

» Relevant Factors in selecting a Preferred Corridor

The following factors were incorporated in the formula using field observations, the CSIR Land Cover Database and high resolution Google satellite imagery as the main source of data:

- * *Wetlands and dams:* Wetlands and dams are of particular importance for birds in the study area, as the area is relatively arid. Currently the study area contains many large wetlands and dams which is an indicator of a higher collision risk.
- * *Rivers:* The study area contains the Lephalale, Mokolo and Mogalakwena and their tributaries. Rivers are obviously important for birds and many waterbird species occur only along the rivers. The rivers are particularly important for stork species such as Black Stork and Yellow-billed Stork and are an indication of a higher collision risk.
- * *Woodland:* Sections of Corridors 2, 4 and 8 lie within pristine woodland habitat. Woodland is an indication of a higher habitat destruction and disturbance risk.
- * *Other transmission lines:* It is a proven fact that placing a new line next to an existing line reduces the risk of collisions to birds. The reasons for that are two-fold, namely it creates a more visible obstacle to birds and the resident birds, particularly breeding adults, are used to an obstacle in that geographic location and have learnt to avoid it (APLIC 1994). Other transmission lines running parallel to the proposed alignments were therefore treated as a risk reducing factor.
- * *Roads:* These were taken as an indication of human activity and particularly vehicle and pedestrian traffic. It was assumed that the birds will avoid the immediate vicinity of roads due to the presence of traffic and pedestrians, and therefore it will reduce the risk of collision with lines running next to roads.
- * *Settlements:* Towns are obvious centres of human activity and are generally avoided by large power line sensitive species. The presence of towns and settlements is therefore a risk reducing factor.
- * *Irrigation:* Irrigation crops, especially lucerne, are important draw cards for species such as cranes and storks, especially in an arid landscape thereby increasing the risk of collisions.
- * *Fallow lands:* Fallow lands create artificial open areas in woodland, which are much favoured by species such as Kori Bustards and Secretarybirds.

» Designing an index to calculate the collision risk in each corridor

The factors mentioned above were incorporated into a formula to arrive at a risk rating for each corridor (refer to Table 5 of the specialist avifauna report contained in Appendix G). The formula was designed as follows:

- * The number of dams or wetlands within 500m of the proposed alignment was calculated.
- * The number of rivers crossed by each alignment was counted.
- * The distance that the proposed corridors lie directly within pristine natural woodland was measured in kilometres.
- * The number of times a primary and/or secondary road was crossed by each of the corridors was calculated.
- * The number of settlements located within 1km of each alignment was counted.
- * The distance that the proposed alignments are directly parallel to other lines was measured.
- * The length of alignment running parallel with or across irrigated crops and fallow lands was measured in kilometres.

As all these factors do not have an equal impact on the size of the risk, a weighting was assigned to each factor, based on the specialist's judgment and experience on how important the factor is within the total equation (refer to Table 6 of the specialist avifauna report contained in Appendix G). Risk reducing factors were assigned a negative weight. The final risk score for a **factor** was calculated as follows: measurements or counts multiplied by the risk weighting. The final risk rating for a **corridor** was calculated as the sum of the risk scores of the individual factors (refer to Table 7.1 below).

Table 7.1: Preference scores for the seven proposed corridors

Alternatives	Score
Corridor 1 (Medupi-Mokopane)	214.86
Corridor 2 (Medupi-Mokopane)	82.98
Corridor 4 (Mokopane-Witkop)	99.52
Corridor 5 (Mokopane-Witkop)	21.70
Corridor 6 (Mokopane-Witkop)	19.92
Corridor 8 (Medupi-Mokopane)	28.76
Corridor 8 Deviation (Medupi-Mokopane)	-6.40

Medupi-Mokopane Corridors:

From the collision risk analysis, as well as from field investigations undertaken, it is clear that **Corridor 8 Deviation** holds the least risk from a bird interaction perspective. From an avifaunal perspective, Corridor 1 is considered to be a no-go area as impacts associated with the construction within this corridor are expected to be of high significance and difficult to mitigate.

The presence of the existing Matimba-Witkop 400kV power line within this corridor played a major role in this outcome, despite the relatively extensive areas of pristine woodland, agriculture and fallow lands. The area surrounding

the existing servitudes is subjected to periodic disturbance as a result of annual maintenance being carried out on the Matimba-Witkop 400kV power lines and the mere presence of the existing transmission lines could potentially reduce the risk of collisions along the proposed Medupi-Mokopane and Mokopane-Witkop power lines provided that the new power lines are constructed immediately adjacent to the existing power lines, with the outer line being within 200m of the existing Matimba-Witkop 400kV power lines.

As already mentioned in Chapter 2, the conclusions of a technical investigation undertaken by Eskom indicate that it will not be technically feasible to construct the new power lines directly adjacent to the existing lines for the entire length of the corridor. This is due to two narrow gorges along the existing Matimba-Witkop alignment within Corridor 8, as well as issues raised by landowners within the EIA process for the Matimba-Witkop No 2 400kV power line which must be taken into consideration. Therefore, should Corridor 8 (or Corridor 8 Deviation) be selected as the preferred option, the new lines would have to deviate from the existing lines in a number of places. These areas are illustrated and explained in Figure 7.2.

Corridor 8 Deviation is considered to hold the least risk from a bird-interaction perspective, provided that deviations indicated in Figure 7.2 are:

- » the only areas where the proposed lines will deviate from the existing lines;
- » the deviation distances are kept short and
- » the deviations denoted in Figure 7.2 are still located within the 5 km corridor assessed within this EIA report.

It must be noted that the deviation indicated with an asterisk in Figure 7.2 will require special attention. The proposed Medupi-Mokopane power lines alongside this nature reserve cannot be placed anywhere within the 5 km corridor. It is highly recommended that the proposed line be placed to the north of the existing lines, on the outer side of reserve's northern boundary as indicated in Figure 7.3 below (yellow hatched line).

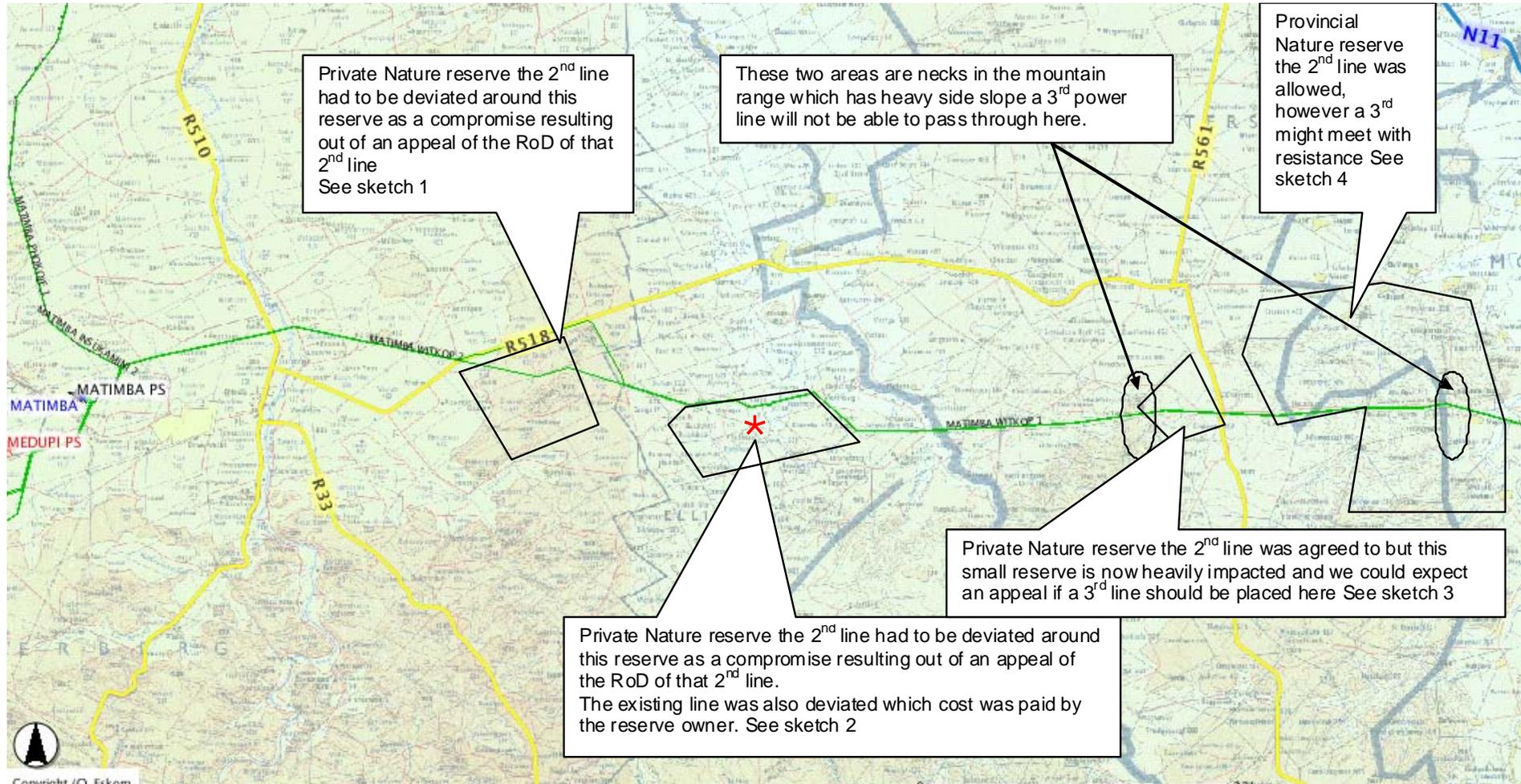


Figure 7.2: Map from Eskom of the existing Matimba-Witkop line indicating the two narrow gorges and sections of line where issues were raised regarding the Matimba-Witkop No 2 400kV line

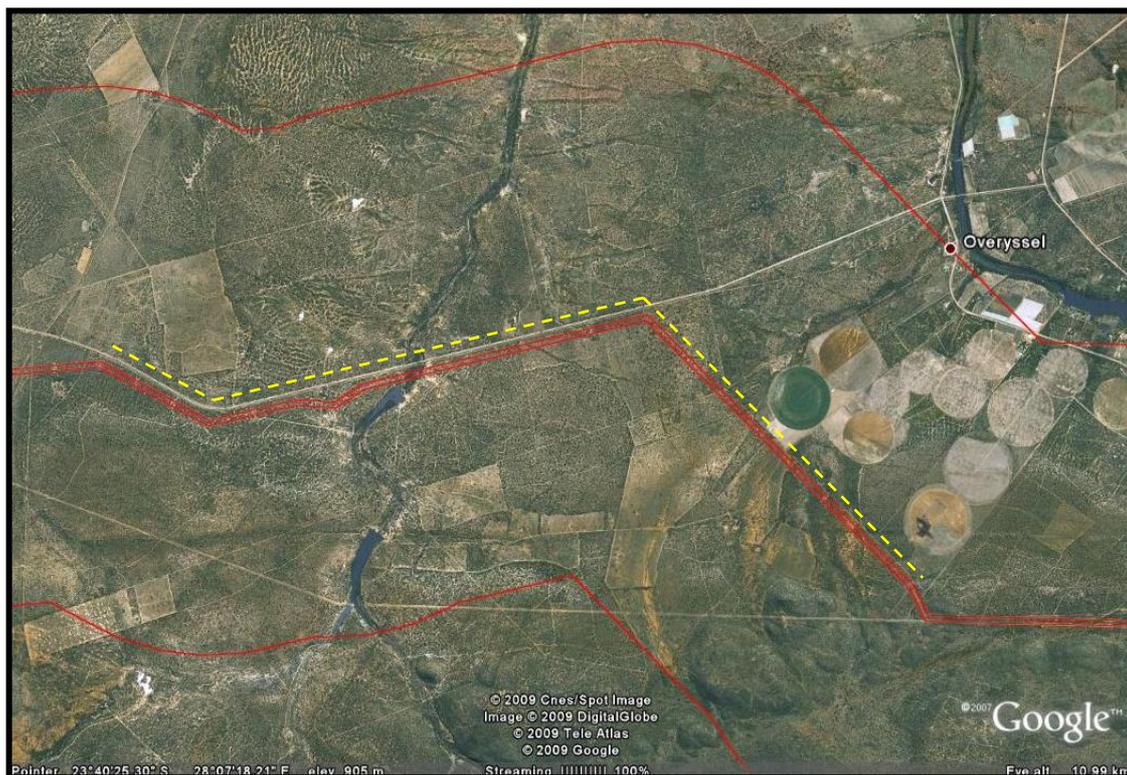


Figure 7.3: The recommended deviation route indicated by the yellow dashed line. The 5 km corridor investigated in the EIA process is indicated by the red solid lines to the south of the proposed route deviation.

In addition to the above conditions, avifaunal sensitive areas were identified within the portion of corridor 2 which forms part of Corridor 8 Deviation (refer to Figure 7.4 and 7.5). These areas (pans, dams, irrigated lands and agricultural fields) have been classed as no go areas based on their ability to support water dependent and large terrestrial bird species, highly susceptible to collisions with the earth wires of transmission lines, therefore **construction within these areas should be avoided**. It must be noted that avoiding these areas does not preclude the marking of the proposed power lines in other areas within the preferred corridor. These areas will be required to be identified during the site specific walk down during the final EMP phase of the project.

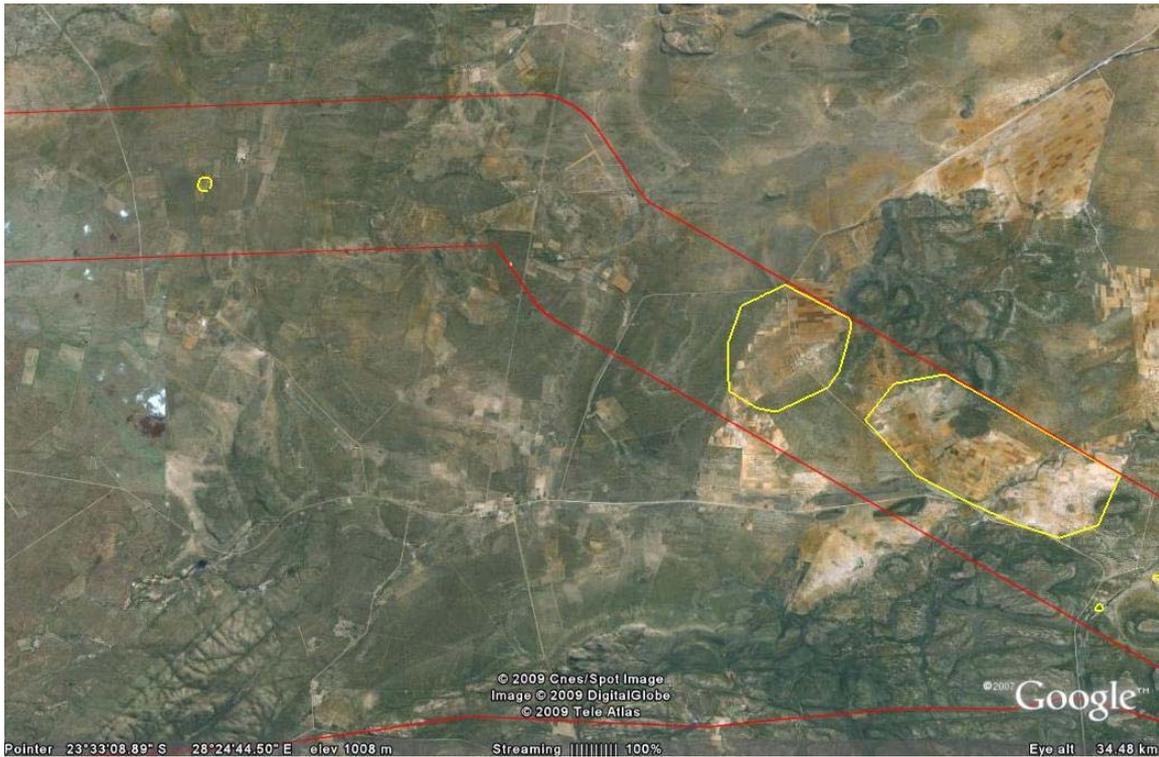


Figure 7.4: No go areas identified within the portion of Corridor 2 which forms part of Corridor 8 Deviation

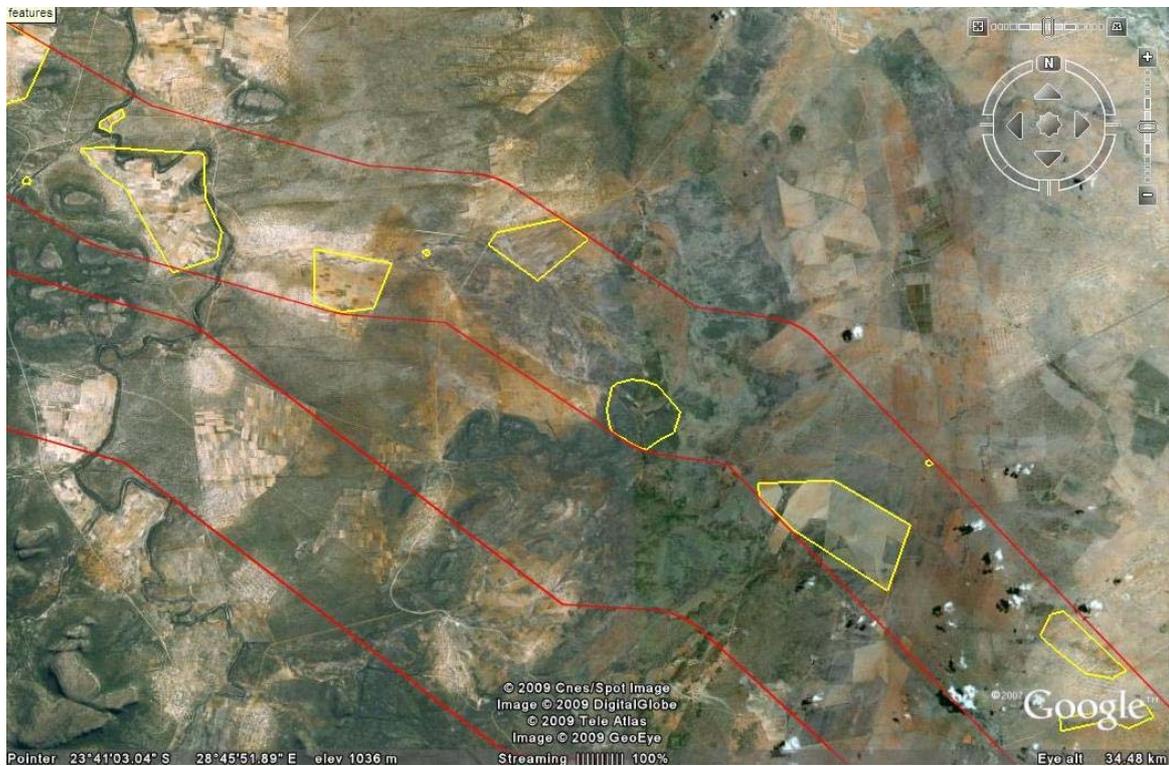


Figure 7.5: No go areas identified within the portion of Corridor 2 which forms part of Corridor 8 Deviation

Mokopane-Witkop Corridors:

As far as the Mokopane-Witkop corridors are concerned, **Corridor 6** presents itself as the preferred alternative from an avifauna perspective. This is due to the presence of an existing transmission line within the corridor. The placement of the proposed Mokopane-Witkop 400kV power lines within this corridor will partially mitigate for the anticipated impacts on avifauna, most particularly that of collision, since the more lines which are placed together, the more visible the overhead cables become, and risks are kept together rather than spread out across the landscape.

Delta-Medupi Corridor:

A single Delta-Medupi corridor was assessed using field observations and high resolution Google Earth Imagery during the EIA phase. Although the corridor does not appear to contain any rivers or drainage lines, the vegetation is largely open and as a result susceptible to collision impacts. One must however consider the existing infrastructure contained within this corridor, the proposed Delta Medupi 400kV power lines and future developments associated with the Medupi Power Station planned in this area which are likely to displace the Red Data species occurring there. Impacts are considered to be relatively low in contrast with the larger Medupi-Mokopane and Mokopane-Witkop corridors, and can be mitigated where necessary.

7.3.2. Conclusions and Recommendations

Collision of large terrestrial Red Data bird species will be a significant impact of the proposed 400kV lines. Species most likely to be affected by this impact are the more heavily-bodied species recorded in the area, i.e. Blue Crane, Secretarybird, Southern Bald Ibis, Denham's Bustard, Kori Bustard, White-bellied Korhaan, Greater and Lesser Flamingos and the various vulture and stork species. These species are priority species due to their proven vulnerability to collision with power lines, and their reported occurrence within the study area. Non-Red Data species such as water birds will also be affected. Provided that the relevant sections of the power line are comprehensively marked with a suitable anti-collision marking device, it is expected this impact can be reduced to acceptable levels. It must be noted that the negative impacts far outweigh the positive impacts associated with a development of this nature.

Following an analysis of the proposed route alignments, **Corridor 8 Deviation** (Medupi-Mokopane) and **Corridor 6** (Mokopane-Witkop) were considered to be the preferred alternatives from an avifaunal perspective. It is considered vital that the identified no-go areas within the portion of Corridor 2 which forms part of Corridor 8 Deviation be considered in the final route planning.

A single Delta-Medupi (Corridor 7) corridor was assessed and the impacts are considered to be relatively low in contrast with the larger Medupi-Mokopane and Mokopane-Witkop corridors, and can be mitigated where necessary.

The following measures are recommended in order to mitigate as far as possible for the above mentioned impacts:

» *Collision with earth wire:*

Avoid construction in the no go areas within Corridor 2 (should this corridor be selected as the preferred alternative). In addition to this, the earth wire of those sections of line that cross or are in close proximity to the dams, rivers, pans, wetlands and arable lands situated along the final power line alignment should be marked with a suitable marking device according to Eskom Transmission Guidelines (refer to the EMP contained within Appendix O for further details in this regard). The actual areas where marking will be effected can only be demarcated once a corridor has been selected and an alignment within the corridor finalised. This exercise will have to be done during the 'walk down' of the power line routes once it has been negotiated, surveyed and pegged.

» *Habitat destruction during construction activities*

All construction and maintenance activities should be carried out according to generally accepted environmental best practices. In particular, care should be taken in the vicinity of the river crossings and woodland areas. Existing roads must be used as far as possible for access during construction. The cutting down of large trees in woodland areas and deep riverine gorges should be avoided.

» *Electrocution*

Due to the large clearances on the proposed lines, electrocution through conventional means is impossible. This impact is therefore insignificant and therefore no mitigation is required.

» *Disturbance during construction activities*

It is envisaged that during the construction activities of the new power lines disturbance of nesting birds is likely to occur and could potentially have an impact on the breeding population of large raptors and other bird species occurring in the study area. The breeding season for the large raptor species is from March to November. The most critical period within this time span is from April to May when the eggs are incubated. Another sensitive period is from October to November when the young birds are almost ready to fledge. Early in the breeding season, the risk of desertion by the adults due to disturbance is larger than later in the season (when the young bird is on the

nest and being fed by the adults). At the end of the breeding season the young bird may be tempted to jump out of the nest and fly prematurely if disturbed, resulting in injury or even death. Every attempt will have to be made to restrict the disturbance of raptors and other bird species to a minimum during construction. Wherever possible, nest sites must be identified during the final EMP phase of the project and mitigated on a site-specific basis.

» *Impact on the quality of supply*

Both bird streamers and bird pollution occur as a result of birds perching on pylons or towers, often directly above live conductors. This impact is likely to occur on the self-supporting towers of the Delta-Medupi, Medupi-Mokopane and Mokopane-Witkop 400kV power lines and turns-ins associated with the Mokopane Substation, particularly those towers that are located close to water sources (rivers, dams and pans). Towers requiring mitigation in the form of bird guards to prevent the birds from perching above critical areas, will be identified during the specialist 'walk-through' survey prior to construction of the transmission lines.

7.4. Assessment of Potential Visual Impacts

The construction of transmission line infrastructure in populated areas will always be problematic from a visual impact point of view. The EIA process for the Mokopane Integration Project highlighted this through the number of complaints and concerns received from landowners and residents within the study area. The lower density residential areas (agricultural holdings), with a decidedly more rural character, will be more affected by the project infrastructure than high-density residential areas. The higher occurrence of structures and visual clutter within high-density residential areas tend to absorb the visual impact.

Potential visual impacts are expected to be associated with both the construction and operational phases of the proposed project. In the event of eventual decommissioning of the infrastructure, impacts are expected to be similar to those experienced in the construction phase of the project.

7.4.1. Potential Visual Impacts associated with the Construction Phase of the Transmission Lines

The construction phase of the proposed 400kV power lines is expected to extend over a 24-month period. This is obviously dependent on a number of external factors that may not always be controlled by either Eskom or the preferred contractors. During this time heavy vehicles will frequent the roads to the substation site and along the transmission line corridor and may cause, at the very least, a visual nuisance to other road users and resident of the area.

Visual impacts associated with the construction phase, albeit temporary, should be managed according to the following principles:

- » Reduce the construction period through careful planning and productive implementation of resources.
- » Restrict the activities and movement of construction workers and vehicles to the immediate construction site.
- » 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.

7.4.2. Potential Visual Impacts associated with the Operational Phase of the Transmission Lines

The construction of the proposed 400 kV transmission power lines will impose a visual impact on the surrounding area. The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers or if the visual perception of the structure is favourable to all the observers, there would be no 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. Potential impacts are expected where sensitive visual receptors occur or in areas where there is higher viewer incidence and/or potentially negative viewer perception of the proposed project infrastructure. Four such areas were identified for the study area:

- » The **first area** includes towns (Lephalale and Mokopane), residential areas (Onverwacht), villages and settlements (predominantly to the north and east of the study area), individual homesteads/farm residences (scattered throughout the study area) and private game reserves/farms (with tourist lodges). The last category includes the farm boundaries of consulted landowners who indicated that their farms are utilised for game viewing, hunting, photographic safaris and/or informal conservation areas. The farms are not expected to contain a high viewer density, but observers (tourists/visitors) are expected to have a potentially high negative viewer perception of the project infrastructure due to the nature-based activities within these areas. Farms in close proximity of the proposed project infrastructure within **area one** include, inter alia:

Kuipersbult 511 LQ	Spider 535 LQ
Zongezien 467 LQ	Durban 522 LR
Kalkfontein 468 LQ	Wynberg 521 LR
Vucht 436 LQ	Weltevreden 508 LR
Wellington 432 LQ	Groetfontein 494 LR
Garibaldi 480 LQ	Spektakel 526 LR
Weltevreden 482 LQ	Drakensberg 549
Grootgenoeg 426 LQ	New Belgium 608
Samaria 207 LR	Hanover 555 LR
Goa 427 LR	Rivierplaats 541
Villa Nora 428 LR	Zwellendam 548 L
Killarney 210 LR	Poeskopdrift 545
Goedgelegen 194 LR	De Koop 525 LR
Buffelsfontein 220 LR	Colesberg 556 LR
Deugdzaamheid 197 LR	Uitvlugt 567 LQ
Stinkkraal 195 LR	Duikerfontein 53
Deugdzaamheid 197 LR	Norfolk 559 LR
Turflaagte 214 LR	Rivierplaats 541
Tiel 218 LR	Eyzerbeen 553 LR
Grobbelaarshoek 462 LR	Sterkfontein 459 LR
Early Morn 215 LR	Duna 554 LR
Witpan 447 LR	Sterkwater 560 L
Pieterman 445 LR	Groot Denteren 5
Rooibokpan 216 LR	Grafton 565 LQ
Duikerrivier 568	Adelaide 557 LR
Schoonhoven 448 LR	Duikerrivier 568
Fairfield 219 LR	Sterkwater 560 L
Leerdam 443 LR	Broederschap 581
Scheveningen 444 LR	Laussonie 561 LR
Welgevonden 449 LR	Daggakraal 591 LR
Gouda 453 LR	Rhynosterfontein 538 LR
Johannisberg 509 LR	Slangfontein 655 LR
Kirstenbos 497 LR	Lola Montez 796 LR
Klip Bank 713 LR	St. Etienne 798 LR
Schrikfontein 715 LR	Wydenhoek 216 KR
Hookdoorn Draai 711 LR	Appingendam 805 LR
Windsor-Castle 493 LQ	Kranskloof 218 KR
Toulon 495 LQ	Smithsfield 536 LQ
Cradock 534 LQ	Fairfield 219 LR
Diepspruit 463 LR	Republiek 456 LR

A comprehensive indication of identified and consulted landowners can be obtained from the project database and the Landowner Map (refer to Appendix C).

The high-density residential areas are expected to have a high visual absorption capacity and will not suffer as severe a potential visual impact as the rural settlements due to the occurrence of less visual clutter. Residents along the perimeter of high-density residential areas could however still be exposed to the project infrastructure, necessitating the inclusion of these neighbourhoods into the first zone. Residents of this zone are seen as potentially sensitive visual receptors upon which the construction of the substation or transmission lines could have a negative visual impact.

Villages and rural settlements (in close proximity of the proposed project infrastructure) within **area one** include:

Neckar	Ga-Lebelo
Ga-Maeteletsa	Mosuka
Abbottspoort	Mphello
Bangalong	Uitspanning
Ga-Monyeki	Diretsaneng
Ga-Musi	Magagamatala
Ga-Nkidikitlana	Buffelshoek
Mongatane	Ga-Tshba
Mathlati	Kgopeng
Setateng	Ga-Malope
Ga-Monare	Diphitshi
Sepobe	Lenkwane
Vianen	Matebeleng
Segole 1	Ga-Monene
Nong	Ga-Malapila
Ga-Rapadi	Ga-Mokwena
Senita	Ga-Molekwa
Ga-Mathekga	Dibeng
Mosira	Thutlane
Sandsloot	Vlakfontein B
Phofu	Ngope
Madietane	Ga-Mosoge
Nokayamatlala	Sekuruwe
Goedehoop	Ga-Malebana
Phetole	Morwasethula
Ga-Masipa	Phatsane
Pudiyakgopa	Ga-Mashashane
Ga-Mabusela	Sebora
Jupiter	Ramorulana
Diana	Ga-Mabuela
Ga-Malokwa	Ga-Tshaba
Ga-Ramu	Mapela
Manyapye	Segoahleng

Ga-Mangou	Mmahlogo
Glen Roy	Ga-Motlana
Ga-Molaka	Ga-Matlapa
Makekengf	Mmamatlakala
Sepharane	Ga-Masenya 2
Utjane	Ga-Molekana
Lyden	Ga-Masenya 1

- » The **second area** includes a 1 000 m buffer zone along the national roads (N1 and N11) and arterial/main roads (R33, R510, R518 and R101) that represents an area with a high potential of sightings of the project infrastructure (by people travelling along these roads).
- » The **third area** includes the formal/statutory conservation and protected areas within the study area. These reserves qualify as potential sensitive visual receptors due to their conservation status and nature based tourism activities. The proposed project infrastructure has the potential to conflict with the current land use within this zone and will more than likely induce a negative viewer perception.

Identified conservation or protected areas include registered private nature reserves, provincial nature reserves and the UNESCO (United Nations Educational, Scientific and Cultural Organisation) declared Waterberg Biosphere Reserve. The following conservation areas form part of the waterberg Biosphere reserve: D'Nyala, Kwalata, Lapalala, Touchstone, Moepel Farms, Wonderkop, Bellevue, Wit Vinger, Percy Fyfe and Kuschke.

- » The **fourth area** includes the mountainous terrain within the study area, delineated as all areas with slope gradients greater than 20% (1:5 slope ratio). This area was identified due to its inherent aesthetic quality or potential as a scenic tourist attraction. The rationale is that the project infrastructure might negatively influence the tourism development potential of this area.

The rest of the study area, **excluding the above-mentioned zones**, is assumed to be greatly devoid of random observers or sensitive visual receptors. This zone is characterised by relatively large and sparsely populated farms that predominantly function as cattle and game farming areas. This zone has, due to the relative absence of observers, an assumed neutral viewer perception of the proposed power line infrastructure.

It has become apparent from site inspections that the visual absorption capacity of the natural veld (thicket, bushland and woodland) is considerable in mitigating the impact of the proposed project infrastructure. This is true for large tracts of land where the natural vegetation is still intact, even where overgrazing

of grass species occur on cattle and game farms in the northern portion of the study area. The observer is effectively shielded from the structures by dense vegetation adjacent to roads and in the vicinity of residences and lodges. The opposite is also very noticeable where the natural vegetation has been cleared for agricultural fields or where the vegetation cover has been removed/severely degraded through over-utilisation (e.g. wood harvesting). The project infrastructure would be exposed within these predominantly rural settlement areas.

7.4.3. Comparison of Transmission Power Line Alternatives

Viewshed analyses for the transmission line alternatives are shown in Figure 7.6. The visibility of the transmission towers were calculated at a maximum offset of 35 m above ground level for a radius of 5 km (i.e. the expected sphere of visual influence of the transmission line infrastructure) from the centre line.

It has become apparent from site inspections that the visual absorption capacity of the natural veld (thicket, bushland and woodland) is considerable in mitigating the impact of the proposed project infrastructure. This is true for large tracts of land where the natural vegetation is still intact, even where overgrazing of grass species occur on cattle and game farms to the north of the study area. The observer is effectively shielded from the structures by dense vegetation adjacent to roads and in the vicinity of residences and lodges. The opposite is also very noticeable where the natural vegetation has been cleared for agricultural fields or where the vegetation cover has been removed/severely degraded through over-utilisation (e.g. wood harvesting). The project infrastructure would be exposed within these predominantly rural settlement areas.

A broad visual absorption capacity map was created, identifying areas where large tracts of natural vegetation had been removed, in order to model the effects of either the absence or the presence of vegetation cover on the visual exposure of the proposed infrastructure. Areas where the natural vegetation is absent received an additional negative value on the visual impact index (i.e. increasing the potential visual impact where the structures are exposed within this zone).

From Figure 7.6 it is clear that the proposed transmission line infrastructure has the potential to be visually exposed to large areas within the 5km corridors. This is due mainly to the relatively tall (35 m) transmission line towers associated with 400kV power lines. The proposed corridors display a more even potential exposure pattern where they traverse flat terrain and more scattered patterns where they encounter varied topography. Corridor 2, which does not traverse the Waterberg Mountains and escarpment, is seen as having a larger area of potential visual exposure than Corridors 1, 8 or 8 Deviation. The latter of these

alternatives (i.e. Corridor 8 and 8 Deviation) traverse both flat terrain and the Waterberg escarpment and therefore have a combined pattern of visual exposure.

Corridors 4, 5 and 6 have very similar patterns of visual exposure due to their close proximity to each other and the relatively homogenous terrain they traverse.

The combined results of the visual exposure, viewer incidence/perception, visual distance and the visual absorption capacity of the seven transmission corridor alternatives are displayed in Figures 7.7 – 7.9. Here the weighted impact and the likely areas of impact are indicated as a visual impact index. Values were assigned for each potential visual impact per data category and merged in order to calculate the visual impact index. An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence, a predominantly negative perception and that falls within an area of low visual absorption capacity would therefore have a higher value (greater impact) on the index. This assists in focussing the attention on the critical areas of potential impact when evaluating visual impact.

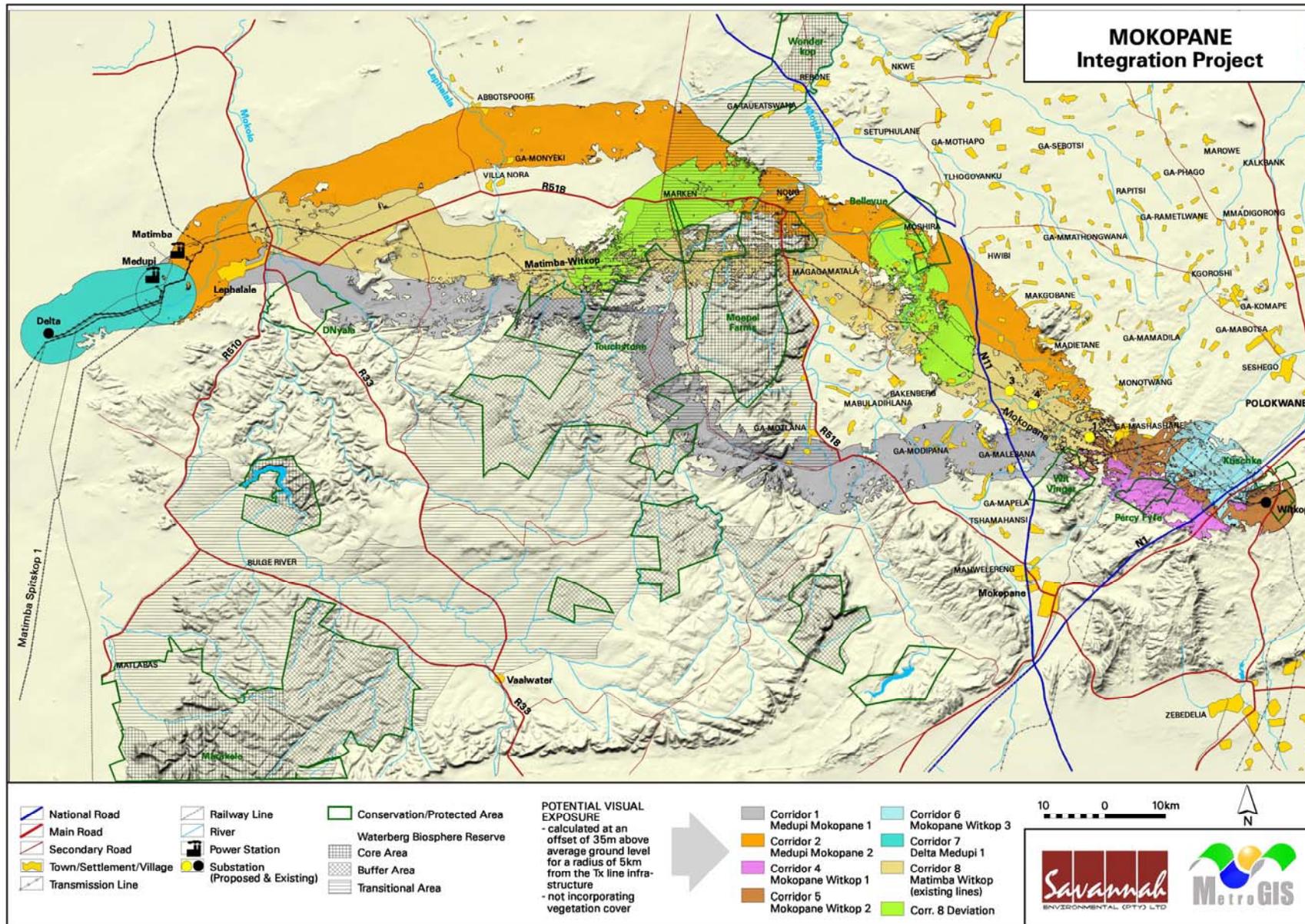


Figure 7.6: Potential visual exposure - transmission line corridor alternatives

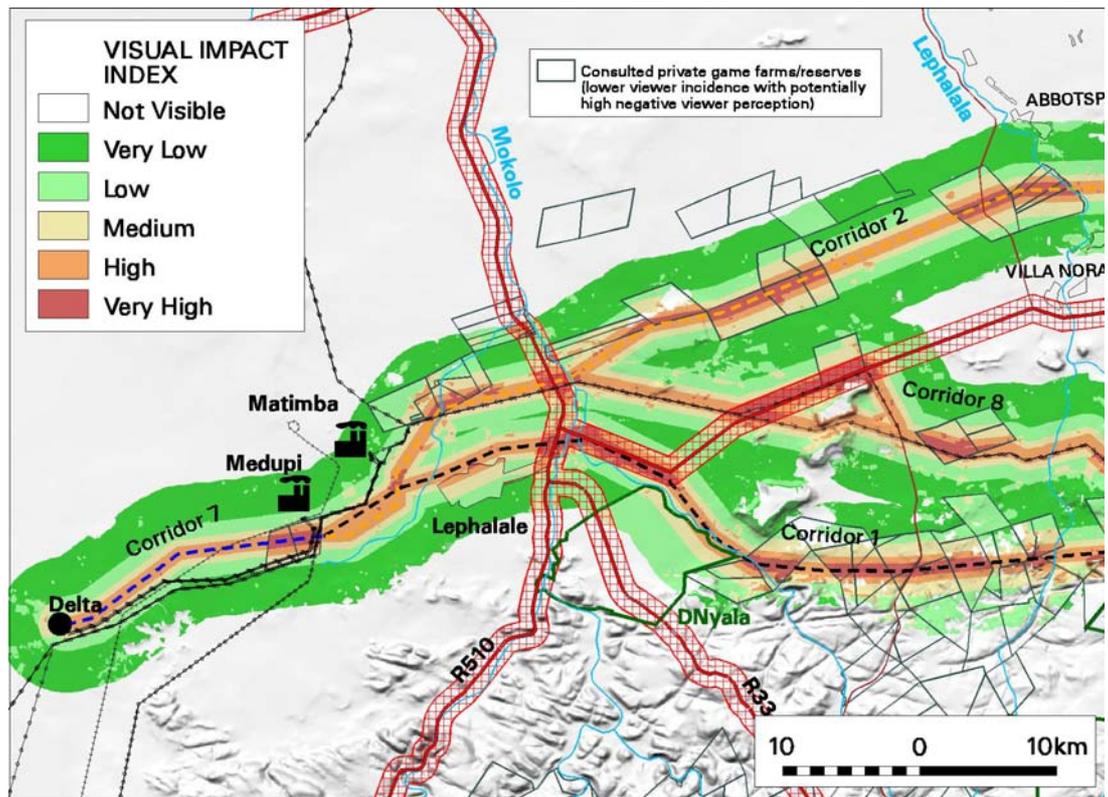


Figure 7.7: Visual Impact Index for transmission line Corridors 1, 2, 7 and 8 (western section)

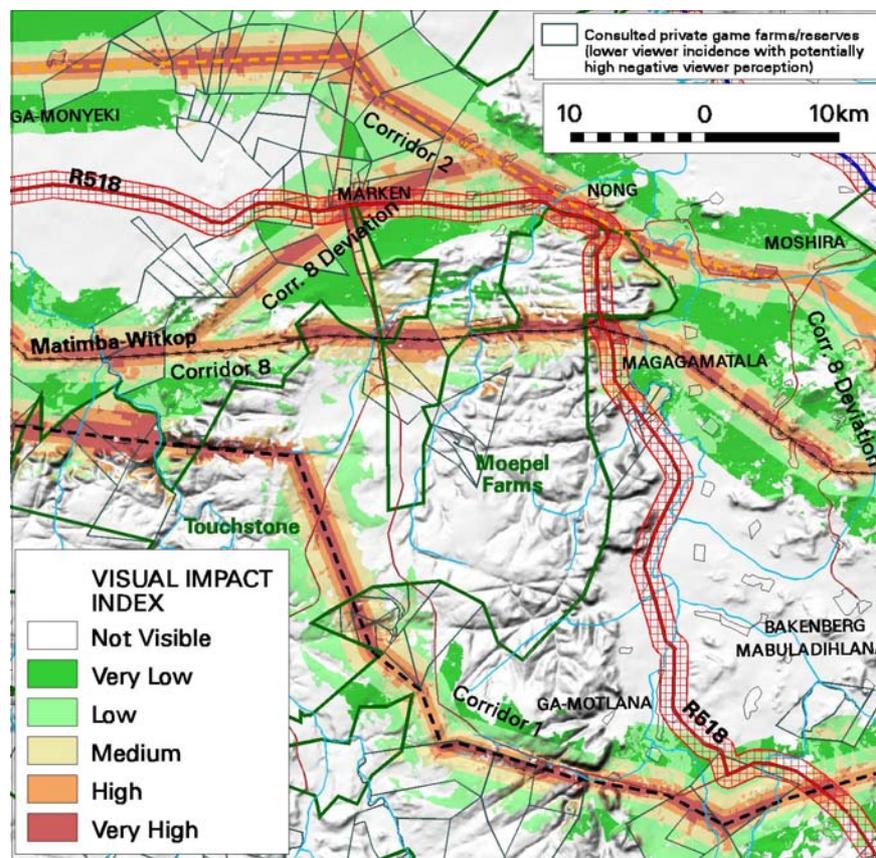


Figure 7.8: Visual Impact Index for transmission line Corridors 1, 2, 8 and 8 Deviation (central section)

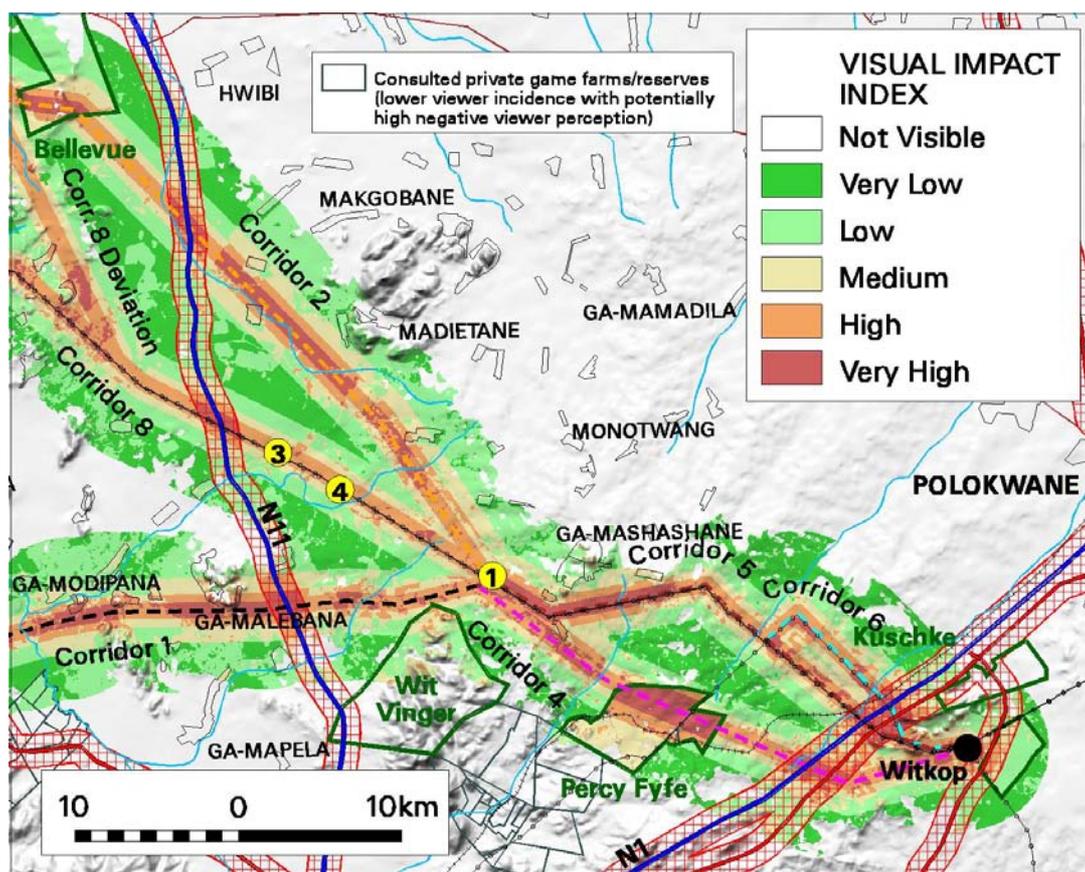


Figure 7.9: Visual Impact Index for Transmission Line Corridors 1, 2, 4, 5, 6, 8 and 8 Deviation (eastern section)

» *Visual impact index – Corridor 1*

Transmission Line Corridor 1 has the potential to have a high visual impact on observers within a 500 m buffer radius along the entire length of the alignment. In many instances this zone traverses remote areas with little or no settlements or major roads (i.e. areas with few or no observers). Most sections of this zone however include isolated homesteads/residences on farms as well as lodges located on game farms and private conservation areas where high to very high visual impacts can be expected.

Farms along this corridor include, inter alia: Spektakel, Drakensberg, New Belgium, Hanover, Rivierplaats, Zwellendam, Poeskopdrift, De Koop, Colesberg, Uitvlugt, Duikerfontein, Norfolk, Rivierplaats, Eyszerbeen, Duikerrivier, Duna, terkwater, Groot Denteren, Grafton, Adelaide, Duikerrivier, Sterkwater, Broederschap, Laussonie, Daggakraal, Rhynosterfontein, Slangfontein, Lola Montez, St. Etienne, Wydenhoek, Appingendam and Kranskloof.

Specific areas of potentially very high visual impact occur where the corridor traverses north of the town of Lephalale (where it crosses over the R310) and where the line runs parallel to the R518 for almost 9 km. The transmission

lines within this corridor are expected to be visible to a great number of observers residing in this area, as well as observers travelling along these roads.

The next section of particular concern, from a visual impact point of view, occurs where the corridor enters the mountainous terrain of the northern part of the Waterberg plateau. The scenic and elevated topography of this area forms part of the buffer zone of the Waterberg Biosphere Reserve and includes a number of conservation/protected areas (including Touchstone, Lapalala, etc.). The potential visual impact for this section of the corridor is expected to be very high due to the envisaged conflicting land use priorities within these protected areas.

The proposed corridor continues across the Waterberg plateau in an easterly direction and drops down the eastern face of the escarpment. It traverses scenic topographical units and could potentially be exposed for great distances due to the elevated nature of the topography. It also passes in close proximity of the Mmamatlakala settlement and private game farms at the foot of the escarpment. This section is expected to have a very high visual impact.

The corridor next enters a more populated region as it crosses the R518, encountering the Mmahlogo, Mapela, Ga-Tshaba and Ga-Malebana settlements, before crossing the N11. This section is expected to have a high frequency of sightings from both the major roads it traverses, as well as from residents living in this area, and is expected to constitute a high to very high visual impact.

The final stretch of the transmission line Corridor 1 includes the northern section of the Witvinger Nature Reserve where it could, depending on the placement of the lines within the corridor, have a moderate to high visual impact on observers.

» *Visual impact index – Corridor 2*

Corridor 2 has the potential to have a high visual impact on observers within a 500 m buffer radius along the entire length of the alignment. This alignment, especially the northern section, is possibly the most remote of all the alternatives. It does, however, encounter a great number of individual homesteads and residences along the way. Many of these function as lodges and guest accommodation on game farms, and could potentially have a very high visual impact on residents and visitors along the corridor.

Farms along this section include, inter alia: Zongezien, Kalkfontein, Vucht, Wellington, Garibaldi, Weltevreden, Grootgenoeg, Samaria, Goa, Villa Nora, Killarney, Goedgelegen, Buffelsfontein, Deugdzaamheid, Stinkkraal,

Deugdzaamheid, Turflaagte, Tiel, Fairfield, Early Morn, Witpan, Pieterman, Rooibokpan, Schoonhoven, Fairfield, Leerdam, Scheveningen, Welgevonden and Gouda.

A number of villages along this alignment could potentially experience short distance visual impacts of the proposed transmission line infrastructure. These include: Bangalong, Ga-Musi, Mongatane, Ga-Monare, Nong, Ga-Mathekga, Ga-Lebelo (west of the N11) and Dibeng, Phofu, Jupiter and Ga-Mangou (east of the N11). Residents of these villages may experience high to very high visual impacts.

This corridor crosses or traverses adjacent to major roads within the region (i.e. the R510, R518 and N11), where very high visual impacts may occur. The corridor runs adjacent to the R518 for approximately 7 km at the northern extremity of the Waterberg escarpment, where it includes a section of the Waterberg Biosphere Reserve core area (Moepel Farms).

Corridor 2 predominantly traverses flat terrain, as it doesn't traverse the Waterberg escarpment. Smaller hills are however encountered where the alignment crosses over the southern section of the Bellevue Nature Reserve, potentially exposing the transmission lines over larger areas within the reserve. Very high visual impacts may occur due to the conflicting nature of land uses within this section.

» *Visual impact index – Corridor 8*

This transmission line alternative differs from the previously mentioned corridors in the sense that it follows the existing two Matimba-Witkop 400kV transmission lines for the entire length of its alignment. It is therefore considered as a "brown fields" linear development as opposed to Corridors 1 and 2 that traverse large tracts of natural land. This development corridor encounters a number of potential visual impacts along its length, but does possess the greatest potential to consolidate the linear infrastructure within the region due to the vertical disturbance caused by the existing lines.

The visual impact index of the Corridor 8 indicates general areas where the construction of two additional transmission lines may contribute to the potential cumulative visual impact along the alignment. These areas, along the entire length of the lines, include individual homesteads/farm houses, lodges and villages/settlements within the corridor.

Villages/settlements along this corridor include: Uitspanning, Magagamatala, Diretsaneng, Ga-Malope, Diphitshi, Ga-Malapila, Ga-Mokwena, Vlakfontein B and Goedeheop.

Farms along this corridor include, inter alia: Johannesburg, Kirstenbos, Klip Bank, Schrikfontein, Hookdoorn Draai, Windsor-Castle, Toulon, Cradock, Smithsfield, Spider, Durban, Wynberg, Weltevreden and Groetfontein

These settlements, lodges and homesteads may experience cumulative visual impacts ranging from moderate to very high.

Specific areas of potentially very high visual impact (due to increased viewer incidence) may occur where the corridor traverses adjacent to the R518 (near Lephalale) for approximately 10 km, the location where it crosses the R518 (near Marken) and the where it crosses the N11 north of Mokopane.

Another area of potentially very high visual impact may occur where the additional lines cross the Waterberg Biosphere Reserve buffer and core areas (Touchstone and Moepel Farms) as well as the section where it drops down the eastern face of the Waterberg escarpment. This entire section of the alignment traverses scenic mountainous terrain that should ideally not have accommodated transmission power line infrastructure.

It must be borne in mind that the potential visual impacts mentioned above would be additional to the existing visual impacts of the two Matimba-Witkop 400kV transmission lines.

» *Visual impact index – transmission line Corridor 8 Deviation*

The transmission line Alternative 8a corridor has the potential to have a high visual impact on observers within a 500m buffer radius along the entire length of the alignment. The western section of this deviation traverses over or near a number of private game farms where it is expected to have a very high visual impact.

Farms along this corridor include: Grobbelaarshoek 462 LR, Diepspruit 463 LR, Sterkfontein 459 LR, Republiek 456 LR and Gouda 453 LR. It further traverses near the little town/settlement of Marken and over the R518 main road, where it will be exposed to a higher number of observers, potentially resulting in a very high visual impact. Villages/settlements along this corridor include: Buffelshoek, Ga-Mokwena and Vlakfontein B.

The eastern section of the Alternative 8a deviation traverses mainly community land where it may have a high visual impact on settlements/villages within the development corridor.

» *Visual impact index – Corridor 4*

The visual impact index of transmission line corridor Alternative 4 indicates potentially high to very high visual impacts within a 500 m buffer of the

proposed lines where the lines traverse near homesteads and a settlement (Ga-Matlapa), where the corridor spans across the Percy Fyfe Nature Reserve and where the corridor crosses the N11 and R101 west of the Witkop substation.

» *Visual impact index – Corridor 5*

Corridor 5 is similar to Corridor 8 due to the fact that it follows the existing Matimba-Witkop transmission lines. The potential visual impacts associated with this alternative are therefore additional to the visual impacts associated with the existing lines.

The cumulative visual impact of the two proposed 400kV transmission lines relates to potentially high to very high visual impacts on homesteads and settlements (Segoahleng, Ga-Matlapa and Seborā) within the corridor, as well as the section where the two new lines cross the R101 and N1 roads.

» *Visual impact index – Corridor 6*

Corridor 6 deviates from Corridor 5 where it follows the two Warmbad-Witkop 275kV transmission lines. Potential cumulative visual impacts (ranging from high to very high) may occur within a 500 m buffer zone of the proposed lines, where the lines traverse adjacent to individual residences, and where the lines cross the R101 and N1 adjacent to the existing power lines.

Both Alternatives 5 and 6 would have to traverse the hills north-west of the Witkop substation, potentially aggravating the cumulative visual impact of power line structures already present on the hills.

» *Visual impact index – Corridor 7*

The 20 km long corridor between the Delta substation and the Medupi power station is relatively uninhabited, except for three or four individual homesteads and the farm Kuipersbult 511 LQ (located south of the Medupi Power Station) that may experience high to very high visual impacts of the proposed new 400kV transmission lines (depending on where they are placed within the corridor). This corridor is adjacent (north) to no less than six transmission power lines originating at the Matimba Power Station, which creates an existing visual disturbance.

Impact tables summarising the significance of Visual Impacts (mitigation not possible) associated with the Transmission Lines – Medupi-Mokopane

Nature of Impact: Potential visual impact on users of major roads in close vicinity of transmission line Corridors 1, 2, 8 and 8 Deviation.				
	Corridor 1	Corridor 2	Corridor 8	Corridor 8 Deviation
Extent	Local (4)	Local (4)	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Very high (5)	Very high (5)	Very high (5)	Very high (5)
Probability	High probability (4)	High probability (4)	High probability (4)	High probability (4)
Status	Negative	Negative	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
Significance	High (64)	High (64)	High (64)	High (64)
Irreplaceable loss of resources?	No	No	No	No
Can impacts be mitigated during operational phase?	No	No	No	No
Mitigation:				
» The Alternative 8 corridor has a higher potential to consolidate the transmission line infrastructure by placing the proposed lines adjacent to existing power lines.				
Cumulative impacts:				
» Alternative 1 runs adjacent to main roads (R518) for longer distances (9km) exposing more power line towers to a higher frequency of road users, thereby increasing the potential visual impact.				
» The placement of too many power lines in one servitude can increase the potential cumulative visual impacts associated with Alternative 8, especially at a local scale. This alternative will run adjacent to the existing Matimba-Witkop power lines, and next to the R518, for approximately 10km.				
Residual impacts:				
N.A.				

Nature of Impact: Potential visual impact on residents and visitors in close proximity to the Corridors 1, 2, 8 and 8 Deviation.				
	Corridor 1	Corridor 2	Corridor 8	Corridor 8 Deviation
All alternatives have the potential to visually impact on residents and visitors in close proximity to the proposed infrastructure. Corridor 8 has a greater potential to consolidate the visual impact if the lines are placed adjacent to the existing power line infrastructure inside the corridor. Ironically this may also increase the potential cumulative visual impact (at a site specific or local scale) of having four power line servitudes next to each other. Ultimately this is preferable due to the comparatively "greenfields" alignments associated with Corridor 1 and 2 being considered more visually sensitive.				
Extent	Local (4)	Local (4)	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Very high (5)	Very high (5)	Very high (5)	Very high (5)
Probability	High probability	High probability	High probability	High

	(4)	(4)	(4)	probability (4)
Status	Negative	Negative	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
Significance	High (64)	High (64)	High (64)	High (64)
Irreplaceable loss of resources?	No	No	No	No
Can impacts be mitigated during operational phase?	No	No	No	No
Mitigation:				
» The placement of the proposed lines within Corridor 8 (or 8 Deviation) adjacent to existing power line infrastructure.				
Cumulative impacts:				
» Corridor 8 and Corridor 8 Deviation will potentially increase the cumulative visual impact of viewing four transmission lines parallel to each other.				
Residual impacts:				
N.A.				

Nature of Impact: Potential visual impact on scenic topographical features and statutory conservation areas of the transmission line Corridors 1, 2, 8 and 8 Deviation.

Alternatives 1 and 8 traverse the Waterberg plateau and escarpment, and subsequently cross central sections of the Waterberg Biosphere Reserve and associated nature reserves. Alternative 2 traverses the southern section of Bellevue Nature Reserve and the northern transitional zone of the Waterberg Biosphere Reserve. This corridor intrudes marginally on the core area of the Biosphere Reserve along the northern section of the Waterberg plateau. The proposed Corridor 8 deviation skirts the north-western section of the Waterberg Biosphere Reserve's buffer area near Marken, but may, together with the joint section with Corridor 2, successfully evade both the Waterberg Biosphere Reserve and the Waterberg Mountains if placed correctly within their respective 5km development corridors.

	Corridor 1	Corridor 2	Corridor 8	Corridor 8 Deviation
Extent	Local (4)	Local (4)	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Very high (5)	High (4)	Very high (5)	High (4)
Probability	High probability (4)	High probability (4)	High probability (4)	High probability (4)
Status	Negative	Negative	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)	Recoverable (3)
Significance	High (64)	Moderate (60)	High (64)	Moderate (60)
Irreplaceable loss of resources?	No	No	No	No
Can impacts be mitigated during operational phase?	No	Yes	No	Yes
Mitigation:				
» The deviation of Alternative 2 (within the designated corridor) to traverse north of the Waterberg Biosphere Reserve's core areas (i.e. north of the Waterberg mountain) and south of the Bellevue Nature Reserve.				
Cumulative impacts:				

» Alternative 8 will potentially increase the cumulative visual impact of viewing four transmission lines parallel to each other where they traverse scenic topographical features and protected areas.
Residual impacts: N.A.

Total significance of visual impacts - transmission line Corridors 1, 2, 8 and 8 Deviation

	Corridor 1	Corridor 2	Corridor 8	Corridor 8 Deviation
<i>Potential visual impact on users of major roads in close vicinity of transmission line Corridors</i>	64	64	64	64
<i>Potential visual impact on residents and visitors in close proximity to the Corridors</i>	64	64	64	64
<i>Potential visual impact on scenic topographical features and statutory conservation areas of the transmission line Corridors</i>	64	60	64	60
Total significance	192	188	192	188
Average significance	64 (High)	62.6 (High)	64 (High)	62.6 (High)

The above table indicates a marginal quantitative preference for Corridor 2 and Corridor 8 Deviation. Corridor 2 however has a low potential to consolidate the visual impact of linear infrastructure within the region. Corridor 8 (utilising the proposed deviation) has a higher potential to succeed should this principle be followed in order to prevent the spreading of power line infrastructure across the region. The true benefit of this visual impact mitigation measure will only be achieved if the additional lines are placed directly parallel to the existing lines. The mountainous terrain where this principle would not have been achieved due to topographical and technical considerations (space constraints) by the Corridor 8 can successfully be overcome by using the Corridor 8 deviation. This allows for the maximum utilisation of existing power line infrastructure without further compromising scenic topographical features or statutory protected and conservation areas.

Alternative 8 Deviation is therefore preferred above Corridors 1, 2 and 8 as a transmission line development corridor for the Medupi Power Station to the proposed Mokopane substation section of the Mokopane Integration Project.

Impact tables summarising the significance of Visual Impacts (with and without mitigation) associated with the Transmission Lines – Mokopane-Witkop

Nature of Impact: Potential visual impact on users of major roads in close vicinity of Corridors 4, 5 and 6			
	Corridor 4	Corridor 5	Corridor 6
Extent	Local (4)	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)	Long term (4)
Magnitude	Very high (5)	High (4)	High (4)
Probability	High probability (4)	High probability (4)	High probability (4)
Status	Negative	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)
Significance	High (64)	Moderate (60)	Moderate (60)
Irreplaceable loss of resources?	No	No	No
Can impacts be mitigated during operational phase?	No	No	No
Mitigation:			
» The Alternative 5 (and to a lesser degree Alternative 6) corridor has a higher potential to consolidate the transmission line infrastructure by placing the proposed lines adjacent to existing power lines.			
Cumulative impacts:			
» The placement of too many power lines in one servitude can increase the potential cumulative visual impacts associated with Alternative 5 and 6, especially at a local scale. It is, however, still preferable to Alternative 4 which will spread the visual impact of lines crossing these roads across a longer distance.			
Residual impacts:			
N.A.			

Nature of Impact: Potential visual impact on residents in close proximity to the transmission line Corridors 4, 5 and 6			
All three alternatives have the potential to visually impact on residents in close proximity to the proposed infrastructure. Corridors 5 and 6 have greater potential to consolidate the visual impact if the lines are placed adjacent to the existing power line infrastructure inside the corridor. Ironically this may also increase the potential cumulative visual impact (at a site specific or local scale) of having four power line servitudes next to each other. However, consolidation of the impacts is still preferable due to the comparatively "greenfields" alignment of Corridor 4 being considered more visually sensitive.			
	Corridor 4	Corridor 5	Corridor 6
Extent	Local (4)	Local (4)	Local (4)

Duration	Long term (4)	Long term (4)	Long term (4)
Magnitude	Very high (5)	Very high (5)	Very high (5)
Probability	High probability (4)	High probability (4)	High probability (4)
Status	Negative	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)
Significance	High (64)	High (64)	High (64)
Irreplaceable loss of resources?	No	No	No
Can impacts be mitigated during operational phase?	No	No	No
Mitigation:			
» The placement of Alternatives 5 and 6 adjacent to existing power line infrastructure.			
Cumulative impacts:			
» Alternatives 5 and 6 will potentially increase the cumulative visual impact of viewing three or four transmission lines parallel to each other.			
Residual impacts:			
N.A.			

Nature of Impact: Potential visual impact on conservation areas of the Corridors 4, 5 and 6			
	Corridor 4	Corridor 5	Corridor 6
Extent	Local (4)	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)	Long term (4)
Magnitude	Very high (5)	Low (2)	Low (2)
Probability	High probability (4)	Improbable (1)	Improbable (1)
Status	Negative	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)	Recoverable (3)
Significance	High (64)	Low (13)	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.

Total significance of visual impacts - transmission line Alternatives 4, 5 and 6

	Corridor 4	Corridor 5	Corridor 6
<i>Table 6 significance</i>	64	60	60
<i>Table 7 significance</i>	64	64	64
<i>Table 8 significance</i>	64	13	13
<i>Total significance</i>	192	137	137
<i>Average significance</i>	64 (High)	45.6 (Moderate)	45.6 (Moderate)

Corridor 4, a "greenfields" alignment that traverses the Percy Fyfe Nature Reserve, fared considerably worse (64) than Corridors 5 and 6 (45.6). Both Corridors 5 and 6 will follow existing power line infrastructure, but Alternative 6 will increase the length of the alignment by 2 km thereby increasing the distance over which visual impacts will manifest. **Corridor 5** is therefore nominated as the preferred alternative from a visual impact perspective.

Impact tables summarising the significance of Visual Impacts (with and without mitigation) associated with the Transmission Lines – Delta-Medupi

Nature of Impact: Overall potential visual impact of Corridor 7.

This corridor is expected to have a relatively localised, yet potentially significant, visual impact on a few individual homesteads and the farm Kuipersbult 511 LQ (located south of the Medupi Power Station).

	Corridor 7
<i>Extent</i>	Local (4)
<i>Duration</i>	Long term (4)
<i>Magnitude</i>	High (4)
<i>Probability</i>	High probability (4)
<i>Status</i>	Negative
<i>Reversibility</i>	Recoverable (3)
<i>Significance</i>	High (60)
<i>Irreplaceable loss of resources?</i>	No
<i>Can impacts be mitigated during operational phase?</i>	No
Mitigation:	
» The placement of Alternative 7 transmission lines in close proximity of existing power line infrastructure.	

Cumulative impacts:

- » This area contains a significant number of power lines (approximately 8 existing lines) and will come under increasing visual strain with the addition of two new power lines. The cumulative visual impact threshold appears to have been exceeded already, negating the addition of two 400kV power lines (in very close proximity of the existing lines) to some degree.

Residual impacts:

N.A.

7.4.4. Conclusions and Recommendations

The construction of power line infrastructure in natural areas with potential conflicting land uses will always be problematic from a visual impact perspective. The study area for the Mokopane Integration Project not only covers large tracts of land that are still in a natural state, but also includes the scenic Waterberg Mountains and escarpment. Ideally the transmission line infrastructure should not traverse mountainous terrain due to the high scenic topographical value and pristine vegetation cover. From a visual impact perspective, **Corridor 8 Deviation** (Medupi-Mokopane) and **Corridor 5** (Mokopane-Witkop) are nominated as the preferred alternatives for the proposed 400kV transmission power lines. No significant impacts were identified to be associated with Corridor 7.

These corridors manage to avoid (or can avoid with minor deviations) the Waterberg plateau and escarpment as well as the formal protected areas (i.e. the Waterberg Biosphere Reserve and Bellevue Nature Reserve) along their respective alignments. The use of Corridor 8 Deviation does however create a new section of transmission line corridor (i.e. the section where the corridor deviates from Corridor 8 and the section of Corridor 2 forming part of this corridor) that may contribute to the visual fragmentation of the region at a larger scale, or encounter additional individual visual impacts at a local scale

The primary visual impact, namely the appearance and dimensions of the substation and transmission power line infrastructure 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 transmission line towers should, in spatially constrained sections of the development corridors (i.e. in built-up areas), consist of monopole structures that are less bulky (albeit slightly taller) and less visually intrusive than conventional power line towers. Where space and technical considerations permit, the utilisation of cross rope suspension tower structures is recommended in preference to the more obtrusive conventional self-supporting strain towers.



Figure 7.10: Examples of monopole distribution power line towers. Similar structures have been used for 400kV towers where space is limited

7.5. Potential Impacts on Heritage Sites

The Phase I Heritage study for the options for the proposed Mokopane Integration Project identified a number of heritage resources. Undiscovered heritage resources may raise this number, although it is generally accepted that this number will decrease after a detailed walk-through study of the final surveyed alignments have been done, and the power lines have been realigned in order to avoid some of these heritage resources whilst others may continue to exist (unaffected) in the power line servitudes. The exact number of heritage resources that may be affected by the proposed power lines and the significance of each of these heritage resources therefore are not yet known.

The following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) were recorded in or near the study area:

- » Scatters of stone tools occur along the Vaalsloot, Klein Sandsloot and Mohlosane Rivers in the Langa Ndebele sphere of influence. Sites are more common along the central parts of both Corridor 1 and Corridor 8 in the mountainous Waterberg areas and include open sites as well as sites located in rock shelters.
- » Rock painting sites occur in the northern mountainous part of the project area, particularly along the central stretches of Corridor 1 and Corridor 8. A cluster with five rock art sites occurs near the start of both these corridors in the west. Here, the mountains of Ga Mabula and Tafelkoppe also hold high rock art sites of high heritage significance (not documented as yet).
- » Early Iron Age Eiland sites have been recorded near the central stretch of Corridor 8 and possibly also occur in or near the central stretch of Corridor 1. These sites are inconspicuous as they mostly cover small surface areas and

are not associated with any stone walls. Their most characteristic feature, if visible on the surface of the land, is the presence of decorated potsherds.

- » Late Iron Age (LIA) Moloko sites, some with stone walls and characterised by Moloko styled pottery as well as with Nguni types of pots, occur in and near the central stretches of both Corridor 1 and Corridor 8. These sites are also common in the Masebe Nature Reserve (e.g. Magagamatala) and in the Villa Nora area (e.g. Bobididi) between Corridors 1 and 8. These sites are also common in the Lange Ndebele sphere of influence in the south-east. The eastern stretch of Corridor 1 runs across this area. LIA Moloko stone walled sites in a poort in Thaba Tšweu fall inside Corridor 6 and are associated with the Langa Ndebele.
- » Historical remains, mostly consisting of homesteads, occur along the eastern stretch of Corridor 1 along the Fonthane mountains in the Langa Ndebele sphere of influence. Widely dispersed colonial farm residences (historical houses) occur in low numbers along the western and central stretches of Corridors 1, 2 and 8.
- » Graveyards occur along all stretches of all the power line corridors. Some of these graveyards are associated with villages which are scattered across the project area whilst others are associated with historical remains from the Langa Ndebele sphere of influence. Inconspicuous graves occur along the eastern stretch of Corridor 1. Graveyards in association with colonial farmsteads are generally low in numbers. Those that are associated with villages are higher in numbers considering the population numbers in these areas.
- » A commemorative beacon has been erected in the Kloof Pass.
- » Other heritage phenomena such as an open-air church occur near the village of Ga-Mathekgwa.

- » *Stone Age sites*
Stone Age sites generally do not cover large surface areas and can be expected to occur nearly anywhere. Stone tools were recorded along the proposed alignment for Corridor 1. Stone Age sites may be impacted when towers are constructed on top of concentrations of stone tools. Stone tools are not destroyed by this action but are usually scattered from a disturbed archaeological context which already has been disrupted as a result of natural environmental occurrences in the past. However, the impact that may be caused by the project will be due to human intervention and will not be caused by natural environmental processes.

- » *Stone walled settlements*
Stone walled settlements are found in areas where low mountains and hills occur as stone were used as the prime source of building material. The biggest concentration of stone walled sites occurs in Thaba Tšweu (Witkop Mountains), to the west of these mountains and in the former sphere of

interest of the Langa Ndebele. The surface of land that is covered by single or clusters of stone walled sites vary considerably. These types of sites are generally absent from the study area.

The stone walled sites in the Witkop Mountains in particular may be impacted by the proposed project if the towers for the power lines are erected within the perimeters of these sites or when the power lines cut across these sites which, together, constitute a small cultural landscape.

» *Historical structures*

The relatively low number of widely distributed colonial homesteads in the area need not be affected by the proposed transmission lines, also when considering that most of these houses are single structures which do not constitute cultural landscapes. Newly planned power lines are also usually designed in such a way as to avoid existing infrastructure. However, when power lines are grouped together, broad power line corridors may require that historical buildings have to be demolished to make way for power lines.

The stone walled homesteads in the Langa Ndebele sphere of influence have little significance. However some of these structures hold the graves of the occupants of these dwellings. Consequently, some of these remains may be considered to be of high significance and may be affected if towers are erected on top of these remains.

» *Memorabilia*

It is highly unlikely that the commemorative beacon in the Kloof Pass will be affected by the proposed lines as Corridor 1 is unlikely to be constructed along this kloof due to technical reasons and aesthetics.

» *Graveyards*

Any of the recorded graveyards or graves or those detected during the walk-through study of the final surveyed power line alignments may be impacted if towers are erected on top of these structures.

The locations of sites recorded within the study area are reflected in Figure 7.11.

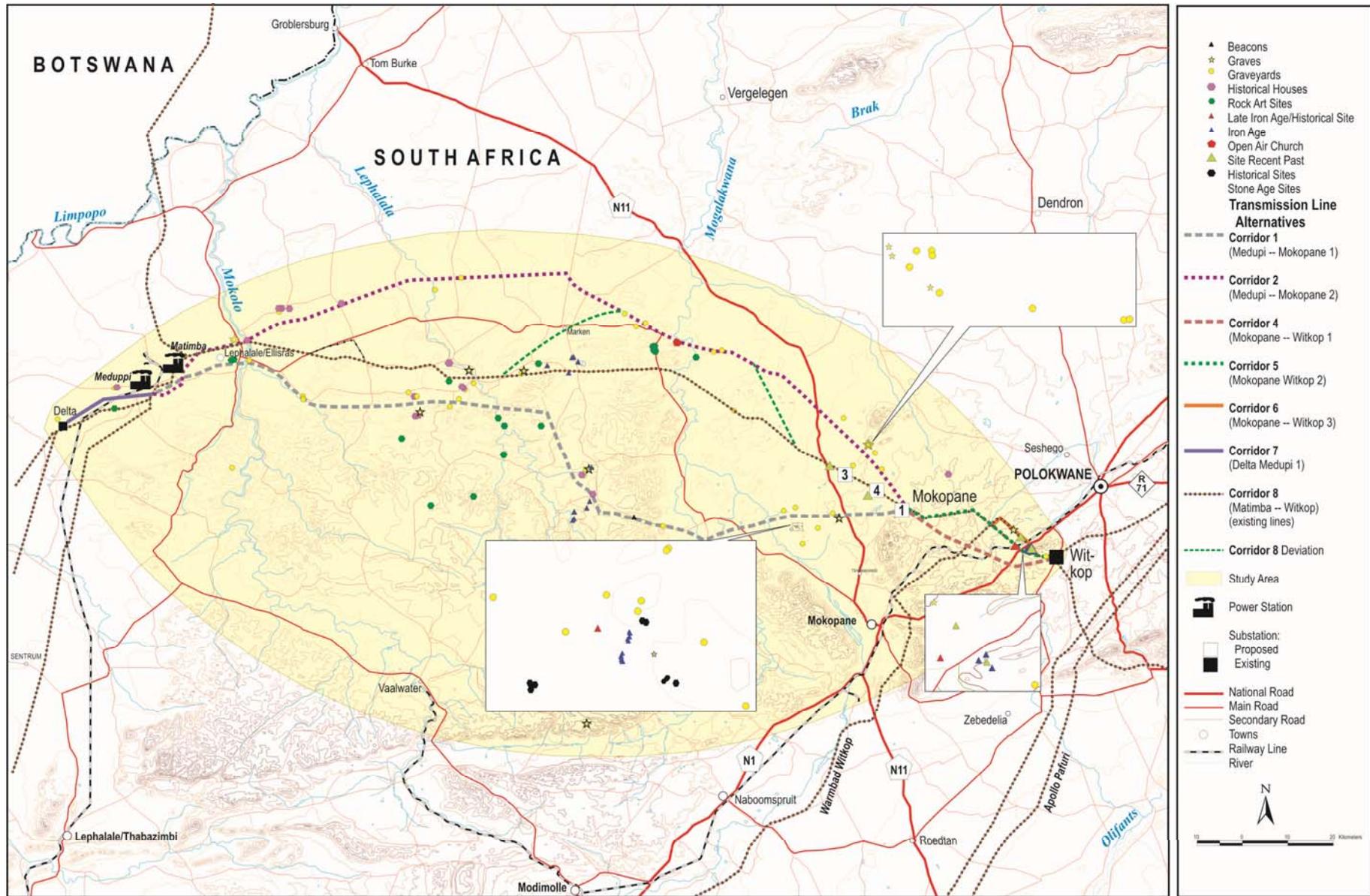


Figure 7.11: Heritage resources recorded in the study area

Power lines are generally more sensitive and conservation friendly towards heritage resources than other kinds of development projects. The impact of power lines on heritage resources therefore, in many instances, can be categorised as being of medium or low significance. Two main types of impacts can be distinguished with regard to heritage resources and power lines, namely:

- » Physical impacts which occur when towers are constructed on top of heritage resources which occur on the surface of the earth.
- » Visual impacts occur when power line infrastructure affects the aesthetics and visual appearance, sense of place, context, or other aspects relating to heritage resources in a negative way.

The number of heritage resources that may be affected by the proposed project can be decreased if the power lines are realigned slightly after the walk-through study has been completed during the final EMP stage.

Impact tables summarising the significance of Transmission Line impacts on Heritage Sites (with and without mitigation)

Nature: Alter, damage or destroy Stone Age sites in/near the power line corridors as a result of pre-construction, construction, or operational activities.		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (5)	Minor (1)
Probability	Probable (3)	Improbable (1)
Significance	Medium (33)	Low 7)
Status	Negative	Negative
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Corridor 8 and Corridor 8 Deviation: Constructed to the north of Tafelkoppe and Ga Mabula (along the R518); Follow dirt road to the north of Kleindenteren 485 and Kirstenbosch 497 (avoiding the kloof and reserve); Constructed further to the north or south on Klipbank 713 (avoid the second kloof); Follow existing corridor to avoid crossing the Masebe Nature Reserve. » No specific mitigation measures for other corridors. 		
Cumulative impacts:		
None.		
Residual impacts:		
None.		

Nature: Alter, damage, destroy Iron Age sites in/near the power line corridors as a result of pre-construction, construction, or operational activities.		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (5)	Moderate (3)
Probability	Probable (3)	Improbable (1)
Significance	Medium (33)	Low (9)
Status	Negative	Negative
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Corridor 8 and Corridor 8 Deviation: Constructed to the north of Tafelkoppe and Ga Mabula (along the R518); Follow dirt road to the north of Kleindenteren 485 and Kirstenbosch 497 (avoiding the kloof and reserve); Constructed further to the north or south on Klipbank 713 (avoid the second kloof); Follow existing corridor to avoid crossing the Masebe Nature Reserve. » No specific mitigation measures for other corridors. 		
Cumulative impacts:		
None.		
Residual impacts:		
None.		

Nature: Alter, damage, destroy Historical Houses in/near the power line corridors as a result of pre-construction, construction, or operational activities.		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (5)	Moderate (3)
Probability	Probable (3)	Improbable (1)
Significance	Medium (33)	Low (9)
Status	Negative	Negative
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Corridor 8 and Corridor 8 Deviation: Constructed to the north of Tafelkoppe and Ga Mabula (along the R518); Follow dirt road to the north of Kleindenteren 485 and Kirstenbosch 497 (avoiding the kloof and reserve); Constructed further to the north or south on Klipbank 713 (avoid the second kloof); Follow existing corridor to avoid crossing the Masebe Nature Reserve. » No specific mitigation measures for other corridors. 		
Cumulative impacts:		
None.		

Residual impacts:

None.

Nature: Alter, damage, destroy battlefields or memorabilia in/near the power line corridors as a result of pre-construction, construction, or operational activities

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (5)	Moderate (3)
Probability	Probable (3)	Improbable (1)
Significance	Medium (33)	Low (9)
Status	Negative	Negative
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	

Mitigation:

- » Corridor 8 and Corridor 8 Deviation: Constructed to the north of Tafelkoppe and Ga Mabula (along the R518); Follow dirt road to the north of Kleindenteren 485 and Kirstenbosch 497 (avoiding the kloof and reserve); Constructed further to the north or south on Klipbank 713 (avoid the second kloof); Follow existing corridor to avoid crossing the Masebe Nature Reserve.
- » No specific mitigation measures for other corridors.

Cumulative impacts:

None.

Residual impacts:

None.

Nature: Alter, damage, destroy graves and graveyards in/near the power line corridors

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (5)	Moderate (3)
Probability	Probable (3)	Improbable (1)
Significance	Medium (33)	Low (9)
Status	Negative	Negative
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	

Mitigation:

- » Undertake heritage walk-through survey during the power line route planning and design phase.
- » Avoid graveyards in final alignment of power line.

Cumulative impacts: None.
Residual impacts: None.

7.5.1. Comparison of Transmission Power Line Alternatives

Medupi-Mokopane

The table below provides a comparison of the alternatives investigated through this study. The corridor alternatives are ranked, with 12 being the least preferred and 3 being the most preferred corridor.

Ranking	Options	Heritage character	Conditions
1	Corridor 01	Will affect the highest number of heritage resources; highest number of types and ranges of heritage resources and heritage resources with possible high significance	Mitigation is possible but may be extensive
2	Corridor 08	Will affect the second lowest number of heritage resources; second lowest number of types and ranges of heritage resources and no outstanding significant heritage resources	Mitigation is possible Construct to the north of Tafelkoppe and Ga Mabula (along the R518). Follow the dirt road north of Kleindenteren 485 and Kirstenbosch 497. Avoid sanstone valleys and Masebe Nature Reserve
3	Corridor 02	Will affect the lowest number of heritage resources; lowest number of types and ranges of heritage resources and no outstanding significant heritage resources	Mitigation is possible and will be limited
3	Corridor 08 Deviation	Will affect the lowest number of heritage resources; lowest number of types and ranges of heritage resources and no outstanding significant heritage resources	Mitigation is possible and will be limited Construct to the north of Tafelkoppe and Ga Mabula (along the R518). Follow the dirt road north of Kleindenteren 485 and Kirstenbosch 497. Avoid sandstone valleys and Masebe Nature Reserve

From the findings of the Phase 1 Heritage Impact Assessment, it was concluded that construction of the proposed power lines within Corridor 2 or Corridor 8 Deviation will affect the lowest number of heritage resources, the least types and ranges of heritage resources, as well as no outstanding significant heritage resources. Corridor 08 Deviation will be required to be constructed to the north of Tafelkoppe and Ga Mabula (along the R518) in order to avoid impacting on significant heritage resources in these areas.

Therefore, **Corridor 2 or Corridor 8 Deviation** are nominated as the preferred alternatives from a heritage perspective.

Corridor 8 is considered acceptable corridor provided the following deviations can be implemented in order to consider current technical constraints and landowner issues:

- » The power lines must be constructed to the north of Tafelkoppe and Ga Mabula (along the R518); follow the dirt road to the north of Kleindenteren 485 and Kirstenbosch 497, avoiding the kloof and reserve; constructed slightly further to the north or south on Klipbank in order to avoid the second kloof and follow its existing corridor in order to avoid crossing the Masbe Nature Reserve.

Corridor 1 is the least preferred from a heritage perspective as construction of the proposed power lines within this corridor will affect the highest number of heritage resources, the greatest variety of heritage resources and heritage resources with possible high significance.

Mokopane-Witkop

The table below provides a comparison of the alternatives investigated through this study. The corridor alternatives are ranked, with 12 being the least preferred and 3 being the most preferred corridor.

<u>Ranking</u>	<u>Options</u>	<u>Heritage character</u>	<u>Conditions</u>
1	Corridor 06	Cluster of stone walled sites in poort Possible graves in a sisal bush.	Mitigation
3	Corridors 04, 05	Stone walled site	Mitigation
3	Corridor 07	Historical houses and Graveyards	Mitigation

From the findings of the Phase 1 Heritage Impact Assessment, it was concluded that construction of the proposed power lines within Corridor 6 will have the highest impact on heritage resources as it contains the following:

- » A cluster of stone walled sites which are already impacted by Eskom's existing 132kV power lines as they run through a poort in Thaba Tsweu in which the power lines are located.
- » This corridor is also associated with a possible graves located in a sisal bush.

Therefore, this corridor is identified as the least preferred corridor from a heritage perspective.

No specific preference, from a heritage point of view, can be made between **Corridor 4 and Corridor 5**. Therefore, the construction of the proposed power lines within either of these corridors would be considered acceptable.

Delta-Medupi

Corridor 7 has no alternatives. However it appears as if this corridor holds no outstanding significant heritage resources other than one or more historical houses and a few graveyards. These heritage resources can either be avoided, or can be incorporated in the power line servitudes.

7.5.2. Conclusions and Recommendations

From a heritage perspective, **Corridor 2 or Corridor 8 Deviation** (Medupi-Mokopane) and **Corridors 4 or 5** (Mokopane-Witkop) are nominated as the preferred alternatives for the proposed 400kV transmission power lines. No significant impacts were identified to be associated with Corridor 7.

An important aspect relating to the mitigation (conservation) of heritage resources in power line corridors is the undertaking of walk-through studies which are done before transmission lines are constructed and have the following benefits, namely:

- » Transmission line towers can be relocated in order to avoid (conserve) heritage sites.
- » Heritage resources can be conserved unaffected (in situ) underneath power lines and can subsequently be managed as long as power lines are operational.

Stone Age sites can in some instances be avoided by means of placing towers on opposite ends (outer perimeters) of these sites. Stone Age sites therefore can be kept underneath (in situ) any number of power lines. It is also possible that affected stone tools can be collected from the surface before the power lines are constructed. These stone tools can be donated to museums (preferably closest to the project area) or to an accredited institution such as a national museum or a

university. Here, it can be safe-kept and be used in displays or in educational programmes.

Stone walled sites can in some instances be avoided by means of placing towers on opposite ends (outer perimeters) of single or small clusters of stone walled sites. Incorporation of a small cluster of stone walled sites underneath any number of power lines may impact on these sites if they constitute cultural landscapes. However, the impact will be visual and not necessarily physical. No fixed prescriptions exist for 'safe distances' that has to be maintained between power lines and stone walled sites. If stone walls have to be destroyed to make way for towers, these stone walled sites must be subjected to Phase II investigations. These investigations require that stone walled sites be documented by means of mapping the sites and possibly by means of small test excavations of the sites.

Historical houses (sometimes with associated infrastructure) which may constitute cultural landscapes can in some instances be avoided by means of routing power lines around these structures. Historical infrastructure, however, cannot be preserved underneath power lines. Power lines that avoid historical structures may still impact visually on these remains. No fixed prescriptions exist that outline 'safe distances' between power lines and historical structures. Historical structures may not be affected (demolished, renovated, altered) by the proposed project prior to their investigation by a historical architect in good standing with SAHRA.

In terms of **memorabilia**, the commemorative beacon in the Kloof Pass must preferably be avoided by the proposed project. If the monument, which can also be conserved beneath the power line, has to be moved it must be shifted to a location where it is accessible to the public, tourists and other interested individuals or groups as it holds educational and other values.

Graves and graveyards in the project area can be mitigated by following one of the following strategies, namely:

- » Graveyards and graves can be conserved in situ beneath power lines. Towers should be erected on opposite ends of graves or graveyards. Consequently, power lines can be strung across and above graves and graveyards. Conserving graves and graveyards in power line servitudes creates the risk that they may be damaged, accidentally, and that Eskom may be held responsible for such damages. Controlled access must exist for any relatives or friends who wish to visit graves or graveyards in power line servitudes.
- » Graves can also be exhumed and relocated. The exhumation of human remains and the relocation of graveyards are regulated by various laws, regulations and administrative procedures. This task is undertaken by

forensic archaeologists or by reputed undertakers who are acquainted with all the administrative procedures and relevant legislation that have to be adhered to whenever human remains are exhumed and relocated. This process also includes social consultation with a 60 days statutory notice period for graves older than sixty years. Permission for the exhumation and relocation of human remains have to be obtained from the descendants of the deceased (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local police.

The protection and conservation of heritage resources in power lines servitudes is advanced by means of walk-through studies which are conducted before the final alignments for power lines are fixed and before the construction of power lines commences. During the walk-through study, the real (factual) impact on recorded heritage resources as well as on earlier undetected heritage resources may be determined. By rerouting the power lines or changing the placement of towers, possible impacts on heritage sites can either be minimised or can be avoided.

7.6. Potential Impacts on the Social Environment

Impacts on the social environment as a result of the proposed transmission lines are expected to occur during both the construction and operation phases (as well as during the eventual decommissioning of the infrastructure).

The Social Impact Assessment considers the following:

- » Demographic processes (the number and composition of people – e.g. number of tourists);
- » Economic processes (the way in which people make a living and the economic activities in society – e.g. income from tourists);
- » Geographical processes (land use patterns – e.g. how land is developed for tourists);
- » Empowerment, institutional and legal processes (the ability of people to be involved and influence decision making processes; and the role, efficiency and operation of governments and other organisations); and
- » Socio-cultural processes (the way in which humans behave, interact and relate to each other and their environment and the belief and value systems which guide these interactions – e.g. the way in which the landscape contribute to tourist expectations and experiences).

Considering all of these processes, potential social health impacts will also be assessed.

A distinction was made between change processes and impacts. A change process is defined as change that takes place within the receiving environment as a result of an intervention. A potential social impact follows as a result of the change process occurring. However, a change process can only result in an impact once it is experienced as such by an individual/household/community/organisation on a physical and/or cognitive level.

The change processes and impacts on the social environment that were assessed included:

- » *Geographical Processes - involuntary resettlement:* Description and Assessment of the Psycho-social Impacts as a result of involuntary resettlement.
- » *Geographical Processes- agricultural activities:* Description and Assessment of mental/psycho-social and physical health impacts as a result of land use changes during construction and operation.
- » *Demographic processes- influx of workers:* Description and Assessment of physical health impacts as a result of influx of workers during construction and operation.
- » *Demographic processes- influx of job seekers:* Assessment of physical health impacts as a result of influx of job seekers during construction and operation.
- » *Socio-cultural processes- influx of workers:* Description and Assessment of impact on social cohesion as a result of influx of workers during construction and operation.
- » *Socio-cultural processes- nuisance impacts:* Description and Assessment of nuisance impacts during construction and operation.
- » *Socio-cultural processes- Impact on sense of place:* Description and Assessment of impact on sense of place during construction and operation.
- » *Bio-physical processes- impact on health:* Description and Assessment on health impacts as a result of bio-physical changes during construction and operation.
- » *Economic Processes- Impact on hunting and tourism industry:* Description and Assessment of the impact on hunting and tourism industry output as a result of project activities.
- » *Economic processes- impact on hunting and tourism industry employment:* Description and Assessment of impact on hunting and tourism industry employment.
- » *Economic Injections:* Description of economic injections and Assessment of project related economic output.
- » *Employment as a result of project activities:* Description and Assessment of employment impact.
- » *Impact on property values:* Description and Assessment of potential impacts on property values.

Impact Tables summarising the significance of Social Impacts associated with the Transmission Lines.

In order to assess the corridor alternatives in respect of their anticipated social impacts, a distinction was made between the following impacts:

- » **Category 1:** Impacts that are not expected to differ between the proposed Corridor alternatives, e.g. the number of construction workers that will be needed for the proposed project remains the same, irrespective of the chosen alternative;
- » **Category 2:** Impacts that are expected to differ between the proposed alternative Corridors, e.g. the number of households to be resettled increases if the development traversed densely populated areas as opposed to skirting populated areas.

Nature: Psycho-social impact as a result involuntary resettlement		
Involuntary resettlement has to take place where dwellings fall in the servitude to mitigate the potential impact of Electro and Magnetic Fields (EMFs) on people. The effect of EMFs as such is not assessed here, because the servitude width is regarded as sufficient mitigation measure to mitigate the potential physical health impacts of EMFs.		
Resettlement is not voluntary. Unmitigated involuntary resettlement could lead to landlessness, joblessness, marginalisation, food insecurity, rejection by host communities. The process could be positive if compensation is considered adequate and the negotiation process is executed in a professional manner.		
This is considered to be a Category 2 Impact .		
	Before Mitigation	After Mitigation
Extent (Scale)	Site only (1)	Site only (1)
Duration	Very short-Permanent (1-5)	Very short-Permanent (1-5)
Magnitude	Low-Moderate (2-3)	Low-Moderate (2-3)
Reversibility	Irreversible (5)	Irreversible (5)
Probability Corridor 1	High (4)	Medium (3)
Probability Corridors 2, 7, 8, 4-6	Medium (3)	Low (2)
Significance Corridor 1	Medium (36-56)	Low-Medium (27-42)
Significance Corridors 7, 2, 8, 4-6	Low-Medium (27-42)	Low (18-28)
Status	Negative, could be positive for some (better circumstances for the poor)	Negative, could be positive for some (better circumstances for the poor)
Mitigation		
» Areas where religious activities take place should be identified during the negotiation		

process and mitigation measures should be implemented to ensure that these activities can carry on.

- » Avoid the involuntary resettlement of people as far as possible.
- » If resettlement is unavoidable, residents should be sufficiently compensated for loss of livelihood and assisted with the relocation process.
- » Those with lack of negotiation skills and lack of knowledge about the negotiation process should be educated and assisted.
- » Impacted people should be informed about the timeframes for the project – not knowing when involuntary resettlement will take place will add to the stress.
- » Poverty and equity: A form of compensation should also be granted to individuals who are residing in informal settlements within the servitude and assistance with relocation should be given. This issue should be approached with caution as this might set a precedent for future projects (people might deliberately move onto a servitude for the purpose of receiving compensation).
- » Compensation should not focus on monetary compensation only. Where necessary, impacted people should be assisted to move, and should receive counselling. Monetary compensation should preferably not be given to the poor because of lack of experience to work with larger amounts of money. Compensation should rather be in the form of material goods and assistance, or financial guidance should be given.
- » A common standard of compensation should be applied to all properties.
- » Landowners should be made aware that a pre- and post evaluation of their land value is possible.
- » Labour tenants who do not move with their employers to their new destination (e.g. where farms are bought out) should be assisted to find alternative long-term jobs.
- » The World Bank guidelines for involuntary resettlement should be followed.
- » Clear roles and responsibilities of Eskom and the impacted people should be formalised and adhered to.
- » Local customs should be acknowledged. E.g. the necessary ceremonies should be performed during the relocation and reburial of graves and Eskom should compensate affected families. However, this is unlikely to happen as Eskom would reroute the line and/or move towers to avoid this
- » Photos of the servitude should be taken prior to the negotiation process to monitor opportunistic settlement in the servitude for the purpose of being compensated.

To minimise the likelihood of development into the servitude during operation, the following mitigation measures are suggested:

- » Educate surrounding communities about the dangers of living in the servitude.
- » Community awareness on the safety mechanisms of a transmission power line and potential dangers.
- » The awareness campaign should also focus on standard operating procedures when there is a breakdown in the line, e.g. people should steer clear of the area, who to contact, etc.
- » Such an awareness campaign should be based on and addressed Frequently Asked Questions (FAQs) regarding a transmission power line.
- » A form of signage on the towers should also indicate that it is dangerous.
- » In some way a barrier (psychological and/or physical) should indicate that no structures should be built in the servitude.

» Eskom together with municipalities and Tribal Authorities should make decisions about whose responsibility it is to move people illegally settling in the servitude.

Cumulative Impacts

None.

Residual impacts

N/A.

Nature: Mental and physical health impacts as a result of the impact of construction activities on farming

Cultivated land and natural vegetation cover a large part of the study area. Game farms and nature reserves occur in the study area. In proximity to villages, subsistence crop farming and livestock farming occur. Commercialised agriculture largely occurs in the northern part of the study area. Irrigated areas can be found along all the alternatives. Potential impacts during construction include:

- » Impacts on cultivation activities because of the access roads needed and occupation of additional land for construction activities.
- » During stringing of the lines it will not be possible to carry on with irrigation.
- » Damage to roads which could impact on safety of people and animals.

This is considered to be a **Category 2 Impact**.

	Before Mitigation	After 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)
Game farming activities	High (4)	Moderate (3)
Reversibility (all)	Reversible (3)	Reversible (3)
Probability Crop Farming		
Corridors 2, 8, 4, 5, 6, 7	High (4)	Medium (3)
Corridor 1	Medium (3)	Low (2)
Probability Cattle Farming		
Corridor 1, 8, 4, 5, 6	Medium (3)	Low (2)
Corridor 2, 7	High (4)	Medium (3)
Probability Game Farming		
Corridors 1, 2, 8, 4, 5, 6, 7	High (4)	Medium (3)
Significance		

Crop Farming 2, 8, 4, 5, 6, 7	Low (28)	Low (18)
Crop Farming 1	Low (21)	Low (12)
Cattle Farming 1, 8, 4, 5, 6	Low (24)	Low (14)
Cattle Farming 2, 7	Medium (32)	Low (21)
Game Farming 1, 2, 8, 4, 5, 6, 7	Medium (36)	Low (24)
Status	Negative	Negative
<p>Mitigation</p> <ul style="list-style-type: none"> » To mitigate the potential impacts of transmission power lines on the health and safety of people executing game capturing and crop spraying activities by aircraft, the transmission power lines should avoid areas where these activities take place, e.g. put them along roads. If this is not possible, they should be located along the borders of farms, and lines should be marked. » Where possible, towers should be located on the border of grazing areas and crop fields. » Towers should be placed in such a way as to avoid impacting on the operation of centre pivots, as far as possible. » Where possible, towers should be located on the border of the game farms and away from capturing nets to lessen the potential impacts. » 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. » It is suggested that construction not take place during animal breeding months or during the main hunting seasons (winter months). » 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 <i>“we know what happens on site and what could be implemented.”</i> » 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 		

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 and damage to irrigation pumps 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.

Cumulative Impacts

The impact might be less where existing lines occur as landowners have already adapted their activities to accommodate these existing lines.

Residual impacts

N/A.

Nature: Mental and physical health impacts as a result of the impact of operation and maintenance activities on farming

Cultivated land and natural vegetation cover a large part of the study area. Game farms and nature reserves occur in the study area. In proximity to villages, subsistence crop farming and livestock farming occur. Commercialised agriculture largely occurs in the northern part of the study area. Irrigated areas can be found along all the alternatives.

- » Cultivated land
It is possible to cultivate land around power line towers, but it does complicate the process and some land for cultivation is lost. This is because the use of farming implements and equipment around/underneath power lines and anchor lines prove problematic.

It is possible to irrigate under a 400kV Transmission power line, because of its height from the ground. Although it is possible for 400kV Transmission power lines to cross centre pivots, it is not possible to have a tower in an area irrigated by centre pivots. The presence of the towers will make it impossible to carry on with the activity, unless the towers can be placed in such a way that they do not impact directly on the irrigation system. In cases where it is not possible to avoid these systems, the centre pivots will have to be moved elsewhere, including the complex irrigation system that goes with it. The impact will not only be economic, but will also cause psycho-social impacts such as frustration.
- » Grazing land
Towers and lines on grazing land pose fewer problems, as livestock move around towers and less land is lost. There have been reports of animals getting entangled in towers, but these occurrences seem to be minimal.
- » Game farms/Nature reserves
Game capturing becomes problematic and dangerous, if not impossible, when game

has to be captured in the vicinity of a power line using a helicopter/small aircraft. The helicopters fly low, and could collide with the line when herding game if these lines are not clearly marked. Should pilots fly higher to avoid the line, they may not be able to effectively herd the game. As a result of ineffective herding, game could collide with fences, and be injured. Game farmers with power lines on their land reported that game moved into the servitudes during game capturing to protect themselves. This makes game capturing by aeroplane/helicopter more challenging.

Other than game capturing, game farm owners will experience similar impacts to cattle farmers during construction and operation. The difference is that the game is not domesticated and the potential impacts on animals are therefore not as easy to mitigate, prolonging the potential impact on their owners. During operation, maintenance by helicopter/small aircraft will be necessary, potentially impacting on game. Some landowners with power lines on their land have claimed that power line maintenance workers have stolen game in the past.

The presence of visitors and hunters during construction and maintenance might add to the stress of landowners, as they are responsible for the safety of these visitors.

» Landing strips

The CAA (Civil Aviation Association) recommends that there are no obstacles greater than 150 feet above the average runway elevation and within 2 000 m of the runway mid-point. The impact of having to move the landing strip will not only be an economic one, but will also cause frustration. The location of landing strips are planned carefully to accommodate activities on the rest of the land and finding alternative suitable land may not be simple.

» Mining

Planning a route for new power lines within areas of likely coal extraction needs to take the potential economic and safety impacts as a result of these land uses into account. For deep underground mining, potential impacts on health and safety is expected to be minimal. Underground mining of platinum should have relatively little impact on power lines.

The avoidance of game farms should be given preference to the avoidance of cattle farms and cultivated land. However, there is hardly a difference between the three alternative corridors in terms of approximate number of game farm portions irrespective of the size of these portions as seen in the table below.

This is considered to be a **Category 2 Impact**.

	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)

Game farming activities	Moderate (3)	Low (2)
Reversibility (All)	Reversible (3)	Reversible (3)
Probability Crop Farming		
Corridors 2, 8 4, 5, 6, 7	Medium (3)	Low (2)
Corridor 1	Low (2)	Improbable (1)
Probability Cattle Farming		
Corridor 1, 8, 4, 5, 6	Low (2)	Improbable (1)
Corridor 2, 7	Medium (3)	Low (2)
Probability Game Farming		
Corridors 1, 2, 8, 4, 5, 6, 7	Medium (3)	Low (2)
Significance		
Crop Farming 2, 8 4, 5, 6	Low (18-27)	Low (12-18)
Crop Farming 1	Low (12-18)	Low (6-8)
Cattle Farming 1, 8, 4, 5, 6	Low (14-20)	Low (6-9)
Cattle Farming 2	Low (24-30)	Low (12-18)
Game Farming 1, 2, 8, 4, 5, 6	Low (24-33)	Low (14-20)
Status	Negative	Negative
Mitigation		
<ul style="list-style-type: none"> » To mitigate the potential impacts of lines in close proximity of landing strips and helicopter pads, landing strips should be avoided to ensure that activities can proceed without risk and lines should be marked. » Maintenance activities must be carefully planned and executed to ensure the least distress to game, and to co-ordinate hunting activities. » 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		
The impact might be less where existing lines occur as landowners have already adapted their activities to accommodate these existing lines.		

Residual impacts

N/A.

Nature : Physical health impacts as a result of the presence of construction workers

Previous studies have indicated that an influx of construction workers (temporary migration) into an area contributed to HIV/Aids, more so in areas where the affected communities were vulnerable. Research also seemed to indicate that construction workers are at risk of contracting HIV from members of local communities, as opposed to be solely responsible for transmitting the infection.

Due to their unique situation, construction workers engage in behaviour such as risky sexual behaviour and destructive behaviour (e.g. alcohol abuse, damaging the environment), which could be explained by their migratory status. When they are separated from their homes, they are also distanced from traditional norms, prevailing cultural traditions and support systems that normally regulate behaviour within a stable community. In addition, it might also be that construction workers who are faced with dangerous working conditions and the risk of physical injury might be more preoccupied by immediate (direct) risks and therefore tend to disregard salient (more indirect) risks, such as HIV infection. Added to this the local population might be uneducated about the risk and transmission of HIV and would therefore more easily engage in risky behaviour as a result of ignorance.

The people who are most likely to be impacted are poor and vulnerable and lack knowledge, money and the means required to maintain a healthy lifestyle in the face of HIV/Aids/STDs.

This is considered to be a **Category 1 Impact**.

	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