
Probability	Medium (3)	Medium (3)
Significance	**Low (21)**	**Low (21)**
Status	Negative	Negative
OPERATION AND MAINTENANCE		
Extent (Scale)	Site (1)	Site (1)
Duration	Very short (1)	Very short (1)
Magnitude	Low (2)	Low (2)
Reversibility	Reversible (3)	Reversible (3)
Probability	Low (2)	Low (2)
Significance	**Low (14)**	**Low (14)**
Status	Negative	Negative

Mitigation

Construction Mitigation:

» Affected parties should be informed about the construction schedule.
» Adjacent property owners should also be consulted regarding construction activities.
» Construction activities should not take place between 18:00 and 06:00.
» Construction should not be done on Sundays or public holidays and contractors should get permission from landowners to carry on with construction activities on these days.
» The hunting season (winter) should be taken into account.
» Ensure that the owners/residents are informed about imminent noise before it starts.
» The negotiation process should include agreements on construction activities.
» Dust:
  * Keep to speed limits.
  * Water roads.
» Corona
  * Avoid dwellings / lodges.

Operation Mitigation:

» Affected parties should be informed about the maintenance schedule.
» As far as possible, maintenance should not be done on Sundays or public holidays. It is important to have some mechanism in place that Eskom can undertake maintenance at these times if necessary.

Cumulative Impacts

Could be cumulative impacts due to construction activities from other projects in the area.

Residual impacts

N/A.

***Nature:* Change in sense of place as a result of the presence of the substation.**		
CONSTRUCTION		
Category 2 Impact	**Before mitigation**	**After mitigation**
Extent (Scale)	Site (1)	Site (1)
Duration	Very short (1)	Very short (1)
Magnitude	Low (2)	Low (2)
Reversibility	Reversible (3)	Reversible (3)
Probability	High (4)	High (4)
Significance	**Low (28)**	**Low (28)**
Status	Negative	Negative
OPERATION SUBSTATION SITES 1 and 3		
Extent (Scale)	Site (1)	Site (1)
Duration	Long (4)	Long (4)
Magnitude	Moderate (3)	Moderate (3)
Reversibility	Reversible (3)	Reversible (3)
Probability	Low (2)	Low (2)
Significance	**Medium (24)**	**Medium (24)**
Status	Negative	Negative
OPERATION SUBSTATION SITE 4		
Extent (Scale)	Site (1)	Site (1)
Duration	Long (4)	Long (4)
Magnitude	Low (2)	Low (2)
Reversibility	Reversible (3)	Reversible (3)
Probability	Low (2)	Low (2)
Significance	**Low (20)**	**Low (20)**
Status	Negative	Negative
Mitigation Mitigation measures detailed in the Visual Impact Assessment and Ecological Assessment should be implemented.		
Cumulative Impacts Other Eskom projects in the study area: The simultaneous influx of appointed construction workers together with the influx of job seekers would further increase the demand on services to the detriment of the receiving environment.		
Residual impacts N/A.		

***Nature:* Impact on health as a result of pollution of the natural environment by construction / maintenance workers and construction / maintenance activities.**		
Category 1 Impact	**Before mitigation**	**After mitigation**
CONSTRUCTION		
Extent (Scale)	Site (1)	Site (1)
Duration	Very short-Medium (1-3)	Very short-Medium (1-3)
Magnitude	Low (3)	Minor (2)
Reversibility	Reversible (3)	Reversible (3)
Probability	Medium (3)	Medium (3)

Significance	**Low-Medium (24-30)**	**Low (21-27)**
Status	Negative	Negative
OPERATION AND MAINTENANCE		
Extent (Scale)	Site (1)	Site (1)
Duration	Very short (1)	Very short (1)
Magnitude	Minor (2)	Minor (2)
Reversibility	Reversible (3)	Reversible (3)
Probability	Low (2)	Low (2)
Significance	**Low (14)**	**Low (14)**
Status	Negative	Negative

Mitigation

» Construction workers are required to be treated for worms.
» Adequate water facilities should be provided.
» Sufficient portable chemical toilets must be provided on site and at the construction village.
» Refuse on site should be discarded in sealed bins and/or in covered skips. Refuse should be removed from the site on regular intervals (at least once a week) and disposed of at an approved waste disposal site.
» Bins should be provided on site and at the camp.
» Some form of punishment should be implemented for littering.
» Construction workers should adhere to a contract with the contractor. These rules of conduct should be stipulated in construction management plans and contracts with workers. These should include the use of sanitation, water and waste as well as informal trading, running of shebeens, and interfering in community affairs.
» The construction management plan should indicate how its water sanitation and waste facilities are in line with legislation.
» Emergency health facilities should be available at the camp.

Cumulative Impacts

The situation will be exacerbated in areas where influx of job seekers occur and as a result of the activities of teams on other power line projects which take place simultaneously in the same area.

Residual impacts

N/A.

Nature: **Increase in employment opportunities due to the construction of the substation.**

Category 1 Impact	**Before Enhancement**	**After Enhancement**
Extent	Local (2)	Local (2)
Duration	Very short (1)	Very short (1)
Magnitude	Minor (1)	Low (2)
Reversibility	Reversible (3)	Reversible (3)
Probability	High (4)	Definite (5)
Significance	**Low (36)**	**Medium (50)**
Status	Positive	Positive

Enhancement

Require contractors to employ contractor staff and temporary labourers are sourced from areas that the power transmission line crosses or from the region whenever possible.

6.6.1. Comparative Assessment of Substation Sites

Considering the assessment of impacts as detailed in the tables above, the following conclusions can be made regarding the proposed substation sites:

» Considering the potential effect of the substation sites on agricultural activities, Site Options 3 and 4 are considered to be preferred from a social perspective. Site Option 1 is more likely to affect cultivation activities on land immediately surrounding the site, and is least preferred. The proposed 400kV transmission power lines will follow a longer length of the existing Matimba-Witkop transmission power lines should Site Option 3 be selected and may localise impacts on agricultural activities. The lines would also follow the existing Matimba-Witkop line if Site Option 4 was selected.
» No involuntary resettlement will be necessary for any of the sites and this impact is therefore not assessed. The existing Matimba-Witkop 400kV Transmission power lines already prohibit development towards the servitude. Development is likely to occur to the north and south of the existing power lines. In terms of scattered dwellings on farm portions, no dwellings will be directly impacted by the proposed substation or turn-in lines at any of the proposed sites.
» The preferred substation site is Site Option 4 in terms of impacts on sense of place.
» Properties on which substation sites are to be located are found in more densely populated and more developed areas close to Mokopane and Polokwane. All substations sites also currently contain power transmission infrastructure. These properties probably do not derive their value largely from a pristine character but rather from an ability to enable economic activity in a context with more development. Any impact on property values due to the location of additional power transmission infrastructure (the substations) is thus unlikely.
» All three alternative substation sites are relatively close to existing local roads. The assumption is therefore that existing roads (be these local gravel roads or power line maintenance roads) will be used to access the preferred site. Considering the potential effect on settlement patterns and development (current and future), the following emerges:
    * In terms of access roads, there is no preferred site.
    * Due to its distance from existing settlements, Site Option 4 is preferred. It is also possible to avoid settlements and not affect their development.
    * Transmission power line corridors not following the existing Matimba-Witkop transmission power lines and entering and exiting Site Options 1 and 3 will potentially affect more settlements.
» To avoid potential negative impacts on health and safety and settlement developments, the preferred site is Site Option 4.

» Considering the potential effect on settlement patterns and development, the existing Matimba-Witkop 400kV Transmission power lines already prohibit development towards the servitude. Development is likely to occur to the north and south of the existing power lines. In terms of scattered dwellings on farm portions, no dwellings will be directly impacted by the proposed substation or turn-in lines at any of the proposed sites.

From an overall social perspective, **Site Option 4** is considered to be the preferred substation site alternative.

6.6.2. Conclusions and Recommendations

Substation site 4 is nominated as the preferred alternative from a social perspective. In order to eliminate or minimise significant impacts identified mitigation measures must be implemented (refer to the specialist social impact assessment in Appendix K and the EMP contained in Appendix O).

6.7. Comparative Assessment and Nomination of a Preferred Substation Site

From the comparative assessment of alternatives undertaken, no environmental fatal flaws have been identified to be associated with any of the identified substation site options. The following conclusions have been drawn:

» Substation Site Option 1 is nominated as the preferred alternative from a biodiversity perspective. Site Option 4 is the least preferred in this regard.
» Substation Site Option 1 is nominated as the preferred alternative from an avifauna perspective.
» Substation Site Option 4 is nominated as the preferred alternative from an agricultural potential perspective.
» Substation Site Option 4 is nominated as the preferred alternative from a visual perspective.
» There is no preference in terms of alternatives from a heritage perspective.
» Substation Site Option 4 is nominated as the preferred alternative from a social perspective.

From the conclusions of the specialist workshop undertaken, it was concluded that Substation Site Option 3 is not preferred and should be avoided. As no environmental fatal flaws were associated with **Substation Site Options 1 and 4**, it was concluded that either of these alternatives would be acceptable for the development of the proposed substation and associated turn-in lines. **Substation Site Option 4** is nominated as the preferred option, due to the lower potential social and visual impacts.

ASSESSMENT OF IMPACTS: 400KV TRANSMISSION POWER LINES CHAPTER 7

As part of its capacity expansion programme, Eskom is currently constructing the new Medupi coal-fired power station in the Lephalale area of the Limpopo Province. In order to integrate this power station into the electricity transmission grid, Eskom Transmission is considering linkages to various points within the electricity transmission system. In order to support the upsurge in demand for the platinum group metals in the Mokopane area, and to improve the reliability of electricity supply to the Polokwane area, Eskom Transmission is therefore proposing the development and implementation of the **Mokopane Integration project**.

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed transmission power line development corridors, and to make recommendations for the management of these impacts for inclusion in the draft Environmental Management Plan (refer to Appendix O).

7.1. Assessment of Potential Impacts on Biodiversity

The vegetation of the study area, considering the diversity, primary status and availability of habitat types, is regarded as being diverse on a local and regional scale in spite of the poor floristic knowledge of the region. All areas of natural vegetation that are regarded to be in a primary status are considered suitable for the presence of Red Data flora species. It is regarded highly likely that numerous Red Data flora species are present within areas of natural/ pristine habitat contained within the proposed corridors. The ecological sensitivity of the study area has been determined through a combination of the likelihood of a specific biophysical attribute being important in terms of biodiversity attributes and the expected reaction of the particular attribute to impacts associated with the proposed project. A biodiversity sensitivity map of the study area on a regional scale which includes the collation of all sensitivities identified is provided in Figure 7.1. More details in this regard are included in the specialist biodiversity report contained within Appendix F.

Impacts resulting from the construction and operation of power lines on ecological attributes of the study area are largely restricted to physical impacts on biota or the habitat in which they occur. Direct impacts, such as habitat destruction and modifications, are regarded immediate, long-term and of high significance. These impacts are mostly measurable and fairly easy to assess as the effects thereof are immediately visible and can be determined to an acceptable level of certainty.

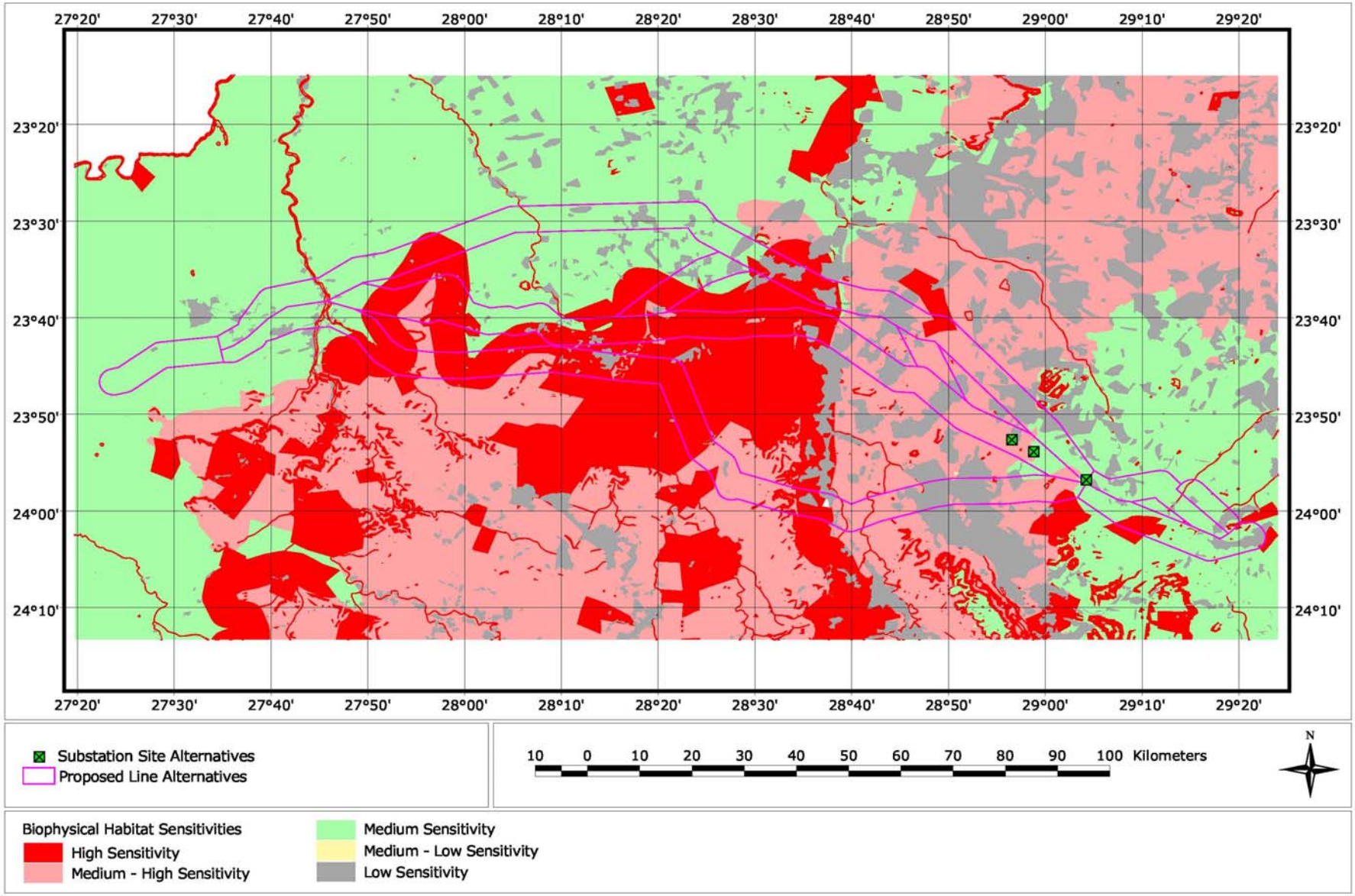

Figure 7.1: Biodiversity sensitivity map of the study area

In contrast, the effect of indirect impacts is not immediately evident and can consequently not be measured immediately. Lastly, impacts of a cumulative nature place direct and indirect impacts of this project into a regional and national context, particularly in view of similar or resultant developments and activities.

Potential impacts on biodiversity associated with the construction and operation of the transmission power lines include the following:

» Direct impacts:
  * Destruction of threatened flora species
  * Destruction of protected tree species
  * Direct impacts on threatened fauna species
  * Direct impacts on common fauna species
  * Destruction of sensitive/ pristine regional habitat types

» Indirect Impacts:
  * Floristic species changes within the servitudes
  * Faunal interactions with structures, servitudes and personnel
  * Impacts on surrounding habitat/ species
» Cumulative Impacts:
  * Impacts on South Africa's conservation obligations and targets
  * Increase in local and regional fragmentation/isolation of habitat
  * Increase in environmental degradation

These are described in more detail within the specialist biodiversity study (refer to Appendix F) and are assessed below for each identified transmission line corridor alternatives. No impacts that could lead to a beneficial impact on the ecological environment were identified.

Impact Tables summarising the Significance of Impacts on Biodiversity (with and without mitigation)

Comparative assessment of biodiversity impacts associated with the construction and operation of power lines along Corridors 1, 2 8 and 8 deviation (Medupi-Mokopane)

	Corridor 1		Corridor 2		Corridor 8 (to the north of the existing lines)		Corridor 8 (to the south of the existing lines)		Corridor 8 deviation	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Regional (3)	Regional (3)	Local (2)	Local (2)	Regional (3)	Local (2)	Regional (3)	Local (2)	Local (2)	Local (2)
Duration	Permanent (5)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	High (4)	High (4)	Moderate (3)	Low (2)	High (4)	High (4)	High (4)	Moderate (3)	High (4)	Moderate (3)
Reversibility	Irreversible (5)	Recoverable, needs input (3)	Recoverable, needs input (3)	Reversible, naturally (1)	Irreversible (5)	Recoverable, needs input (3)	Irreversible (5)	Recoverable, needs input (3)	Recoverable, needs input (3)	Reversible, naturally (1)
Probability	Definite (5)	Definite (5)	Medium (3)	Low (2)	High (4)	High (4)	High (4)	High (4)	Medium (3)	Low (2)
Significance	**High (85)**	**High (70)**	**Moderate (36)**	**Low (18)**	**High (64)**	**Moderate (52)**	**High (64)**	**Moderate (48)**	**Moderate (39)**	**Low (20)**
Status	Negative	Negative	Negative	Negative	Negative	**Negative**	Negative	Negative	Negative	Negative
Irreplaceable loss of resources?	No		No		No		No		No	
Can impacts be mitigated	Yes		Yes		Yes		Yes		Yes	
Mitigation: Refer to Section 12, 13 and 14 of the Specialist Ecology Report (Appendix F) and to the draft EMP (Appendix O)										
Cumulative Impacts	» Significant increase in fragmentation and isolation of remaining natural habitat, particularly in central		» Slight increase in fragmentation and isolation of remaining natural habitat, particularly in western		» Slight increase in fragmentation and isolation of remaining natural habitat, particularly in central part of study area, mainly because		» Slight increase in fragmentation and isolation of remaining natural habitat, particularly in central part		» Slight increase in fragmentation and isolation of remaining natural habitat, particularly in western	

	part of study area, extensive untransformed areas will be affected. » Significant effect on conservation targets/ areas on a regional scale. » Significant increase in general environmental degradation.	sections. » Slight impact on conservation targets/ areas on a regional scale. » Slight increase in general environmental degradation.	of existing line, otherwise more severe cumulative impact. » Increase in general environmental degradation.	of study area, mainly because of existing line, otherwise more severe cumulative impact. » Increase in general environmental degradation.	sections. » Slight impact on conservation targets/ areas on a regional scale. » Slight increase in general environmental degradation.
Residual Impacts » Cleared servitudes likely to become infested with alien and invasive plant species. » Remains of access roads into topographically challenging areas are likely to remain as visual and environmental impacts. » Physical habitat disturbance is likely to result in permanent scars in sensitive areas (evident from existing line in high sensitivity areas).					

Comparative assessment of biodiversity impacts associated with the construction and operation of power lines along Corridors 4, 5 and 6 (Mokopane-Witkop)

	Corridor 4		Corridor 5		Corridor 6	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	National (4)	National (4)	3 (Regional)	2 (Local)	3 (Regional)	2 (Local)
Duration	Long term (4)	Medium term (3)	4 (Long term)	Medium term (3)	4 (Long term)	Medium term (3)
Magnitude	High (4)	Moderate (3)	Moderate (3)	Moderate (3)	High (4)	Moderate (3)
Reversibility	Recoverable, needs input (3)	Recoverable, needs input (3)	Recoverable, needs input (3)	Recoverable, needs input (3)	Recoverable, needs input (3)	Recoverable, needs input (3)
Probability	High (4)	High (4)	Medium (3)	Medium (3)	Medium (3)	Medium (3)
Significance	**High (60)**	**Moderate (52)**	**Moderate (39)**	**Moderate (33)**	**Moderate (42)**	**Moderate (33)**
Status	Negative	Negative	Negative	Negative	Negative	Negative
Irreplaceable loss of resources?	No		No		No	
Can impacts be mitigated	Yes		Yes		Yes	
Mitigation: Refer to Section 12, 13 and 14 of the Specialist Ecology Report (Appendix F) and to the draft EMP (Appendix O)						
Cumulative Impacts » Slight increase in fragmentation and isolation of remaining natural habitat, particularly in central section. » Slight impact on conservation targets/ areas on a regional scale. » Slight increase in general environmental degradation.						
Residual Impacts Cleared servitudes likely to become infested with alien and invasive plant species.						

Nature: Biodiversity Impacts of power lines along Corridor 7		
	Without Mitigation	**With Mitigation**
Extent	2 (Local)	1 (Site only)
Duration	4 (Long term)	4 (Long term)
Magnitude	3 (Moderate)	2 (Low)
Reversibility	3 (Recoverable, needs input)	1 (Reversible, naturally)
Probability	3 (Medium probability)	2 (Low probability)
Significance	**36 (Moderate)**	**16 (Low)**
Status	**Negative**	**Negative**
Irreplaceable loss of resources?	No	
Can impacts be mitigated	Yes	
Mitigation: Refer to Section 12, 13 and 14 of the Specialist Ecology Report (Appendix F) and to the draft EMP (Appendix O)		
Cumulative Impacts » Slight increase in fragmentation and isolation of remaining natural habitat. » Slight increase in general environmental degradation.		
Residual Impacts Cleared servitudes and immediate surrounds might become infested with increaser and invasive plant species during and subsequent to operational phase.		

7.1.1. Comparison of Transmission Power Line Alternatives

Results of the ecological integration of the biophysical-, floristic- and faunal habitat sensitivity calculations indicate the following:

Corridors 1, 2, 8 and 8 Deviation (Medupi-Mokopane):

» *Corridor 1:*
Corridor 1 is situated in the central-southern part of the study area and is characterised by the escarpments, plains, table-lands, low mountains and lowlands with mountains topographical variations. Vegetation types that occur include Limpopo Sweet Bushveld, Roodeberg Bushveld, Waterberg Mountain Bushveld, Makhado Sweet Bushveld, Central Sandy Bushveld and Polokwane Plateau Bushveld. A matrix of untransformed, degraded and transformed faunal habitats is found in this corridor, including nature conservation areas of Touchstone and Witvinger. This corridor is considered to be of **high ecological sensitivity** and is **least preferred** corridor from a biodiversity perspective.

» *Corridor 2:*
This corridor is situated in the central-northern part of the study area and is characterised by the escarpments, plains (including slightly and strongly

undulating plains), and lowlands with mountains topographical variations. Vegetation types that occur include Limpopo Sweet Bushveld, Roodeberg Bushveld, Makhado Sweet Bushveld and Polokwane Plateau Bushveld. A matrix of untransformed, degraded and transformed faunal habitats is found in this corridor, including nature conservation areas of Bellevue and Masebe. This corridor is nominated as the **preferred alternative** from a biodiversity perspective.

» *Corridor 8:*

This corridor is situated in the central section of the study area and is characterised by escarpments, plains, table-lands and lowlands with mountains topographical variations. Vegetation types that occur include Limpopo Sweet Bushveld, Roodeberg Bushveld, Waterberg Mountain Bushveld, Makhado Sweet Bushveld and Polokwane Plateau Bushveld. A matrix of untransformed, degraded and transformed faunal habitats is found in this corridor; it includes the nature conservation areas of Keta and Moepel. This corridor is considered to be of **moderate ecological sensitivity**. Although corridors 8 follows existing lines and would normally represent lower levels of impacts, it was indicated by Eskom that technical constraints in certain areas will not allow the construction of new lines directly adjacent to the existing lines. These space constraints are mainly the result of topographical diversity of landscape features. New lines will therefore have to deviate from existing lines in certain areas to allow for sufficient space for the servitude. Inevitably, where such topographical constraints occur, ecological sensitivity is invariably high and the expected impacts of construction and operation of power lines in these parts are regarded extremely high, similar to Corridor 1. Sensitivities of natural habitat in Corridor 8, particularly in highly sensitive areas, were therefore ascribed without the consideration of the existing lines. In this regard, corridor 8 is **not preferred** from a biodiversity perspective.

» *Corridor 8 Deviation:*

This corridor follows the existing Matimba-Witkop line for an extensive potion of its length, deviating to the north before the high sensitivity habitat associated with corridor 8, and following part of Corridor 2 until a deviation to the south to reconnect with corridor 8. The central part of the corridor comprises sensitive habitat, but the alignment with the existing line is likely to reduce potential impacts to an acceptable level. This corridor is considered to be of **moderate ecological sensitivity** and is the **second most preferred corridor** from a biodiversity perspective, provided that the new power lines are constructed immediately parallel to the existing power lines. Should the servitude deviate from the existing line outside the deviation, the sensitivity will increase proportionally. Impacts in areas where new lines deviate from the existing corridor are regarded as a 'new' impact, in spite of the presence

of an existing line in the nearby vicinity. Effects of construction and operation will therefore not be lessened or masked by the presence of existing lines in these areas.

Corridors 4, 5 and 6 (Mokopane-Witkop)

» *Corridor 4:*
Corridor 4 represents the southern option of the eastern section of the study area and is characterised by the strongly undulating plains and low mountains with topographical variations. Vegetation types that occur include Polokwane Plateau Bushveld and Mamabolo Mountain Bushveld. Small portions are transformed and degraded and the area is characterised the buffer zones and core conservation areas of the Percy Fyfe and Kuschke conservation areas. This corridor is considered to be of **high ecological sensitivity** and is the **least preferred** corridor from an ecological perspective.

» *Corridor 5:*
This corridor represents the middle option of the eastern section of the study area and is characterised by the strongly undulating plains topographical variations. Vegetation types that occur include the Polokwane Plateau Bushveld. Small portions are transformed and degraded and the area is characterised some buffer zones of the conservation areas of the Percy Fyfe and Kuschke conservation areas. This corridor is considered to be of **low ecological sensitivity** and is the **most preferred** corridor from an ecological perspective.

» *Corridor 6:*
This corridor represents the northern option of the eastern section of the study area is characterised by the strongly undulating plains of Polokwane Plateau Bushveld and Mamabolo Mountain Bushveld. Small portions are transformed (cultivated lands) and degraded. This corridor is considered to be of **moderate to high ecological sensitivity** and is the **second preferred** corridor from an ecological perspective.

Corridor 7 (Delta-Medupi)

» *Corridor 7:*
This corridor is situated at the western end of the proposed lines and is characterised by the plains of Western Sandy Bushveld and Limpopo Sweet Bushveld. Small portions are transformed (cultivated lands) and degraded. No alternative was presented for this line and a comparative analysis is therefore not possible. This corridor is considered to be of **low ecological sensitivity** and therefore no impacts of significance are expected.

7.1.2. Conclusions and Recommendations

Results of the impact assessment generally indicate the high significance of expected impacts associated with development in pristine woodland areas in the southern and central parts of the study area. These impacts are regarded extremely high and the use of these areas for the proposed project is not recommended. Conversely, compared to the central and southern areas, the northern part of the study area is lower in general ecological sensitivity and is more suitable for the proposed development from an ecological perspective.

Results of the ecological integration of the biophysical-, floristic- and faunal habitat sensitivity calculations indicate the following:

» From the integration of the respective biophysical-, floristic- and faunal habitat sensitivity calculations and ratings it is evident that transmission line Corridor 1 and Corridor 4 are not regarded suitable for the proposed project. Even with the application of significant mitigation measures extensive impacts are still expected to occur within sensitive parts of these corridors. Calculations in the respective disciplines mirrored the eventual results. Conversely **Corridor 2** (Medupi-Mokopane) and **Corridor 5** (Mokopane-Witkop) are regarded the least sensitive in terms of ecological attributes and are therefore recommended for the proposed project.
» Although Corridor 8 includes existing lines, and it would normally be preferable to locate new infrastructure adjacent to existing infrastructure to localise the impact, it was indicated by Eskom that technical constraints in certain areas will not allow the construction of new lines directly adjacent to the current lines. These space constraints are mainly the result of topographical diversity of landscape features. New power lines will therefore have to deviate from existing lines in certain areas to allow for sufficient space for the servitude. Where such topographical constraints occur, ecological sensitivity is invariably high and the expected impacts of construction and operation of power lines in these parts are regarded as extremely high, similar to Corridor 1. Overall, expected impacts from the proposed development in areas where new lines deviate from the existing corridor are therefore regarded as a 'new' impact, in spite of the presence of an existing line in the nearby vicinity. Effects of construction and operation will therefore not be lessened or masked by the presence of existing lines in these areas.
» The moderate suitability of Corridor 8 Deviation is strongly biased by the Floristic sensitivity. As indicated in the relevant section, this sensitivity reflects the presence of extensive areas of Medium-high floristic sensitivity which is the result of the length of the alignment. The extent of High floristic sensitivity habitat within this alignment is actually lower than in other corridors. The suitability of this line for the proposed project is also strongly influenced by the presence of an existing line for much of the alignment,

rendering this option also suitable for the project. It should be mentioned that this statement only holds true where the approved servitude follows the existing line. Should the servitude deviate from the existing line outside the deviation, the sensitivity will increase proportionally and suitability will decrease. Impacts in areas where new lines deviate from the existing corridor are regarded as a 'new' impact, in spite of the presence of an existing line in the nearby vicinity. Effects of construction and operation will therefore not be lessened or masked by the presence of existing lines in these areas.

» No significant impacts were identified to be associated with Corridor 7.

Mitigation measures are required to be implemented in order to eliminate or reduce the significance of potential impacts on biodiversity. In this regard, mitigation measures specified in the specialist biodiversity study (refer to Appendix F) are mainly aimed at limiting the effects of construction and servitude maintenance activities.

Generic Mitigation Measures and recommendations with regard to impacts on biodiversity are included within the draft EMP (refer to Appendix O). Specific mitigation measures include:

» Conduct a final walkthrough prior to commencement of construction activities. Responsibilities should be ensuring absence of Red Data species from construction sites, marking of protected tree species, identification of localised areas of significance, etc.
» Identify areas of high ecological sensitivity during final walk-through and recommend localised deviations in the power line alignment.
» Obtain permits for pruning, cutting or removal of protected trees. Protected trees should be identified and marked by the ECO/ecologist during a final walk-through prior to commencement of construction.
» Demarcate construction areas in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit dilution or spread of peripheral impacts.
» Limit damage/pruning/cutting of trees to a minimum in accordance to Eskom guidelines. The pruning of the woody layer is recommended instead of complete removal of all woody plants. Leaving a significant portion of the woody structure intact will prevent the establishment of an atypical habitat, limiting adverse impacts to a large extent.
» Prohibit construction of new access roads in areas of high environmental sensitivity. Use should be made of existing roads, ensuring proper maintenance/upgrade. Alternative methods of construction/access to sensitive areas are recommended.
» Construction of new/ temporary bridges as part of access roads across non-perennial streams and larger rivers is regarded as a prohibited activity, use should be made of existing crossings, ensuring proper maintenance/upgrade.

» Ensure surface restoration and re-sloping after construction activities are complete in order to prevent erosion, taking cognisance of local contours and landscaping.
» Ensure that riparian areas are spanned/ pole structures are not placed within proximity to rivers, streams. Ensure placement of footprints outside 1:100 year flood lines. Crossing of riparian systems is only permitted at existing/ approved crossing points, taking due care to prevent additional/new impacts.
» Remove invasive and alien vegetation, particularly in vicinity of riparian zones where alien and invasive trees are known to occur. The implementation of a monitoring programme in this regard is recommended, being the responsibility of the ECO/ecologist.
» Rehabilitation of disturbed areas subsequent to construction activities, taking cognisance of factors such as topsoil replacement, removal of introduced materials, local environmental factors.
» Final inspection in order to ensure adherence to EMP guidelines, completion of localised/ remaining areas of impact, monitoring of rehabilitation success, etc.

7.2. Assessment of Potential Impacts Associated with Agricultural Potential

A summary of the various classes of agricultural potential, based on the soils and/or rock occurring in each land type, is given in Table 1 in the specialist Agricultural Potential report (Refer to Appendix H). The study refers to soil potential only, with no prevailing climatic conditions taken into account.

7.2.1. Comparison of Transmission Power Line Alternatives

From the desk-top analysis of agricultural potential within the proposed corridors, it was concluded that:

» *Medupi-Mokopane Corridors:*
  * Corridor 1 has some high potential soils south-east of Lephalale, otherwise mostly low to medium potential soils.
  * Corridor 2 has mostly medium potential soils, with high potential soils west of the Lephalala River and between Steilloopbrug and Mokopane.
  * Corridor 8 has little high potential soils, and much rocky land.
  * Corridor 8 Deviation does not impact on a new land type and, as can be seen from the potential map (Appendix 2 of the specialist Agricultural Potential report (Refer to Appendix H)), the agricultural potential of the soils being traversed does not significantly vary from corridor 2 or corridor 8.

  Based on the above, it would appear as if the preferred route would be the **Corridor 1** (potentially fewer high potential soils) followed by Corridor 8, and

the least favoured, Corridor 2 (where the most amount of high potential soils occur).

» *Mokopane-Witkop Corridors:*
In terms of all three Mokopane-Witkop corridors there is little variation, as the same land type, with medium potential soils, occurs throughout. Thus from Mokopane to Witkop, there is **no preference** based on soils.

7.2.2. Conclusions and Recommendations

It should be clearly noted that, since the information contained in the land type survey is of a reconnaissance nature, only the general dominance of the soils in the landscape can be given, and not the actual areas of occurrence within a specific land type. Also, other soils that were not identified due to the scale of the national Land Type Survey may also occur.

In terms of all three Mokopane-Witkop corridors there is little variation as the same land type occurs throughout with medium potential soils. However, on analysis of the soils the preferred route would be the **Corridor 1** (potentially fewer high potential soils) followed by Corridor 8, and the least favoured, Corridor 2 (where the greatest extent of high potential soils occur). It should be noted that no fatal flaws are considered to be associated with Corridors 2 and 8 since most agricultural activities can continue underneath overhead power lines. No significant impacts were identified to be associated with Corridor 7.

7.3. Assessment of Potential Impacts on Avifauna

Potential impacts on avifauna associated with the establishment of the proposed transmission infrastructure include the following:

» Electrocution of birds on overhead lines.
» Collisions with the earth wire of power lines.
» Habitat destruction and transformation during the construction, maintenance and eventual decommissioning of power lines.
» Disturbance during the construction, maintenance and eventual decommissioning of power lines.

Electrocution of birds on overhead lines is an emotional issue as well as an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa. However, in the context of overhead lines above 132kV, electrocutions are not of major concern. 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. Due to the large size of the clearances on most overhead lines above 132kV, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components.

The following series of tables provides a summary of the potential impacts on avifauna associated with the construction and operation of the proposed transmission power lines.

Impact tables summarising the significance of Transmission Line Impacts on Avifauna (with and without mitigation)

Nature: Impact of birds on quality of supply (Faulting) – all alternatives

There are a number of mechanisms through which birds are able to cause electrical faults on power lines. In the case of a bird streamer induced fault, the fault is caused by the bird releasing a "streamer" of faeces which can constitute an air gap intrusion between the conductor and the earthed structure. The fault appears to flash across the air gap (i.e. between the live conductor and the tower steelwork which is earthed) and does not follow an insulator creepage path as observed on pollution faults. Bird species capable of producing large or long streamers are more likely to cause streamer faults. Bird stomach volume is important in this respect. Larger birds such as vultures and eagles are capable of holding larger quantities of food and therefore defecating larger volumes.

Bird pollution is a form of pre-deposit pollution. A flashover occurs when an insulator string gets coated with pollutant, which compromises the insulation properties of the string. When the pollutant is wetted, the coating becomes conductive, insulation breakdown occurs and a flashover results. Since this involves a build up of bird faeces or bird pollution and not a once off event such as a streamer, the size of the bird is less important, although still a factor. Obviously the more an insulator string becomes coated with faeces, the more likely that a fault will occur. Larger birds and congregations of birds are likely to result in heavy pollution of insulator strings. Bird nests may also cause faults through nest material protruding and constituting an air gap intrusion.

Relevant to this study, faulting associated with streamers and faecal pollution is possible on the self support towers of the proposed 400kV power lines, particularly those towers that are located close to water sources (rivers, dams and pans). Towers constructed within Corridor 2 will also be highly susceptible to this impact because of the proximity of the two vulture restaurants (i.e. cumulative impact). An assessment table for this impact has not been compiled as the impact is specific to self-supporting towers in areas close to water sources regardless of the Corridor chosen. The negative impact caused to the quality of the electrical supply can be mitigated through the installation of bird guards on towers identified during the site-specific EMP (walk down).

	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (3)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (60)**	**Low (28)**

Status	Negative impact on the power line	Negative impact on the power line
Reversibility	Yes	
Irreplaceable loss of resources	Impact on the quality of supply	Impact on the quality of supply
Can impacts be mitigated	Yes	
Mitigation: » Bird guards to be installed on towers identified during the site specific EMP. The high risk towers will be identified during the Construction EMP.		
Cumulative impacts: » Corridor 2 – High cumulative impacts due to presence of two vulture restaurants.		
Residual impacts: » High residual impacts. This impact will persist as long as the power lines are operational		

7.3.1. Comparison of Transmission Power Line Alternatives

The tables overleaf provide a comparative assessment of the potential impacts on avifauna associated with each alternative corridor under consideration.

Impact tables Comparing the significance of Impacts on Avifauna for each Transmission Line Corridor: <u>Medupi-Mokopane Corridors</u>

Nature of the Impact: **Collisions with the 400kV power lines and turn ins (vulnerable Red Data species include Blue Crane, Secretary bird, Kori Bustard, Denham's Bustard and the various stork species)**

Relevant to this study, the earth wire of the 400kV power lines will be the biggest risk from a bird collision perspective. Birds in flight tend to see the bundled conductors, and then gain height to avoid them. In the process, the much thinner earth wire is not noticed and the birds may then collide with it. The species most likely to be impacted upon include the Blue Crane, Secretarybird, Southern Bald Ibis, Denham's Bustard, Kori Bustard, White-bellied Korhaan, Greater and Lesser Flamingos, the various vulture and stork species. The dams, rivers, pans, wetlands and arable lands identified during the field investigations will undoubtedly attract most of these species and since these habitats feature along each of the proposed corridors, it is likely that significant mitigation will have to be employed regardless of the corridor chosen, however this is particularly true for Corridors 1 and 2.

	Corridor 1		**Corridor 2**		**Corridor 8**		**Corridor 8 deviation**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Spatial Extent	Regional (3)	Local (2)	Regional (3)	Local (2)	Regional (3)	Local (2)	Regional (3)	Local (2)
Duration	Permanent (5)	Long Term (4)	Permanent (5)	Long Term (4)	Permanent (5)	Long Term (4)	Permanent (5)	Long Term (4)
Magnitude	Moderate (3)	Low (2)	High (4)	Moderate (3)	Moderate (3)	Low (2)	High (4)	Moderate (3)
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
Probability	Medium (3)	Low (2)	High (4)	Medium (3)	Medium (3)	Low (2)	High (4)	Medium (3)
Significance	**Medium (42)**	**Low (22)**	**Medium (60)**	**Medium (36)**	**Medium (42)**	**Low (22)**	**Medium (60)**	**Medium (36)**
Status (positive or negative)	Negative							
Irreplaceable loss of resources	Yes							
Can impacts be mitigated?	Yes							
Mitigation: Bird Fight Diverters to be installed on the earth wires of high risk sections of power line identified during the walk down								
Cumulative impacts	Cumulative impact is low, limited existing impacts		Cumulative impact is high with the presence of agricultural activities i.e. irrigated lands, subsistence and commercial farming					
Residual impacts: impact remains until power lines are decommissioned and removed								

Nature of the Impact: **Habitat destruction associated power line developments (vulnerable species include those Red Data species that utilise woodland and riparian habitats)**

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 minimise the risk of fire under the line, since it can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, through the modification of habitat.

Habitat destruction within sections of Corridor 2, Corridor 8 and Corridor 8 Deviation is not anticipated to be significant since much of the study area is considered to be already transformed and disturbed through the establishment of infrastructure, subsistence and commercial agricultural practices, pastoral activities and settlements. This change in land use has resulted in a relatively small extent of natural habitat left intact. However the converse is true for the vast tracts of woodland in Corridor 1.

	Corridor 1		**Corridor 2**		**Corridor 8**		**Corridor 8 Deviation**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Spatial Extent	Regional (3)	N/A	Regional (3)	N/A	Regional (3)	N/A	Regional (3)	N/A
Duration	Long Term (4)	N/A	Long Term (4)	N/A	Long Term (4)	N/A	Long Term (4)	N/A
Magnitude	High (4)	N/A	Moderate (3)	N/A	Moderate (3)	N/A	Moderate (3)	N/A
Reversibility	Irreversible (5)	N/A	Recoverable (3)	N/A	Recoverable (3)	N/A	Recoverable (3)	N/A
Probability	Definite (5)	N/A	High (4)	N/A	Medium (3)	N/A	Medium (3)	N/A
Significance	**High (80)**	**N/A**	**Medium (52)**	**N/A**	**Medium (39)**	**N/A**	**Medium (39)**	**N/A**
Status (positive or negative)	Negative							
Irreplaceable loss of resources	Yes, particularly woodland vegetation							
Can impacts be mitigated?	No							
Mitigation: None								
Cumulative impacts	Cumulative impact is low, limited existing impacts		Cumulative impact is high (other impacts include an existing transmission power line, irrigated lands, road networks, housing and mining).					
Residual impacts: Impact remains until power lines are decommissioned and removed								

Nature of the Impact: **Disturbance (vulnerable breeding Red Data species include Martial Eagle, Tawny Eagle, White-backed Vulture, Cape Griffon and the various stork species)**

During the construction and maintenance of electrical infrastructure, a certain amount of disturbance results. Although existing disturbance levels are moderate to low along Corridors 8 and 8 Deviation (emanating from the existing settlements, agricultural practices and maintenance of existing power lines) it is likely that the cumulative impact of these sources of disturbance could impact negatively on the breeding activities of most bird species occurring in these corridors.

	Corridor 1		**Corridor 2**		**Corridor 8**		**Corridor 8 Deviation**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Spatial Extent	Regional (3)	Local (2)	Regional (3)	Local (2)	Regional (3)	Local (2)	Regional (3)	Local (2)
Duration	Medium Term (3)	Short Term (2)	Medium Term (3)	Short Term (2)	Medium Term (3)	Short Term (2)	Medium Term (3)	Short Term (2)
Magnitude	High (4)	Moderate (3)	Moderate (3)	Low (2)	Moderate (3)	Low (2)	Moderate (3)	Low (2)
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
Probability	High (4)	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)
Significance	**Medium (52)**	**Medium (30)**	**Medium (36)**	**Low (27)**	**Medium (36)**	**Low (27)**	**Medium (36)**	**Low (27)**
Status (positive or negative)	Negative							
Irreplaceable loss of resources	Yes							
Can impacts be mitigated?	Yes							
Mitigation: Identify active nests during walk down and limit construction and unnecessary driving past nests during breeding times								
Cumulative impacts	Low		High (existing disturbance levels emanating from the settlements and agricultural practices)		Medium (existing disturbance associated with maintenance of the existing power lines)			
Residual impacts: Impact remains until power lines are decommissioned and removed								

Impact tables Comparing the significance of Impacts on Avifauna for each Transmission Line Corridor: <u>Mokopane-Witkop Corridors</u>

Nature of the Impact: **Collisions with the 400kV power lines and turn ins (vulnerable Red Data species include Blue Crane, Secretary bird, Kori Bustard, Denham's Bustard and the various stork species)**

Relevant to this study, the earth wire of the 400kV power lines will be the biggest risk from a bird collision perspective. Birds in flight tend to see the bundled conductors, and then gain height to avoid them. In the process, the much thinner earth wire is not noticed and the birds may then collide with it. The species most likely to be impacted upon include the Blue Crane, Secretarybird, Southern Bald Ibis, Denham's Bustard, Kori Bustard, White-bellied Korhaan, Greater and Lesser Flamingos, the various vulture and stork species. The dams, rivers, pans, wetlands and arable lands identified during the field investigations will undoubtedly attract most of these species and since these habitats feature along each of the proposed corridors, it is likely that significant mitigation will have to be employed regardless of the corridor chosen.

	Corridor 4		**Corridor 5**		**Corridor 6**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Spatial Extent	Regional (3)	Local (2)	Regional (3)	Local (2)	Regional (3)	Local (2)
Duration	Permanent (5)	Long Term (4)	Permanent (5)	Long Term (4)	Permanent (5)	Long Term (4)
Magnitude	High (4)	Moderate (3)	Moderate (3)	Low (2)	Moderate (3)	Low (2)
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
Probability	High (4)	Medium (3)	Low (2)	Improbable (1)	Low (2)	Improbable (1)
Significance	**Medium (60)**	**Medium (36)**	**Low (28)**	**Low (11)**	**Low (28)**	**Low (11)**
Status (positive or negative)	Negative					
Irreplaceable loss of resources	Yes					
Can impacts be mitigated?	Yes					
Mitigation: Bird Fight Diverters to be installed on the earth wires of high risk sections of power line identified during the walk down						
Cumulative impacts	Cumulative impact is low, limited existing impacts		Cumulative impact is high with the presence of agricultural activities i.e. irrigated lands, subsistence and commercial farming			
Residual impacts: Impact remains until power lines are decommissioned and removed						

Nature of the Impact: **Habitat destruction associated power line developments (vulnerable species include those Red Data species that utilise woodland and riparian habitats)**

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 minimise the risk of fire under the line, since it can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, through the modification of habitat.

The vast tracts of woodland in sections of Corridor 4 would be particularly vulnerable to habitat destruction. It is likely that the majority of the raptor species recorded in the study area are resident within these woodlands. The clearing of servitudes along these corridors would pose a significant threat to these species as they require large trees in which to breed and nest successfully.

	Corridor 4		**Corridor 5**		**Corridor 6**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Spatial Extent	Regional (3)	N/A	Local (2)	N/A	Local (2)	N/A
Duration	Long Term (4)	N/A	Long Term (4)	N/A	Long Term (4)	N/A
Magnitude	High (4)	N/A	Low (2)	N/A	Low (2)	N/A
Reversibility	Irreversible (5)	N/A	Recoverable (3)	N/A	Recoverable (3)	N/A
Probability	Definite (5)	N/A	Medium (3)	N/A	Medium (3)	N/A
Significance	**High (80)**	**N/A**	**Medium (33)**	**N/A**	**Medium (33)**	**N/A**
Status (positive or negative)	Negative					
Irreplaceable loss of resources	Yes, particularly woodland vegetation					
Can impacts be mitigated?	No					
Mitigation: None						
Cumulative impacts	Cumulative impact is low, limited existing impacts		Cumulative impact is high (other impacts include an existing transmission power line, irrigated lands, road networks, housing and mining).			
Residual impacts: Impact remains until power lines are decommissioned and removed						

Nature of the Impact: **Disturbance (vulnerable breeding Red Data species include Martial Eagle, Tawny Eagle, White-backed Vulture, Cape Griffon and the various stork species)**

During the construction and maintenance of electrical infrastructure, a certain amount of disturbance results. Although existing disturbance levels are moderate to low along Corridors 5 and 6 (emanating from the existing settlements, agricultural practices and maintenance of existing power lines) it is likely that the cumulative impact of these sources of disturbance could impact negatively on the breeding activities of most bird species occurring in these corridors.

	Corridor 4		**Corridor 5**		**Corridor 6**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Spatial Extent	Regional (3)	Local (2)	Regional (3)	2 (Local)	Regional (3)	2 (Local)
Duration	Medium Term (3)	Short Term (2)	Medium Term (3)	Short Term (2)	Medium Term (3)	Short Term (2)
Magnitude	High (4)	Moderate (3)	Moderate (3)	Low (2)	Moderate (3)	Low (2)
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
Probability	High (4)	Medium (3)	Low (2)	Low (2)	Low (2)	Low (2)
Significance	**Medium (52)**	**Medium (30)**	**Low (24)**	**Low (18)**	**Low (24)**	**Low (18)**
Status (positive or negative)	Negative					
Irreplaceable loss of resources	Yes					
Can impacts be mitigated?	Yes					
Mitigation: Identify active nests during walk down and limit construction and unnecessary driving past nests during breeding times						
Cumulative impacts	Low		High (existing disturbance levels emanating from the settlements and agricultural practices)			
Residual impacts: Impact remains until power lines are decommissioned and removed						