3.4 Terrestrial Fauna (ex Birds)

3.4.1 An overview of transmission line impacts

Impacts regarding transmission lines consist of disturbances caused during the construction and maintenance phase. These include the construction and positioning of the tower structures, laydown areas, construction camps as well as a number of access roads. However, secondary impacts that could occur during the construction and maintenance phase include hunting of animals, localised habitat destruction during fire-wood collection, uncontrolled burning regimes and potential imbalances caused to the natural flow-regime and sediment loads of natural drainage lines (e.g. erosion along streambanks).

During the construction phase, it is possible that areas corresponding to the footprint of the proposed pylon structure could provide habitat for conservation important fauna species. Typical examples include damage and disturbances caused to rocky grassland and dolerite outcrops. These features are the preferred habitat for protected scorpion species (namely *Opistacanthus validus*) or rupiculous reptile taxa that seek shelter between the various rock layers. Species most likely to be affected are either "K-selected" species or habitat specialists e.g. substrate specialists (e.g. certain invertebrate and reptile species). K-selected species are mostly long-lived species with slow reproductive rates, while habitat specialists are those restricted to a particular type of microhabitat or niche, being it structurally, altitudinal or floristic. Therefore, these species often seek shelter when threatened rather than running away and are invariably associated with rocky grassland, upland seeps or riparian vegetation zones.

Most mammal species are in general highly mobile and therefore able to vacate areas should adverse environmental conditions prevail (e.g. high ambient noise levels caused by construction activities). Therefore, direct impacts associated with construction activities on adult mortality are less likely to occur, although indirect impacts will have consequences on their “fitness” (e.g. the ability of a species to reproduce). However, persistent disturbances across extended temporal scales will eventually affect any population’s ability to sustain itself, and will more than likely result in the total abandoning of a particular area. Although considered to be of short duration, many of the larger terrestrial species (e.g. game species) will vacate the study area during the construction phase and will become temporarily displaced.

Faunal compositions are believed to remain the same irrespective of the intensity of the construction activities associated with the transmission line, but the distribution and abundance of species could effectively change. Many habitat specialists (in particular those restricted to the rocky grasslands) could eventually suffer from local range contraction should their habitat be altered in a significant manner.

3.4.2 An overview of threatened, near-threatened and conservation-dependant fauna species

The study area provides suitable habitat for a diversity of conservation-dependant fauna which is attributed to the high spatial heterogeneity of the landscape (e.g. the intricate topography of the many ridges and rocky grassland patches) and the various drainage lines.

The proposed alternatives will traverse through sections of extensive upland grassland and ridges, especially on the eastern section of the study area which could be suitable habitat for a variety of range-restricted mammal species. Likewise, the hillslope seeps and tributaries provide suitable habitat for a number of near-threatened and data deficient taxa that are wetland-dependant (e.g. the Spotted-necked Otter *Lutra macullicollis* and golden mole members of the genera *Amblysomus* and *Chrysospalax*). Although the study area is unlikely to hold large mammal species, it does support a population of the "Endangered" Oribi (*Ourebia ourebi*) (pers.obs.).

Table 5 provides a list of threatened, “near-threatened” and conservation important faunal species with geographic distribution ranges sympatric (overlapping) to the study area.

3.4.3 The predicted occurrence of Oribi (Ourebia ourebi) on the study area

Table 5: A list of threatened, "near-threatened" and conservation important faunal species likely to occur on the study area (excluding introduced game). The conservation status of mammal, reptile and invertebrate taxa was based on Friedmann and Daly (2004)*, the IUCN (2012)**, Henning *et al*. (2009)*** and Schedule B1**** of the list of threatened and protected species issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004.

Scientific Name	Common Name	Conservation Status	Probability of Occurrence	Habitat
Mammals				
Chrysospalax villosus	Rough-haired Golden Mole	Vulnerable**	Could occur	Sandy, well-drained soils along upland seeps
Amblysomus septentrionalis	Robust Golden Mole	Near-threatened**	Could occur along upland seeps and drainage lines	Mainly along the edges of seep zones dominated by Ouhout (*Leucosidea sericea*). Also gardens.
Amblysomus hottentotus	Hottentot Golden Mole	Data Deficient*	High - a widespread golden mole on the study area.	Sandy soils in gardens and even wattle plantations.
Crocidura cyanea	Reddish-Grey Musk Shrew	Data Deficient*	High – likely to occur on most of the available natural habitat types.	Dry terrain among rocks in dense scrub and grass, in moist places and in hedges. Also vleis with good grass cover.
Crocidura flavescens	Greater Musk Shrew	Data Deficient*	High - likely to occur.	Often partial to disturbed areas and rural gardens.
Crocidura fuscomurina	Tiny Musk Shrew	Data Deficient*	High, likely to occur on most of the natural habitat types.	Wide habitat tolerance.
Crocidura hirta	Lesser Red Musk Shrew	Data Deficient*	High – likely to occur along moist grassland areas bordering drainage lines and impoundments.	Moist situations along drainage lines.
Crocidura mariquensis	Swamp Musk Shrew	Data Deficient*	High - – likely to occur along moist grassland bordering drainage lines and impoundments.	Moist habitats, e.g. thick grass along riverbanks, reedbeds and in swamps.
Myosorex varius	Forest Shrew	Data Deficient	High, likely to occur along the drainage	Wetlands with dense cover.

Scientific Name	Common Name	Conservation Status	Probability of Occurrence	Habitat
			lines bordered by *Breonadia salicina* woodland	
Miniopterus natalensis	Natal Long-fingered Bat	Near-threatened*	Likely to occur, although considered to be a foraging visitor.	Open grassland.
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	Near-threatened*	High - could occur.	Varied, although partial to caves and rock exfoliations.
Graphiurus platyops	Rock Dormouse	Data Deficient*	High – especially on the ridges.	Rocky areas.
Dasymys incomtus	African Marsh Rat	Near-threatened*	Could occur - a wetland species that could be present along the drainage lines.	Well-vegetated wetlands (dominated by *Phragmites* & *Typha*).
Lemniscomys rosalia	Single-striped Mouse	Data Deficient*	High, likely to be present .	Tall grasslands, also secondary grassland.
Lutra maculicollis	Spotted-necked Otter	Near-threatened*	High, likely to occur along the perennial streams (especially the Komati River system).	Clear streams and rivers as well as dams.
Poecilogale albinucha	African Striped Weasel	Data Deficient*	Could occur.	Varied but prefers grassland seres with a high density of rodent prey.
Mellivora capensis	Honey Badger	Near-threatened*	High, could occur on all the habitat types.	Varied, also cultivated areas.
Parahyaena brunnea	Brown Hyaena	Near-threatened**	Could occur although rare.	Varied.
Leptailurus serval	Serval	Near-threatened*	High - a widespread species likely to occur on moist grassland bordering drainage lines and impoundments.	Moist savanna and tall grassland.
Panthera pardus	Leopard	Near-threatened**	Possible although considered to be unobtrusive and occasional.	Varied.
Ourebia ourebi	Oribi	Endangered*	High - confirmed from the eastern parts of the study area.	Upland mixed primary grassland with localised patches of tall grassland (roosting sites).
Herpetofauna				
Homoroselaps dorsalis	Striped Harlequin Snake	Near-threatened**	Could occur.	Rocky grassland and disused termitaria.

Scientific Name	Common Name	Conservation Status	Probability of Occurrence	Habitat
Acontias breviceps	Short-headed Legless Skink	Near-threatened**	High - likely to occur.	Upland primary grassland.
Tetradactylus breyeri	Breyer's Long-tailed Seps	Vulnerable**	High - an obligate Highveld grassland species.	Rocky primary grassland.
Invertebrates				
Metisella meninx	Marsh Sylph	Vulnerable***	High, an obligate wetland species.	Highveld seeps dominated by *Leersia hexandra*.
Opistacanthus validus		Protected****	High, associated with the rock exfoliations.	Ridges with exfoliated rock and crevices in rocky grassland.

3.4.4 Faunal impacts

As mentioned previously, impacts regarding power lines consist of (1) disturbances, (2) habitat loss (3) and various secondary impacts caused during the construction phase and maintenance phase. These include the construction and positioning of the tower structures, laydown areas, construction camps and access roads. However, the significance of the impacts related to *transmission* lines also depend on the tower structure, whereby a larger footprint is imposed during the construction of self-supporting towers.

In most cases, the impact is proportional to vegetation structure. Anecdotal observations of grassland compositions corresponding to existing power line servitudes (i.e. the area of grassland underneath the power lines) affirmed that the graminoid compositions remained unchanged. This essentially exemplifies the fact that grasslands with an intrinsically short structure are significantly unaffected by power line servitudes in the absence of soil surface disturbances. Therefore, the residing faunal composition also remains unaffected. However, the converse is true for savanna or forest compositions that are subjected to large-scale clearing or "pruning" of the trees/vegetation underneath the power line servitude.

The following impacts are anticipated during the *construction* phase (see Appendix 3):

Loss of primary upland and rocky grassland: It is anticipated that the placement of tower structures and access roads (especially when corresponding to primary upland grassland and rocky grassland) could destroy or alter the ecological condition of the grassland seres and the faunal species specific to it (e.g. stenotopic species).

Loss of conservation important faunal species: During the construction phase, it is possible that areas corresponding to the footprint of the proposed tower structures could provide habitat for threatened or protected fauna species. However, the impact is predicted to be more eminent when the placement of the tower structures concurs on rocky grassland, upland seeps or riparian vegetation.

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

Disruption of functional ecological habitat types (rocky grassland and wetlands): It is possible that areas with high ecological function could become disrupted during the construction phase, especially during the demarcation of access roads on landscapes with a linear configuration which act as important dispersal corridors.

The following impacts are anticipated during the *operational/maintenance* phase (see Appendix 3):

Disturbances associated with maintenance procedures: Maintenance procedures (e.g. pruning of trees, fault detection) are generally believed to produce lower ambient noise levels in contrast to those experienced during the construction phase.

Maintenance of the vegetation on the power line servitude: Fires are detrimental towards the proper functioning of power lines, which necessitates the early burning (or mowing) of structurally tall grasslands (e.g. *Hyparrhenia* or secondary grassland) and the "pruning" of emergent trees along riparian zones. The removal of vegetation along the power line servitude and persistent maintenance procedures (e.g. clearing) could change the floristic properties (both structurally and compositionally) of the vegetation sere along the servitude. At worst, the removal of "climax" vegetation could facilitate the establishment of a secondary faunal composition.

Increased hunting, poaching and removal of fire-wood: It is possible that the labour force could engage in activities that could lead to the hunting of wildlife for food or medicinal purposes. It is especially species such as the Oribi that are at risk from poaching during maintenance procedures. In addition, the removal of firewood could alter the natural structure of the vegetation which could eventually lead to shifts in the natural faunal species composition and increased competition between species for resources.

3.5 Sensitivity analysis

A sensitivity map was compiled, illustrating areas comprising of potential sensitive elements based on the following ecological zones (Figure 18):

Zone 1:

- Upland and rocky grassland of primary composition with a high anticipated floristic richness;
- High density of threatened and near-threatened faunal taxa; and
- Occurrence of extensive upland seeps responsible for high reporting rates of Wattled Cranes.

Zone 2:

- Large ephemeral pans that provide foraging habitat for large numbers of "near-threatened" Greater Flamingo and Lesser Flamingo; and
- Large ephemeral pans that provide habitat for large congregations of waterfowl, wading birds and Palaearctic wader species.

Zone 3:

- The extensive grassland units provide an important interconnected corridor for faunal species. These grasslands have the inherent potential to provide habitat for a number of threatened and conservation important faunal species, in particular mammal, bird and reptile taxa (e.g. Oribi, Secretarybird, White-bellied Korhaan and Denham's Bustard);.
- The rocky grassland shows high spatial heterogeneities (based on the quartzite and dolerite outcrops), thereby contributing to a myriad of microhabitat types and niche space. This high diversity in microhabitat types are the main reason for the high expected faunal richness; and
- The Komati River system provides suitable roosting and foraging habitat for the “Near-threatened” Spotted-necked Otter and maintains a high connectivity with adjacent habitat types and wetland features of similar structure and composition beyond the borders of the study area. Therefore, these units have the inherent potential to function as important dispersal corridors and flyways for both mammal and bird species since it increased the probability of colonisation of areas outside of the study area, thereby reducing genetic isolation of residing populations.

It should be borne in mind that the current sensitivity map shows a large surface area that is earmarked as sensitive grasslands. This is based on information as provided by the Mpumalanga Conservation Plan (2006). It is unlikely that all of these grassland patches are intact due to current habitat modifications. It is therefore expected that some of these grassland patches represent secondary (transformed) compositions. In retrospect, it is also possible that some of the areas earmarked as being "Least Concern" could represent primary grasslands when evaluated on a finer scale.

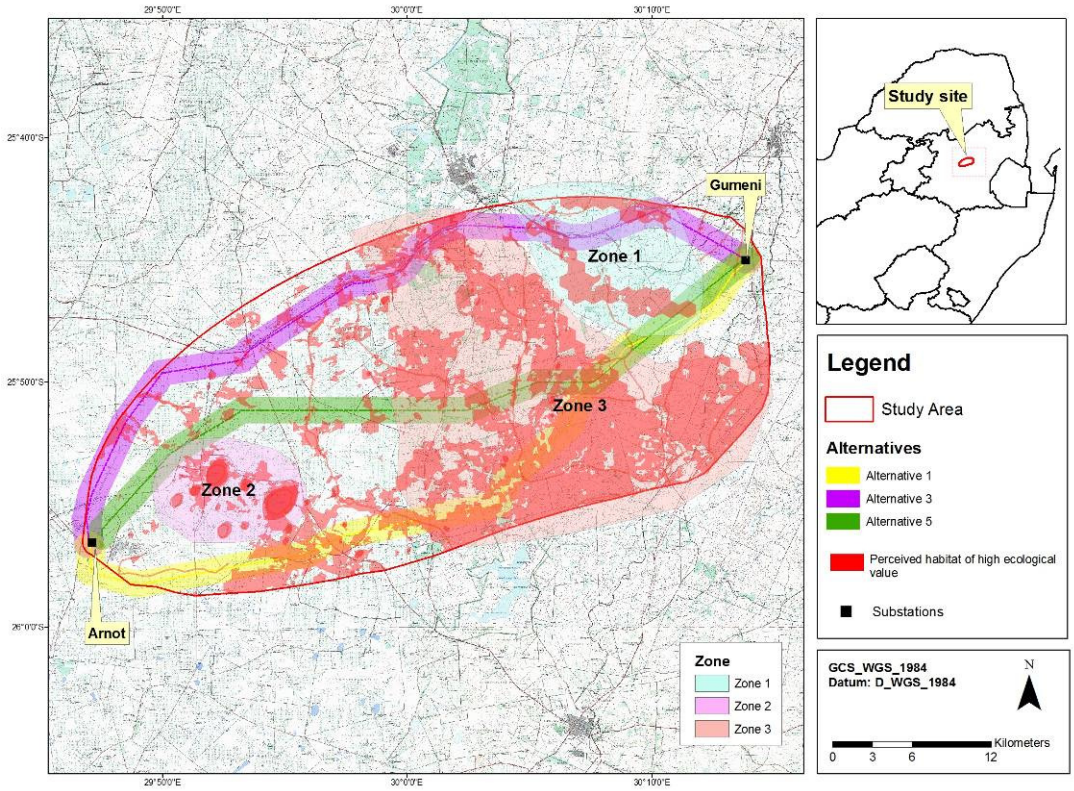

Figure 18: A map illustrating areas of perceived high ecological value and function.

It is evident from Figure 18 that Alternative 1 corresponds to more habitat types of high perceived ecological value when compared to Alternative 3 and 5.

3.6 Analysis of proposed alternatives: A case study based on the occurrence and breeding of crane (Gruidae) species on the study area

From a bird impact perspective, for any line to be regarded as a suitable candidate it must (a) traverse the least number of vegetation types, in particular vegetation in pristine condition, (b) traverse the least number of wetland/drainage lines/rivers (c) corresponds to an area with low reporting rates for bird species considered to be threatened or “near-threatened” (in this case referring to areas with low occurrence of cranes or an absence of crane nesting sites) and (d) follow existing servitudes (or transmission lines).

Before any route can be selected it is imperative to provide a brief outline of the life-history characteristics of each crane species that could occur on the study area:

3.6.1 Wattled Crane (Bugeranus carunculatus)

Distribution, population demographics and threats

The Wattled Crane is restricted to sub-Saharan Africa and consists of an estimated 7 990 individuals (Beilfus *et al*, 2005) confined to three disjointed populations with the largest population found in central Africa (in Zambia). It is listed as *Vulnerable* due to a small global population which have experienced a rapid decline during the past decade (BirdLife International, 2012).

It is however listed as *Critically Endangered* in South Africa (Barnes, 2000) with an estimated 75-80 pairs recorded between 1997 and 1999 (Allen, 2005).

It is primarily threatened by wetland degradation as a result of agricultural intensification, flooding and dam construction. Other important threats include disturbances at nesting sites, collision with power lines, incorrect burning regimes and persecution (BirdLife International, 2012).

Habitat & nesting preference

In general, *B. carunculatus* is entirely dependent on wetlands and riparian floodplains, although the South African population is restricted to high-altitude (above 1000 m a.s.l.) permanent wetlands (alternatively known as 'sponges') that is surrounded by grassland (Allen, 2005).

They prefer to breed on fairly large wetlands (*ca*. 40 ha) surrounded by extensive grassland (of at least 150 ha) (Tarboton, 2001). However, in Mpumalanga breeding corresponds during the early summer period.

They occur on wetland and grassland habitat types as opposed to modified or man-made areas. This is an important consideration for any development in close proximity of natural wetland systems on the study area.

3.6.2 Blue Crane (Anthropoides paradiseus)

Distribution, population demographics and threats

The Blue Crane is near-endemic to South Africa with a small breeding population also in Namibia (Etosha). It therefore represents the world's most range-restricted crane species (Allen, 2005). The national population has declined dramatically during the last 40 years with declines observed from many stronghold populations (e.g. up to 80 % decline in the eastern parts of South Africa). The estimated global population is approximately 25 000 individuals (McCann 2001; 2003). It is listed as *Vulnerable* (Barnes, 2000; BirdLife International, 2012).

The juvenile appears to be highly migratory, and move into the Carolina-Ermelo area during the winter (McCann & Shaw, 1989).

It is threatened by a loss of suitable breeding habitat (due to afforestation and mining operations), poisoning and power line collisions (BirdLife International, 2012).

Habitat & nesting preference

It breeds in open, undisturbed grassland (on the study area it breeds on dryland near wetlands), but forages in a wide variety of other habitat types, including pastures and agricultural land.

On the study site breeding corresponds to the early summer period (mainly October - December).

3.6.3 Grey Crowned Crane (Balearica regulorum)

Distribution, population demographics and threats

The Grey Crowned Crane is fairly widespread in sub-Saharan Africa with the large populations found in Kenya, Uganda, the Democratic Republic of Congo and South Africa. The national population stands at approximately 2 000 - 4 000 individuals (McCann 2001; 2003) of which at least 50 % occurring in KwaZulu-Natal (Allen, 2005). However, it has experienced dramatic declines in the last three generations (approx. 45 years) resulting in it being up-listed to the *Endangered* category (BirdLife International, 2012).

It is threatened by habitat degradation (e.g. wetland breeding sites), overgrazing and trampling of breeding sites and poisoning (BirdLife International, 2012). It is also threatened by live trapping, illegal egg collection and hunting.

Habitat & nesting preference

It breeds in shallow wetlands with tall emergent vegetation surrounded by grassland, pastures and agricultural land. Breeding normally takes place within or at the edge of tall emergent vegetation that stands at least 1-2 m above the water surface. It has adapted well to man-made dams, and will often breed in these if the vegetation structure is sufficient (pers. obs.). It prefers to forage on short to medium grassland but is also tolerant to croplands and pastures (Allen, 2005). The latter is mainly utilised by non-breeding birds during winter.

Non-breeding birds roost communally in large trees or will even use power line structures or open shallow impoundments (pers. obs.). Breeding birds roost on the ground, close to their nesting localities.

On the study site breeding corresponds to the early summer period (mainly November –December).

3.6.4 Synthesis: Preferred alternative corridor

Figure 19 shows the cadastral farm properties on the study area where cranes occur or are known to breed (data obtained from EWT, 2012). Based on the occurrence of cranes on the study area, it is evident that Alternative 1 and Alternative 5 provide important nesting and foraging habitat for crane species (Table 6), in particular the Wattled Crane when compared to Alternative 3.

The importance of potential crane nesting habitat (especially Wattled Crane and Grey Crowned Crane nesting areas) on the proposed corridors is reiterated by the number of anticipated wetland intersections. The wetlands also function as dispersal routes or flyways for waterfowl. Alternative 5 (followed by Alternative 1) intersects a greater number of priority crane breeding habitat (Table 7) and also more wetland types (Table 8) when compared to the other corridors. Therefore, the intersection of the different wetland types by Alternative 5 and Alternative 1 could have a greater impact on cranes and waterfowl than Alternative 3.

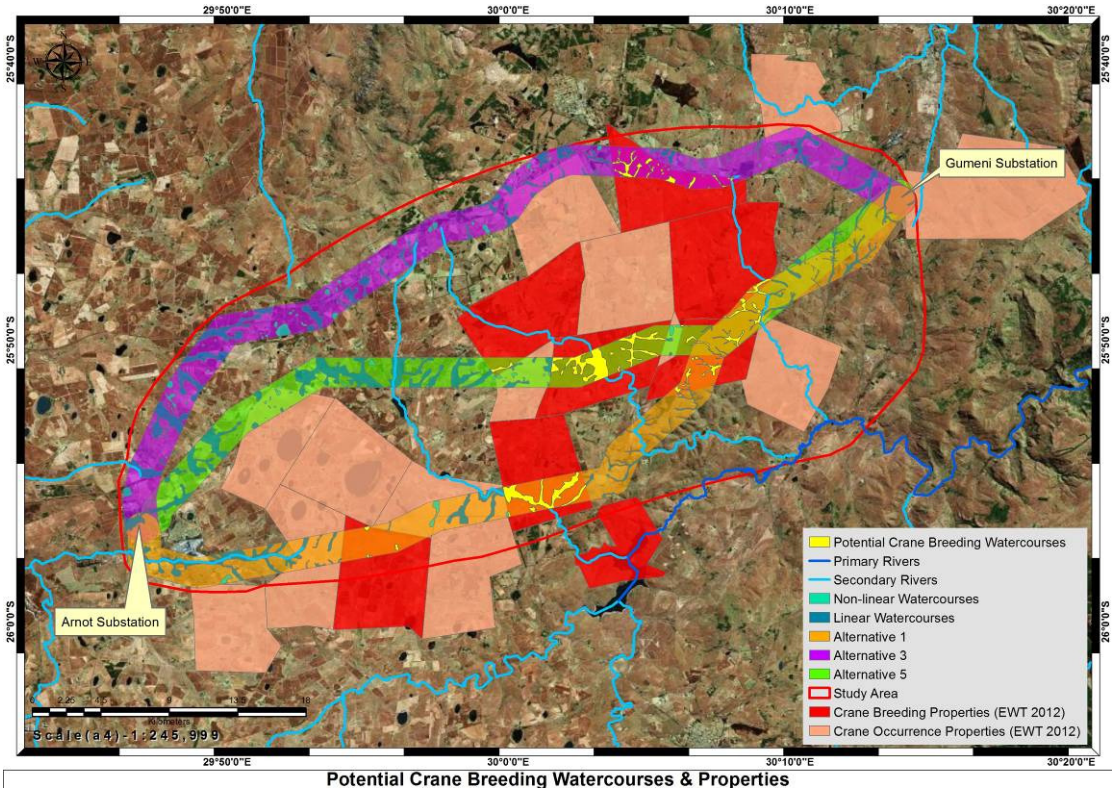

Figure 19: Crane occurrence and breeding within the proposed study area and an indication of potential crane breeding watercourses.

Table 6: An overview of the percentage of crane occurrence and breeding confirmed from each transmission line alternative.

Crane breeding & occurrence (EWT, 2012)	Alternative 1 Hectares	Alternative 3 Hectares	Alternative 5 Hectares
Breeding	3139	916	2741
Occurrence	2014	824	1350
	%	%	%
Breeding	**27.9**	7.7	26.1
Occurrence	**17.9**	7	12.8
Total (combined breeding & occurrence)	**45.8**	**14.7**	**38.9**

Table 7: Potential crane breeding watercourses based on recorded properties with breeding crane pairs (EWT, 2012), and overlapping watercourses delineated in each corridor.

Alternative name	Combined watercourse surface area	Number of potential crane breeding watercourses
Alternative 1	534.43 ha 652.06909 ha	22 30
Alternative 3	130.693 ha 130.66845 ha	17
Alternative 5	**585.96 ha 703.76662 ha**	**24 31**

Table 8: Combined watercourse crossing length along the centre-line for each alternative corridor; highest values indicated in bold.

Alternative Name	Combined length of watercourse crossings along centre-line	Number of watercourse crossings per centre-line
Alternative 1	7.77 km 7768.26653 meters	37
Alternative 3	12.40 km 12395.78622 meters	41
Alternative 5	**12.69 km 12679.21154 meters**	**44**

In summary, the three corridors correspond to an area that is well known for its high diversity of threatened and near-threatened avifauna. More importantly, the study area is known for the high density of cranes, and it is apparent that Alternative 1 and 5 will have more eminent impacts when compared to Alternative 3.

The low crane occurrence or nesting localities on farm properties on Alternative 3 and the presence of a busy highway/transport network alongside the proposed corridor, renders Alternative 3 as the "better" option when compared to the other corridors.

3.7 Recommended mitigation measures

3.7.1 Avifauna

There are many ways to ameliorate or mitigate bird impacts imposed by power line interactions. Probably the best way is to proactively avoid areas where the potential for bird interaction is evident by means of subsequent route deviations or modifications. However, route deviations are not always financially plausible unless significant bird mortalities or habitat destruction is inevitable. An option to overcome bird collisions is to replace overhead lines with underground cables. This method does come at a huge expense, and construction activities could irreparably damage sensitive habitat types. It is also more time-consuming to repair faults on underground *versus* overhead cables.

The following obligatory recommendations are applicable to the project area, and only if a Record of Decision for Alternative 3 is issued by the authorities:

1. A “walk-through” of the selected route must be conducted prior to the construction phase:

- The ”walk-through” will aim to identify areas where marking of lines by means of “deterrent devices” is considered to be beneficial or compulsory;
- All intact/primary grassland, wetland, river and drainage line crossings should by default be marked;
- Where the line crosses a wetland/river, the actual crossover span as well as one span on either side of the wetland/river/ should be marked;
- Marking devices to be used should include large Double Loop Bird Flight Diverters. Spans in close proximity to crane nesting sites or areas known to provide foraging habitat, as spans in close proximity to pans should be marked by alternating between Double Loop Bird Flight Diverters and the Inotec BFD88;
- All devices should be applied in a staggered fashion to the phase while alternating between black and white diverters. The maximum distance between the diverters should not exceed 5 m; and
- A representative of EWT (preferably a field officer affiliated with the Highveld Crane Conservation Project) with a good local knowledge of the area should assist during the ”walk-through”.

2. Mandatory measures to be implemented during the construction phase:
    - The construction sites must be confined to disturbed areas or those identified with low conservation importance. All construction sites must be demarcated on site layout plans (preferably), and no construction personnel or vehicles may leave the demarcated area except those authorised to do so. Those areas surrounding the construction sites that are not part of the demarcated development area should be considered as “no-go” areas for employees, machinery or even visitors;
    - A natural buffer zone (to be announced by the wetland specialist) should be allowed between the line servitude and any wetland or other sensitive habitat type;
    - All road networks must be planned with care to minimize dissection or fragmentation of important avifaunal habitat type. Where possible, the use of existing roads is encouraged. Access must be determined during the “walk-through” process;
    - The breeding status of threatened species, in particular bustards and korhaan species, Yellow-breasted Pipit and Rudd's Lark should be evaluated prior to construction/decommissioning. If breeding is confirmed, the nest site must be barricaded and appropriately buffered (by at least 500 m). Construction/ decommissioning activities shall only commence once the fledglings are successfully reared and has left the nesting site;
    - Construction activities are not allowed within 1000 m of a known crane breeding site – even when the nesting site is not in use/occupied;
    - Depending on the crane species, construction activities should cease during the peak breeding period when within 1 km of a nesting site: November to December. The breeding status of known nesting sites should be verified by a representative of EWT;
    - It is recommended that the “cross-rope suspension” type tower be used for the proposed transmission line;
    - A representative of EWT (preferably a field officer affiliated with the Highveld Crane Conservation Project) should oversee the construction activities and act as a temporary Environmental Control Officer;
    - Open fires is strictly prohibited and only allowed at designated areas; and
    - Killing or poaching of any bird species (in particular cranes) should be avoided by means of awareness programmes presented to the labour force. The labour force should be made aware of the conservation issues pertaining to the bird taxa occurring on the study area. Any person found deliberately harassing any bird species in any way should face disciplinary measures, following the possible dismissal from the site.

3.7.2 Other fauna

The following obligatory recommendations are applicable to the project area, and only if a Record of Decision for Alternative 3 is issued by the authorities:

1. *A "walk-through" of the selected route must be conducted prior to the construction phase*:

- The "walk-through" will aim to identify areas where conservation-dependant species are likely to occur; and
- When a threatened or near-threatened faunal species/population is identified, a route/pylon deviation is advised to minimise the interference of the servitude/pylon footprint on the respective faunal species/population;

2. Mandatory measures to be implemented during the construction and operational phases:

- The attached sensitivity map should be used as a decision tool to guide the layout design of the proposed development - all wetland areas (including man-made areas), upland primary grassland, ridges and outcrops (irrespective of their surface area) are regarded as sensitive habitat units;
- The quartzite and dolerite grassland provide important refuge for reptile and range-restricted invertebrate taxa. Therefore, these areas should be avoided during the construction phase to prevent unnecessary damage or disturbances;
- The construction of "new" access roads should be limited, and existing roads should be used during the construction phase. It is suggested that the construction of roads be avoided and that all access roads be limited to grassy "tracks";
- Where possible, the servitude below the line should be left natural and is not allowed to be burned on an annual basis. The unnecessary removal of natural vegetation should be avoided;
- The extent of the construction sites and access roads should be demarcated on site layout plans and should be restricted to disturbed areas or those identified with low conservation importance. Therefore, no construction personnel or vehicle may leave the demarcated area except those authorised to do so. Those areas surrounding the construction site that are not part of the demarcated development area should be considered as "no-go" areas for employees, machinery or even visitors;
- Checks must be carried out at regular intervals to identify areas where erosion is occurring. Appropriate remedial action, including the rehabilitation of eroded areas should be undertaken;
- Open fires is strictly prohibited and only allowed at designated areas;

- Harvesting of firewood or any plant material (for medicinal or cultural purpose) during the construction phase is strictly prohibited. Labour or personnel shall only assist with the removal of plant matter if requested to do so by the ECO;
- Hunting/snaring is strictly prohibited. Any person found hunting or in the possession of any indigenous animal (including invertebrate taxa) should face disciplinary measures, following the possible dismissal from the site;
- Intentional killing of any faunal species (in particular invertebrates and snakes) should be avoided by means of awareness programmes presented to the labor force. The labor force should be made aware of the conservation issues pertaining to the taxa occurring on the study area. Any person found deliberately harassing any animal in any way should face disciplinary measures, following the possible dismissal from the site;
- If any subterranean/fossorial reptile, scorpion or mammal species is recovered during the construction phase, this species must be relocated to the nearest area or natural open space with suitable habitat for the particular species to continue its life history. If accidentally killed, then this species should be adequately preserved as a "voucher" specimen (with the assistance and knowledge of the ECO). These specimens may contribute towards a better understanding of biogeography and animal systematics; and
- All construction activities must be limited to daylight hours

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5. APPENDICES

Appendix 1: Bird richness and abundance values obtained from 19 sites corresponding to high-altitude grassland and selected wetland features on the eastern section of the study area.

Scientific Name	Common Name	1	2	3	4	6	7	8	8	9	10	11	13	14	15	16	23	24	25	26	Total
Anas undulata	Yellow-billed Duck															2		2	2	1	**7**
Anthropoides paradiseus	Blue Crane															2	2				**4**
Anthus chloris	Yellow-breasted Pipit														1						**1**
Anthus cinnamomeus	African Pipit									2					1			3			**6**
Anthus similis	Long-billed Pipit		1									1									**2**
Apalis thoracica	Bar-throated Apalis		2																		**2**
Ardea cinerea	Grey Heron																			1	**1**
Ardea melanocephala	Black-headed Heron		1							2										1	**4**
Bradypterus baboecala	Little Rush Warbler																			2	**2**
Bostrychia ibis	Hadeda Ibis		3			2						3			2	2				2	**14**
Bubulcus ibis	Cattle Egret					1	4							1	9	2		1		4	**22**
Bugeranus carunculatus	Wattled Crane															2					**2**
Burhinus capensis	Spotted Thick-knee														2					2	**4**
Buteo buteo	Steppe Buzzard		1					1		1				1							**4**
Campicoloides bifasciata	Buff-streaked Chat											4									**4**
Chersomanes bifasciata	Spike-heeled Lark														4					4	**8**
Certhilauda semitorquata	Eastern Longbilled Lark													1							**1**
Chalcomitra amethystina	Amethyst Sunbird	1																			**1**
Chlidonias hybrida	Whiskered Tern		2																	1	**3**
Chrysococcyx cupreus	Diderick Cuckoo	1						1												1	**3**
Ciconia ciconia	White Stork						17														**17**

Scientific Name	Common Name	1	2	3	4	6	7	8	8	9	10	11	13	14	15	16	23	24	25	26	Total
Cisticola aridulus	Desert Cisticola														1						**1**
Cisticola ayresii	Wing-snapping Cisticola		3	2	1	1	4	1	2	1		1	2	2	2	3	3	2	1	3	**34**
Cisticola cinnamomeus	Pale-crowned Cisticola	1					2		1										1		**5**
Cisticola juncidis	Zitting Cisticola	3	1		2	1	3	1	3	2		2		1	1	3	2	2	1	1	**29**
Cisticola lais	Wailing Cisticola	1						2				4					1				**8**
Cisticola fulvicapilla	Neddicky								1					1							**2**
Cisticola textrix	Cloud Cisticola	1																			**1**
Cisticola tinniens	Levaillant's Cisticola	1	2		1	1			2			2			4		2		1	2	**18**
Corvus capensis	Black Crow																			2	**2**
Cossypha caffra	Cape Robin-chat					1				1				1							**3**
Coturnix coturnix	Common Quail						1								1				1		**3**
Crithagra gularis	Streaky-headed Seed-eater											2		1							**3**
Dicrurus adsimilis	Fork-tailed Drongo													1							**1**
Egretta intermedia	Yellow-billed Egret		2																		**2**
Elanus caeruleus	Black-shouldered Kite											1				1				1	**3**
Estrilda astrild	Common Waxbill							1	2	2		3		2	1		1	2	2		**16**
Euplectes afer	Yellow-crowned Bishop						3								4		2		1	14	**24**
Euplectes axillaris	Fantailed Widowbird	2		1	1		3	2	4	6		1					4		1		**25**
Euplectes progne	Long-tailed Widowbird			1			3	1	1	4	1			1	3		1	4	5	5	**30**
Euplectes orix	Southern Red Bishop	1					8		2	2							50			28	**91**
Eupodotis caerulescens	Blue Korhaan														2						**2**
Eupodotis senegalensis	White-bellied Korhaan		1																	1	**2**
Falco amurensis	Amur Falcon	1	4			2	4			1					1	2		2			**17**
Fulica cristata	Red-knobbed Coot														1	2	50			2	**55**
Gallinago nigripennis	African Snipe														1						**1**
Gallinula chloropus	Common Moorhen														2						**2**
Geronticus calvus	Southern Bald Ibis														5						**5**

Scientific Name	Common Name	1	2	3	4	6	7	8	8	9	10	11	13	14	15	16	23	24	25	26	Total
Haliaeetus vocifer	African Fish-eagle					1															**1**
Heteromirafra ruddi	Rudd's Lark														1						**1**
Laniarius ferrugineus	Southern Boubou							2													**2**
Lanius collaris	Common Fiscal	1				2	1	1				1			2		1	1			**10**
Lophaetus occipitalis	Long-crested Eagle					1															**1**
Lybius torquatus	Black-collared Barbet							2													**2**
Macronyx capense	Cape Longclaw	2	2			2	4		5	4		1	2	1	3	3	2	2		1	**34**
Milvus aegyptius	Yellow-billed Kite																1				**1**
Mirafra africana	Rufous-naped Lark	1			1			1						1							**4**
Motacilla capensis	Cape Wagtail									1									1		**2**
Myrmecocichla formicivora	Ant-eating Chat			1					1						5	3	2		1	3	**16**
Nectarinia famosa	Malachite Sunbird											2		2							**4**
Neotis denhami	Denham's Bustard															1					**1**
Numida meleagris	Helmeted Guineafowl	1																			**1**
Oriolus larvatus	Black-headed Oriole									1											**1**
Ortygospiza fuscocrissa	African Quailfinch	2		1					1	2				2	1			2		1	**12**
Passer domesticus	House Sparrow																	2			**2**
Passer melanurus	Cape Sparrow	2						1													**3**
Phalacrocorax africanus	Reed Cormorant									1						1			2	1	**5**
Phalacrocorax lucidus	White-breasted Cormorant														1						**1**
Plectropterus gambiensis	Spurwinged Goose															1					**1**
Ploceus capensis	Cape Weaver																1				**1**
Ploceus velatus	Southern Masked Weaver	1												1			2	1		1	**6**
Polyboroides typus	African Harrier-hawk							2													**2**
Prinia hypoxantha	Drakensberg Prinia							1													**1**
Prinia subflava	Tawnyflanked Prinia							2	2	1											**5**
Pternistis natalensis	Natal Spurfowl						2	2													**4**

Scientific Name	Common Name	1	2	3	4	6	7	8	8	9	10	11	13	14	15	16	23	24	25	26	Total
Pternistis swainsonii	Swainson's Francolin														1						**1**
Pycnonotus tricolor	Dark-capped Bulbul	2						1									1				**4**
Rallus caerulescens	African Rail																			2	**2**
Sarothrura rufa	Red-chested Flufftail																1				**1**
Saxicola torquata	African Stonechat				1			1			1				3			1	3		**10**
Scleroptila africanus	Red-winged Francolin															3					**3**
Scleroptila levaillantii	Grey-winged Francolin														4						**4**
Serinus canicollis	Cape Canary					1			1			5	1				2		12		**22**
Serinus mozambicus	Yellow-fronted Canary													1							**1**
Sphenoeacus afer	Cape Grassbird					1		1	1												**3**
Spreo bicolor	Pied Starling							5												25	**30**
Streptopelia capicola	Cape Turtle Dove	1	3					1	1	1				2	1	1	1		1		**13**
Telophorus zeylonus	Bokmakierie	2					2	2	2			2		2	1	2	2				**17**
Vanellus armatus	Blacksmith Lapwing															2			4	2	**8**
Vanellus coronatus	Crowned Lapwing															5			4		**9**
Vanellus melanopterus	Black-winged Lapwing						10									29					**39**
Vanellus senegallus	Wattled Lapwing									2					3					2	**7**
Vidua macroura	Pin-tailed Whydah				2		2			1							1				**6**
Zosterops virens	Cape White-eye									2							2	2			**6**
	Total	**28**	**28**	**6**	**9**	**17**	**73**	**35**	**32**	**40**	**2**	**35**	**5**	**25**	**74**	**72**	**137**	**29**	**44**	**116**	**807**

Appendix 2: Bird impact table and description of impact ratings.

The overall bird impacts associated with the proposed alignment corridors are detailed in the table below:

Alternative 1						
Impact	**Magnitude**	**Scale**	**Duration**	**Probability**		**Significance**
Collision (operational only)	High	Regional	Long term	Definite		
	8	3	4	5	75	High
Loss of habitat & disturbance (construction & operational)	High	Local	Medium-term	Highly Probable		
	8	1	3	4	48	Moderate
Poaching & trade of birds (construction & operational)	Medium	Site	Short term	Probable		
	6	2	1	2	18	Negligible
Alternative 3						
Impact	**Magnitude**	**Scale**	**Duration**	**Probability**		**Significance**
Collision (operational only)	High	Regional	Long term	Highly Probable		
	8	3	4	4	60	Moderate
Loss of habitat & disturbance (construction & operational)	Medium	Local	Medium-term	Highly Probable		
	6	1	3	4	40	Low
Poaching & trade of birds (construction & operational)	Medium	Site	Short term	Probable		
	6	2	1	2	18	Negligible
Alternative 5						
Impact	**Magnitude**	**Scale**	**Duration**	**Probability**		**Significance**
Collision (operational only)	High	Regional	Long term	Definite		
	8	3	4	5	75	High
Loss of habitat & disturbance (construction & operational)	High	Local	Medium-term	Highly Probable		
	8	1	3	4	48	Moderate
Poaching & trade of birds (construction & operational)	Medium	Site	Short-term	Probable		
	6	2	1	2	18	Negligible

Appendix 3: Fauna impact table and description of impact ratings.

The construction impacts associated with the proposed alignment corridors are detailed in the table below:

Impact	Alternative	Magnitude	Scale	Duration	Probability	Significance	
Loss of primary/rocky/wetland habitat	**1**	High	Site	Medium term	Definite		
		8	2	3	5	65	High
	3	High	Site	Medium term	Highly probable		
		8	2	3	4	52	Moderate
	5	High	Site	Medium term	Definite		
		8	2	3	5	65	High
Loss of threatened/near-threatened/protected taxa	**1**	High	Local	Medium term	Highly probable		
		8	1	3	4	48	Moderate
	3	High	Local	Medium term	Probable		
		8	1	3	2	24	Low
	5	High	Local	Medium term	Highly probable		
		8	1	3	4	48	Moderate
Disturbances	**1**	High	Local	Medium term	Highly probable		
		8	1	3	4	48	Moderate
	3	High	Local	Medium term	Highly probable		
		8	1	3	4	48	Moderate
	5	High	Local	Medium term	Highly probable		
		8	1	3	4	48	Moderate
Loss of ecological function/dispersal corridors	**1**	High	Regional	Long term	Highly Probable		
		8	3	4	4	60	Moderate
	3	High	Regional	Long term	Probable		
		8	3	4	2	30	Low
	5	High	Regional	Long term	Definite		
		8	3	4	5	75	High

Hunting/snaring/poaching	**1**	Medium	Local	Medium term	Probable		
		6	1	4	2	22	Low
	3	Medium	Local	Medium term	Probable		
		6	1	4	2	22	Low
	5	Medium	Local	Medium term	Probable		
		6	1	4	2	22	Low

The operational impacts associated with the proposed alignment corridors are detailed in the table below:

Impact	Alternative	Magnitude	Scale	Duration	Probability	Significance	
Disturbances	**1**	Medium	Local	Short term	Probable		
		6	1	1	2	16	Negligible
	3	Medium	Local	Short term	Probable		
		6	1	1	2	16	Negligible
	5	Medium	Local	Short term	Probable		
		6	1	1	2	16	Negligible
Maintenance of servitude (fire/composition shifts)	**1**	Medium	Site	Long term	Probable		
		6	2	4	2	24	Low
	3	Medium	Site	Long term	Probable		
		6	2	4	2	24	Low
	5	High	Site	Long term	Probable		
		8	2	4	2	28	Low
Hunting/snaring/poaching	**1**	Medium	Local	Medium term	Probable		
		6	1	4	2	22	Low
	3	Medium	Local	Medium term	Probable		
		6	1	4	2	22	Low
	5	Medium	Local	Medium term	Probable		
		6	1	4	2	22	Low

Impact Assessment Methodology

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

Construction phase

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

Operational phase

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

The impact rating enables the analysis of the impact results, in terms of:

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

Assessment Criteria

An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need.

The significance of the aspects/impacts of the process will be rated by using a matrix derived from Plomp (2004) and adapted to some extent to fit this process. These matrixes use the consequence and the likelihood of the different aspects and associated impacts to determine the significance of the impacts.

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

Probability: This describes the likelihood of the impact actually occurring.

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

Duration: The lifetime of the impact

- **Short Term:** The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
- **Medium Term:** The impact will last up to the end of the phases, where after it will be negated.

- **Long Term:** The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
- **Permanent:** The impact is non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Scale: The physical and spatial size of the impact

- **Local:** The impacted area extends only as far as the activity, e.g. footprint
- **Site:** The impact could affect the whole, or a measurable portion of the above mentioned properties.
- **Regional:** The impact could affect the area including the neighbouring residential areas.

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

- **Low:** The impact alters the affected environment in such a way that natural processes are not affected.
- **Medium:** The affected environment is altered, but functions and processes continue in a modified way.
- **High:** Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

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

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

- **Low:** The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
- **Moderate:** The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
- **High:** The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights were assigned to each attribute:

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

Low	**>20 ≤40**
Moderate	**>40 ≤60**
High	**>60**