REDZ 3 Power Corridor 400kV Main Transmission Substation, Blue Crane Route Municipality, Eastern Cape Province

AVIFAUNAL IMPACT ASSESSMENT REPORT

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EXECUTIVE SUMMARY

It is anticipated that the proposed 400kV Main Transmission Substation (MTS) will have a variety of impacts on avifauna, but these are likely only to be of LOW significance on the bird communities. The identified impacts are:

- Habitat loss from the vegetation removal
- Disturbance of birds during the Construction phase
- Disturbance of birds during the Operational phase
- Electrocution of birds on the MTS equipment
- Birds nesting or roosting on or near the MTS equipment
- Birds impacting on the quality of power supply
- Effect of yard lights on birds
- Collision and electrocution of birds on powerlines and their infrastructure.

The proposed 400kV MTS falls in the Eastern Corridor of the Strategic Transmission Corridors, with a Strategic Environmental Assessment (SEA) of the Department of Environmental Affairs (2015).

This report lists 283 bird species while nine Species of Conservation Concern were recorded during the Pre-construction bird monitoring study. These include Blue Crane, Ludwig's Bustard, Denham's Bustard, Kori Bustard, Southern Black Korhaan, Secretarybird, Cape Vulture, Martial Eagle, and Verreaux's Eagle. These were all classed as Priority species for the impact assessment.

The Preferred location for the 400kV MTS has only Karoo shrubland vegetation (bossieveld) and therefore attracts mainly the large terrestrial birds such as cranes, bustards, Secretarybird and storks. The removal of 36ha of this Karoo shrubland vegetation will affect this group of Priority species. However, habitat loss is relatively small and is near existing power lines (an already-transformed landscape). High abundances of Southern Black Korhaan were recorded during the pre-construction surveys but the proposed development is unlikely to have an effect on these birds, other than the small amount of habitat loss. Small open veld bird species included pipits and larks and with low abundance.

Cape vultures were recorded roosting on power lines near the site between November 2019 and February 2020 during the pre-construction monitoring study, and during that time were regularly observed soaring on thermals near the site, though their occurrence at this site is very unusual (preferring usually to saty closer to their main roost site at Agieskloof, 58km to the north-east). If the MTS is approved, the operation of the MTS is unlikely to affect this vulture behaviour.

An active Martial Eagle nest was found 4.6km from the proposed site. Disturbance during the construction and operation phase is likely to cause these eagles to avoid the general area around the MTS yard, but this is not an important part of their range.

The Table below summaries the assessments for the different potential impacts at the 400kV MTS:

Potential Impacts on Birds	Without mitigation	With mitigation
Construction Phase		
Habitat Loss	MEDIUM	LOW
Disturbance	MEDIUM	MEDIUM
Operation Phase		
Disturbance	MEDIUM	MEDIUM
Electrocution of birds on MTS equipment	MEDIUM	LOW
Effect of yard lights on birds	MEDIUM	LOW
Collision with Powerline conductors/wires	MEDIUM	LOW
Electrocution on Powerline structures	LOW	LOW
Cumulative Effects over the Wider area	LOW	MEDIUM

Ornithological mitigation measures will be required, including the production and implementation of a Construction Method Statement, powerline design measures to ensure that the risk of electrocution is minimised and fitting of new overhead lines in higher risk areas with Bird Flight Diverters to increase visibility and reduce collision risk (within 5km of vulture roosts, 5km from eagle nests and all areas identified as important for blue crane and bustards). Additionally, vulture roost deterrents will be fitted (Eskom employ 'bird-guards' above the hanging insulators to restrict large birds/vultures perching in these areas on the cross-member), within 5km of the main vulture roosts.

During the Construction phase, loss of habitat will have LOW effects on all priority species, while disturbance due to the construction will have a MEDIUM effect on all priority species.

During the Operation phase, all impacts were assessed to be LOW on all priority species, apart from collision with powerlines, which will have a MEDIUM effect on two species, namely, Blue Crane and Ludwig's Bustard.

The cumulative impacts of the entire Choje energy complex were judged as a MEDIUM impact.

The overall conclusion is that there are likely to be LOW to MEDIUM ornithological impacts from the proposed 400kV MTS, assuming that the mitigation measures specified in this report are implemented. With regard to avifaunal impacts, this proposed project can be approved considering all the recommendations and suggested mitigation are accepted and implemented.

1. INTRODUCTION

Wind Relic (Pty) Ltd is proposing the development of a 400kV Main Transmission Substation (MTS) and 400kV power lines on a site located approximately 38km south of Cookhouse and 34km north-west of Riebeek East, within the Blue Crane Route Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province.

A preferred project site with an extent of 168ha has been identified by Wind Relic (Pty) Ltd as a technically suitable area for the development of the MTS, with a capacity of 400kV. A permanent development footprint of 600mx600m will be placed and appropriately sited within the 168ha area considering technical and environmental constraints. The connection points into the national grid will be the existing Poseidon-Grassridge No.2 400kV power line and the existing Poseidon – Dedisa No.1 400kV power line, which both run approximately 600m to the east of the proposed MTS site. The power line corridor is 300m wide and approximately 660m long. The proposed loop-in loop-out 400kV power lines will be placed within the power line corridor and each will have a servitude of 60m. The entire project site is located within a Strategic Transmission Corridor. Due to the location of the project site within a Corridor, a Basic Assessment (BA) process will be undertaken in accordance with GN113 as formally gazetted on 16 February 2018.

Savannah Environmental (Pty) Ltd, (hereafter referred to as Savannah) has been appointed by Wind Relic to undertake the Environmental Impact Assessment (EIA) process for the entire Choje energy complex. These services are to ensure compliance with the relevant environmental legislation and are to include applications to various Competent Authorities for environmental authorisations, licenses and permits. East Cape Diverse Consultants and Ecology Consulting have been appointed by Wind Relic to conduct the necessary avifaunal pre-construction monitoring study for this process.

The pre-construction monitoring was designed using BirdLife South Africa (BLSA) guidelines and international best practice (Jenkins *et al*. 2015, SNH 2017). The pre-construction bird monitoring data was collected as part of a combined programme for the entire Choje renewable energy complex between June 2019 and August 2020. Data collection methods included Vantage Point (VP) surveys (from 56 locations, 17 in the East block and 39 in the West block), Vehicle Transect Surveys and Walking Transect Surveys, together with specific surveys for breeding raptors.

This report assesses only the avifaunal impacts of the 400kV substation and the associated loop-in lines.

This 400kV MTS is located in the West block of the Choje study area. The project requires the removal of 600m x 600m natural vegetation for the construction of the 400kV substation, which make up the basis of the application for Environmental Authorisation and is considered as the worst-case scenario.

The vegetation is 'Nama-Karoo' Lower Karoo NKl4 Albany broken veld, dominated by dwarf shrubs or Karoo bossie veld (Mucina and Rutherford 2006). The image on the title page shows this vegetation, where no grasses occur in the shrublands but after good rain, annual grasses will dominate for a while.

It is important to note that the proposed MTS and associated 400kV power lines forms part of the larger Choje energy complex, and the design of the bird study focused on the whole extent of the developments, not just the small area in which the MTS would be located.

1.1. Project Description

The 400kV MTS and associated power lines form part of the Choje complex of wind and solar renewable energy development (referred to hereafter as the 'Choje Renewable Energy Area'). This area comprises two discrete parts, an Eastern Block and a Western Block (see Figure 1). That Figure illustrates the main habitats across the area (from Mucina and Rutherford 2006). Figure 2 shows the distribution of land cover classes from the 2018 South Africa National Land Cover survey [1] across the area.

These two blocks have been further sub-divided into six specific zones that will each form the basis of the wind farm applications, two in the Eastern Block and four in the Western Block.

[1] https://www.environment.gov.za/projectsprogrammes/egis_landcover_datasets. Accessed 30/6/20.

The proposed 400kV MTS is in the Western Block. The project site (referred to hereafter in the report as the 'MTS400 Site') comprises the following two (2) farm portions:

- Farm 434; and
- Portion 3 of Farm Driefontein 259

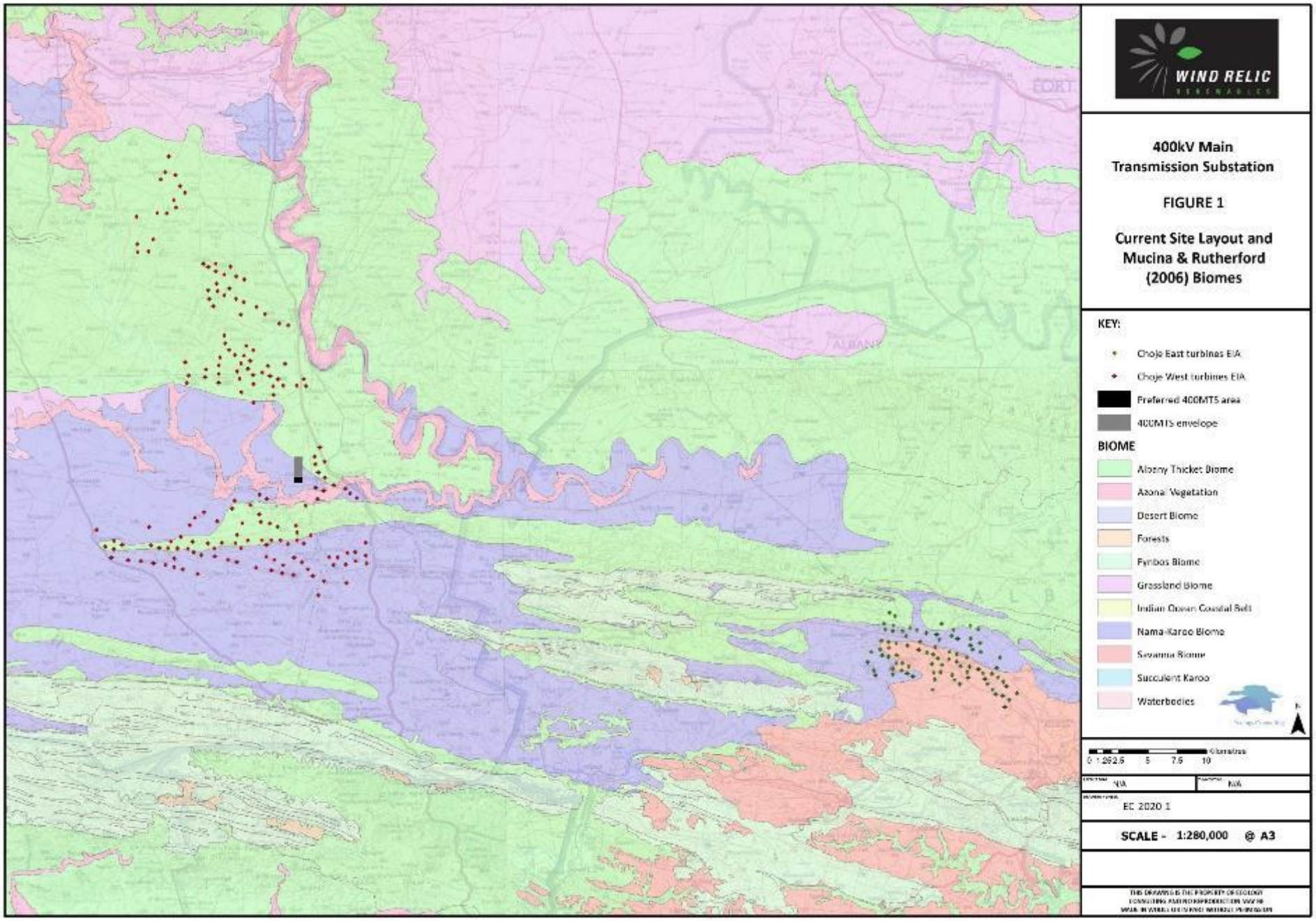
The REDZ 3 Power Corridor 400MTS project site is proposed to accommodate the MTS, two power lines as well as access gravel roads with a width of up to 8m and internal gravel roads of up to 4.5m in width.

A development envelope for the placement of the MTS (i.e. development footprint) has been identified within the project site and assessed as part of the Basic Assessment (BA) process. The development envelope is ~168ha in extent and a much smaller development footprint of 600m x 600m will be located within this development envelope (Figure 3).

Two 600m long powerlines (incoming and outgoing) will be constructed between the MTS and an existing Eskom 400kV powerline just east of the proposed 400kV MTS (Figure 3). A 300m corridor within which the powerlines will be located was assessed. The precise number of pylons is uncertain at this stage but all natural vegetation will be cleared under each pylon footing. A service/vehicle track will run under the powerlines.

Figure 3 shows the location of the additional infrastructure to be constructed as part of the overall renewable energy project (Choje Western Block). This includes 16km of new overhead 132kV powerlines, 12.5km of which will follow an existing 400kV Eskom corridor (north-south) and 3.5km (east-west) will be on a new development corridor. The new corridor will be parallel to the Bloemhof gravel road, so no additional disturbances to large birds in that area will occur.

Each wind farm will each have its own collector substation (Figures 3, 3a and 3b). Additionally, there will be working areas required for the construction site buildings, storage areas, concrete batching plant and camp site for staff accommodation, which will also require vegetation clearance and hence loss of bird habitat, all within the MTS400 Site. The total area of the temporary infrastructure is expected to be ~18ha. All temporary infrastructure will be rehabilitated following the completion of the construction phase, where it is not required for the operation phase.


WIND RELIC
RENEWABLES
400kV Main
Transmission Substation
FIGURE 1
Current Site Layout and
Mucina & Rutherford
(2006) Biomes
KEY:
Choje East turbines EIA
Choje West turbines EIA
Preferred 400MTS area
400MTS envelope
BIOME
Albany Thicket Biome
Azonal Vegetation
Desert Biome
Forests
Fynbos Biome
Grassland Biome
Indian Ocean Coastal Belt
Nama-Karoo Biome
Savanna Biome
Succulent Karoo
Waterbodies
0 1.252.5 5 7.5 10
N/A
N/A
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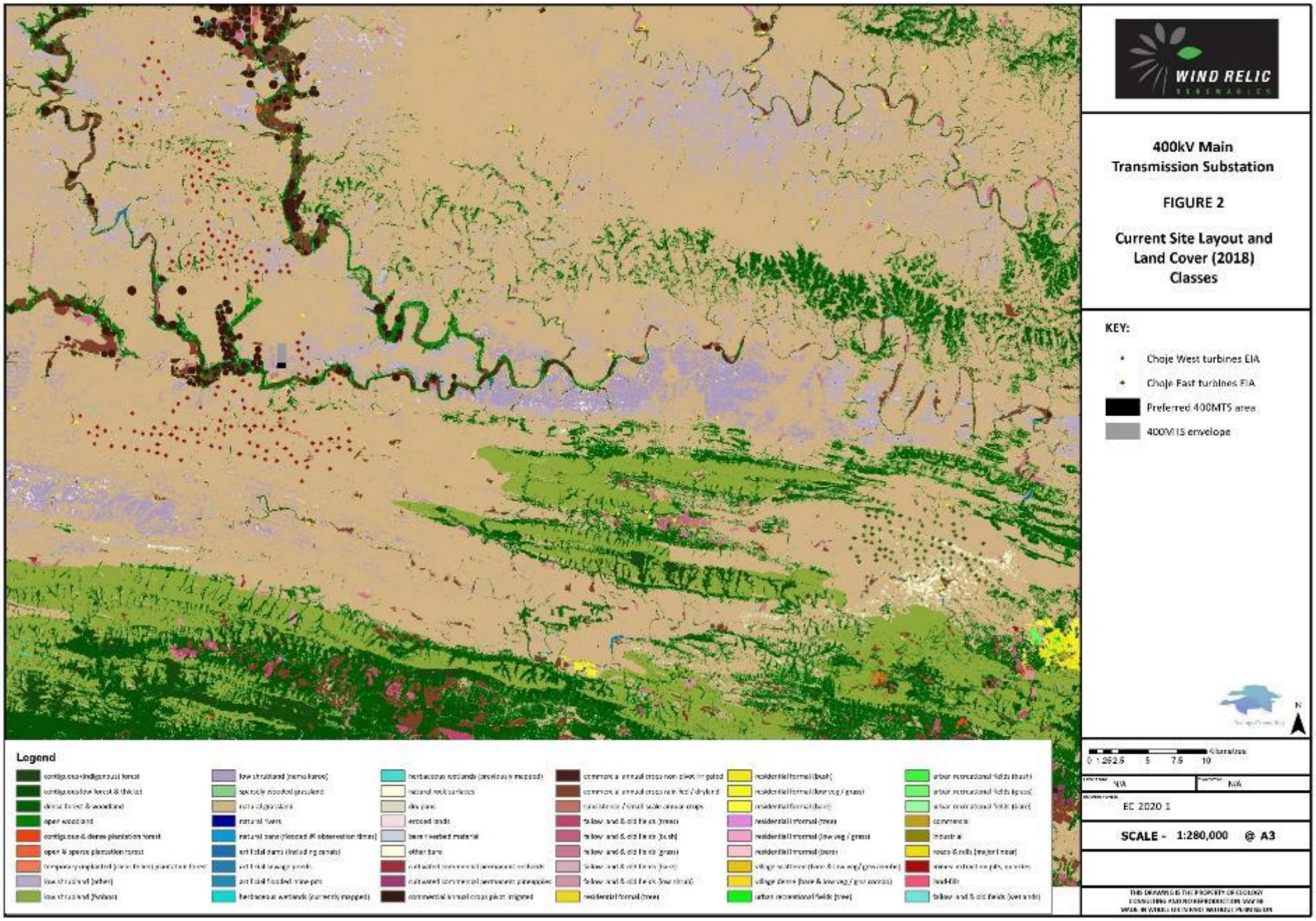
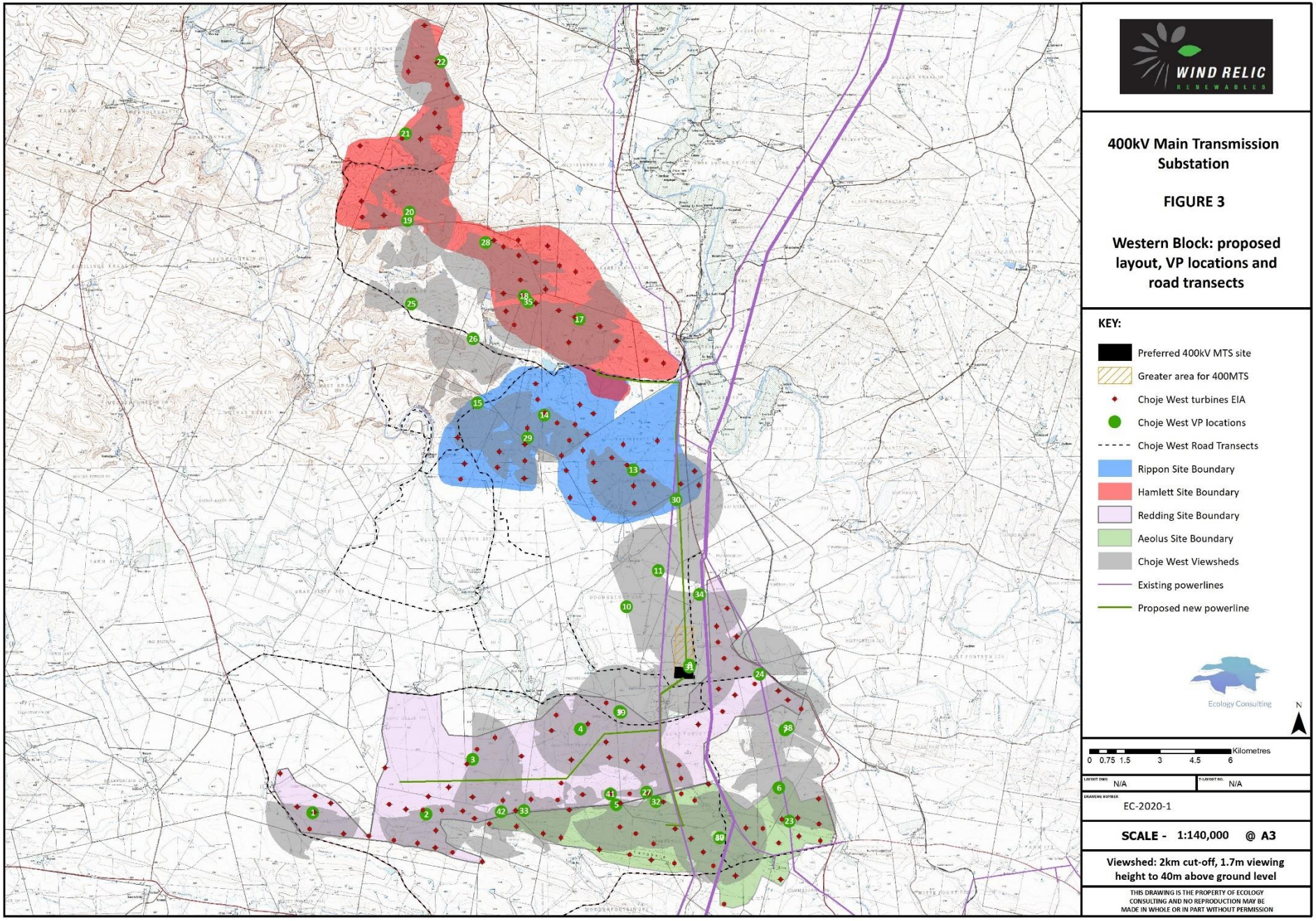

WIND RELIC
400kV Main
Transmission Substation
FIGURE 2
Current Site Layout and
Land Cover (2018)
Classes
KEY:
Choje West turbines EIA
Choje East turbines EIA
Preferred 400MTS area
400MTS envelope
Legend
SCALE - 1:280,000 @ A3
EC 2020 1


WIND RELIC
RENEWABLES
400kV Main Transmission Substation
FIGURE 3
Western Block: proposed layout, VP locations and road transects
KEY:
Preferred 400kV MTS site
Greater area for 400MTS
Choje West turbines EIA
Choje West VP locations
Choje West Road Transects
Rippon Site Boundary
Hamlett Site Boundary
Redding Site Boundary
Aeolus Site Boundary
Choje West Viewsheds
Existing powerlines
Proposed new powerline
Ecology Consulting
N
0 0.75 1.5 3 4.5 6 Kilometres
N/A
N/A
EC-2020-1
SCALE - 1:140,000 @ A3
Viewshed: 2km cut-off, 1.7m viewing height to 40m above ground level
THIS DRAWING IS THE PROPERTY OF ECOLOGY CONSULTING AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

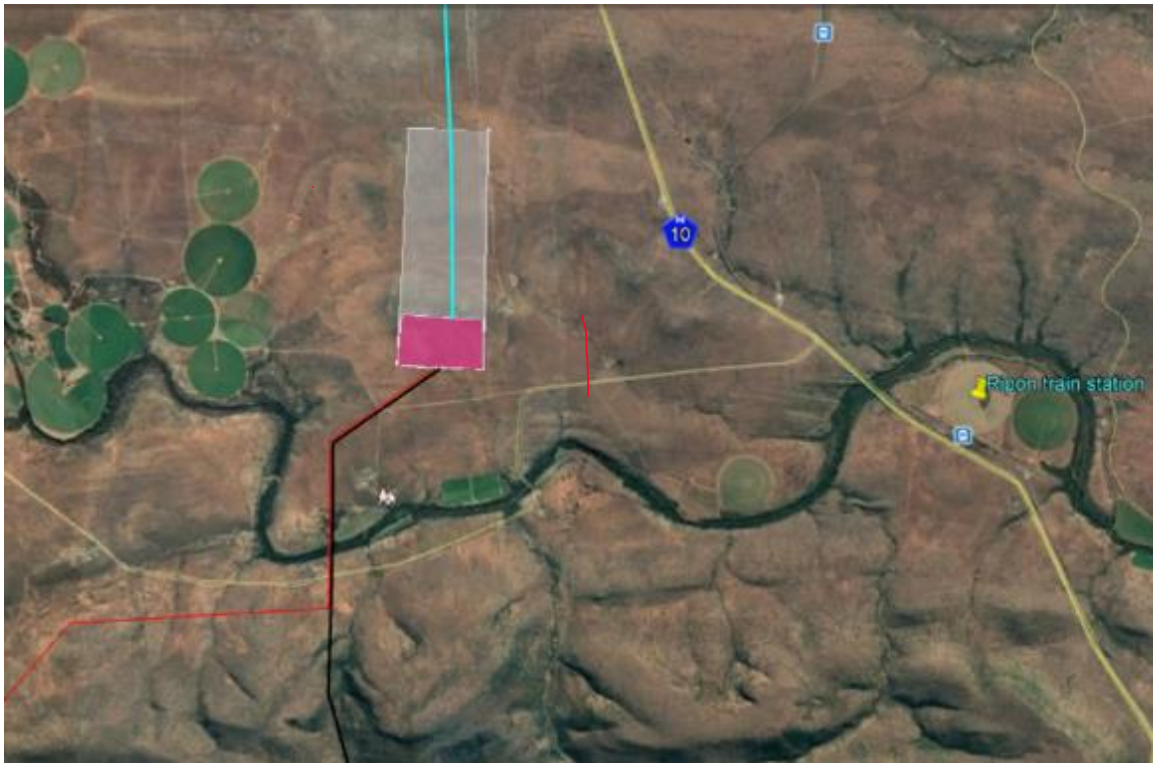


Figure 3a. The Preferred site, 600x600m will be positioned in the pink area for the proposed 400kV substation site, which will be west of Ripon train station and 35km south of Cookhouse along the N10 motorway.

Figure 3b. The two incoming and outgoing powerlines with a 300m corridor each from the proposed 400kV substation to the existing 400kV Eskom powerline.

2. BIRD STUDY DESIGN

This section of the report sets out the preliminary information on the area's ornithological sensitives that were obtained from the Strategic Environmental Assessment (SEA) report of the Department of Environmental Affairs (2015), that was used to inform the pre-construction study, and how this was used to design the field studies (in conjunction with reference to the BirdLife South Africa (BLSA) guidance and international best practice (Jenkins *et al*. 2015, SNH 2017, BLSA 2017, BLSA 2018), and data from initial site surveys).

2.1. Strategic Environmental Assessment report

The site lies within the Cookhouse Focus Area, which the Strategic Environmental Assessment (SEA) (Jenkins 2019) describes as follows:

"This FA (7,366 km^2) falls within the Albany Thicket Biome, at the interface between the Albany Thicket and the Sub-escarpment Grassland Bioregions (Mucina and Rutherford 2006). The area features open, hilly grassland, grading into wooded and succulent-rich thicket vegetation along the drainage lines and forest patches along the base of the escarpment. It is bordered by the Winterberge, the Bloemfonteinberge and the Groot-Bruintjieshoogte mountains to the north, crossed by a series of smaller mountains extending to the north-east of Grahamstown, and traversed by the Great and Little Fish Rivers, and the Koonap River, which form deeply incised valleys through the central plains.

The SEA notes that the Focus Area is not located close to any recognised national Important Bird Areas, but that it does support a diverse avifauna. It identified at least 283 bird species that could regularly occur, using data from the South Africa bird atlas (SABAP) project. This includes 19 red-listed species, six of which are endemic (Barnes 1998, 2000), namely, Ludwig's Bustard, Blue Crane, Cape Vulture, Black Harrier, Melodious Lark and African Rock Pipit. The key ornithological features of the Cookhouse Focus Area SEA (from Table 3 from the SEA Appendix A5) is given in Table 1.

Table 1. Key ornithological features of the Cookhouse Focus Area SEA (source: Table 3 from the SEA (Appendix A5), updated for current IUCN status.

Species	Threat status		SA Endemism	National sensitivity rating (wind only)	SABAP2 Rep Rate (%)	FA-specific predicted susceptibility to	
	Regional	Global				Wind	Solar
Denham's Bustard	Vulnerable	Near-threatened	-	19	1.89	High	Moderate
Ludwig's Bustard	Endangered	Endangered	Near-endemic	14	2.83	High	Moderate
Kori Bustard	Near-threatened	Near-threatened	-	38	1.65	High	Moderate
Southern Black Korhaan	Vulnerable	Vulnerable	Endemic	36	8.96	Moderate	Moderate
White-bellied Korhaan	Vulnerable	Least concern	-	35	3.77	Moderate	Moderate
Blue Crane	Near-threatened	Vulnerable	Near-endemic	13	9.91	High	Moderate
African Fish-Eagle	-	-	-	24	12.50	High	Low
Cape Vulture	Endangered	Endangered	Near-endemic	1	0.94	Very high	Low

Species	Threat status		SA Endemism	National sensitivity rating (wind only)	SABAP2 Rep Rate (%)	FA-specific predicted susceptibility to	
	Regional	Global				Wind	Solar
Black Harrier	Endangered	Endangered	Near-endemic	7	6.37	Moderate	Moderate
Jackal Buzzard	-	-	Near-endemic	42	26.18	High	Low
Verreaux's Eagle	Vulnerable	Least concern	-	3	3.30	Very high	Low
Booted Eagle	-	-	-	57	5.19	High	Low
Martial Eagle	Endangered	Endangered	-	5	4.72	Very high	Moderate
African Crowned Eagle	Vulnerable	Near-threatened	-	27	4.25	Very high	Low
Secretarybird	Vulnerable	Endangered	-	12	5.42	High	Moderate
Lesser Kestrel	-	-	-	64	0.47	High	Moderate
Amur Falcon	-	-	-	65	2.59	High	Moderate
Lanner Falcon	Vulnerable	Least concern	-	20	2.59	High	Low
Melodious Lark	Least concern	Near-threatened	Near-endemic	92	1.42	Low	High

The SEA sensitivity mapping was based on the data available at the time on these species' distributions, and on habitat features associated with these species, including high voltage (>132kV) power lines (which could be used for roosting sites by Cape Vultures and nesting large eagles, buzzards and falcons), larger river corridors (potential bird flyway and waterbird communities), wetlands, and a historic migratory kestrel roost site. The key ornithological features of the Cookhouse Focus Area SEA sensitivity mapping are given in Table 2 (extract from Table 4 of the SEA Appendix A5).

Table 2. Cookhouse Focus Area SEA key ornithological features used in the sensitivity mapping (source: Table 4 of the SEA Appendix A5).

Ornithological feature	Information source	Sensitivity and buffer extent
Power lines ≥132 kV possibly used by roosting Cape Vultures and nesting large eagles, buzzards, falcons	Eskom Networks layer, 2014	Medium: 5 km
Great Fish River as an avian flyway; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river
Little Fish River as an avian flyway; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river

Ornithological feature	Information source	Sensitivity and buffer extent
Koonap River as an avian flyway; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river
Selected CWAC site, with high total counts, spp. diversities, and presence of Red-listed species	CWAC data base, ADU	Very High: 2 km from edge
Known Cape Vulture roost site at Agieskloof /Lichtenstein	EWT Knowledge Management Database, BLSA, Boshoff *et al.* 2009 a and b	Very High: 20 km High: 40 km
Known Blue Crane nesting areas	EWT Knowledge Management Database	Very High: 150 m High: 300 m
Past and possible future migrating kestrel roost site	EWT Knowledge Management Database, BLSA	High: 5 km
Known Lanner Falcon nest sites	A. Stephenson Unpubl. data, Jenkins *et al.* 2012b, 2013a	Very High: 1 km High: 3 km
Presence data for a suite of threatened, impact susceptible large terrestrial birds	SABAP2, ADU	Medium: No buffer

Additionally, though not specifically described in Table 2, an extensive area of high sensitivity is identified in the SEA mapping as 'Cliffs (slope >75°)', presumably for its potential to support large raptors that could be sensitive to wind farm development (such as Verreaux's Eagle).

A key conclusion with regard to this sensitivity mapping is that although potentially important habitats such as cliffs and wetlands/river corridors have been identified, at the time of the SEA analysis, there was a lack of detailed knowledge of the baseline conditions, which could mean that (a) important sensitivities may not have been mapped, and (b) some areas mapped in the SEA as higher sensitivity on a precautionary basis may actually not support important bird populations that would be a constraint to renewable energy development. The programme of site-based bird baseline surveys have, however, addressed this issue and provided a more accurate local picture of the ornithological sensitivities.

The proposed 400kV MTS site lies outside several of the key constraint areas identified in the Focus Area SEA for renewable energy development. It is beyond the 40km buffer (which was used in the SEA to identify high sensitivity areas) from the important Cape Vulture roost, and outside the BLSA-recommended 50km buffer to identify high sensitivity areas from main vulture roosts, being 58km from the nearest regular roost at Aggieskloof.

The SEA considered the area within 1km of Lanner Falcon nests to be very high sensitivity, and within 3km to be high sensitivity. No nests were reported in the SEA within this distance of the MTS site.

The SEA identified a range of other key species that are likely to use the area, but no detailed spatial information was available. It is likely that there are other bird sensitives that could be an issue, but there is not any further information available from the SEA that would enable that risk to be determined. Some of these will be associated with particular habitats, e.g. cliffs and rocky outcrops for nesting Verreaux's Eagle, open grassland for bustards and cranes, wetlands and river corridors for waterbirds, but specific nesting locations for most of these key species were not identified in the SEA. There would therefore be a higher risk of encountering these species in those habitats, but there may be extensive areas of those habitats where they are not present. The SEA mapped cliffs as areas of higher ornithological risk for this reason, buffered by a 3km distance. The SEA also mapped river corridors as higher risk areas, with a 1km buffer.

2.2. Guideline Documents on Baseline Bird Surveys

The design of the bird study drew primarily on BirdLife South Africa (BLSA) guidelines, including general guidelines on survey methods and assessment (Jenkins *et al.* 2015), as well as being informed by international

best practice (SNH 2017). As set out in that guideline, the baseline surveys used a range of methods to obtain quantitative data on the distribution and abundance of small birds (using walked transects), large terrestrial birds (using driven vehicle transects), focal point surveys of key ornithological features such as priority species nests and communal roosts and vantage point surveys to map priority species flight activity.

The surveys were carried out over a minimum of 12 calendar months between June 2019 to August 2020 (no surveys were conducted in April 2020 due to Covid-19 restrictions). For the VP surveys, the BLSA recommended minimum of 48 hours survey per VP was achieved for all VPs.

The study area was defined to inform the assessments for all of the components of the Choje Renewable Energy Development Area. This included areas outside the potential impact zone of the MTS and other developments, in order to provide a reference area for post-construction monitoring (to compare priority species' numbers, distribution and flight activity in that area with that in the wind farm site) and enable a Before-After-Control-Impact analysis to be carried out.

The surveys for the Choje Renewable Energy Development Area also took into account additional specific guidelines produced for particular species of importance, including:

- Verreaux's Eagle (BLSA 2017): dedicated surveys were carried to identify nest sites within and around the entire Choje Renewable Energy Development Area, and included are two seasons' nest surveys (2019 and 2020). Survey effort in proximity to Verreaux's Eagle nests were not increased to 72 hours as, through early design mitigation, no nests were located within 1.5km of any proposed turbine locations. None were nesting within 5km of the MTS400 Site, so are not relevant to this assessment.
- Cape Vulture (BLSA 2018): BLSA guidance recommends 72h/VP per year in areas within 50km of a vulture roost. The MTS400 Site lies 58km from the nearest regularly-used roost, so falls outside this zone. Furthermore, the vultures were present in the study area for only a relatively short period (November-March) and were unexpected given the previous lack of records in the area (from the SEA, local landowner consultation, and the surveyors' own experience in the area). Additional focussed survey work was however undertaken on the vultures' roost when they were present, including VP surveys and roost counts. Though only a single vulture season was covered in the baseline, the relatively high numbers present meant that a comprehensive picture of their use of the area could be established, including spatial modelling to investigate the factors affecting their flight activity (and hence collision risk).
- Black Harrier (Simmons *et al.* 2020): areas potentially suitable for this species checked out during initial surveys in February-May 2019 but no breeding birds were found. The same result was recorded from the from ongoing surveys through to August 2020, with no data to contradict these initial findings. Overall, there was no evidence that the study area is important for this species. None were nesting within 5km of the MTS400 Site, so are not relevant to this assessment.

In summary, the baseline surveys are consistent with BLSA guidance, apart from the following:

- The recommended increase in VP survey hours to 72 was undertaken at key locations where turbines were proposed and where collision risk to species of conservation concern was higher but not all 'high sensitivity' areas. The focus of the work was to obtain key data to inform site design and risk. There has been a very extensive VP survey effort that provides extensive data on all priority species.
- The surveys have not met the BLSA recommendation for two years' baseline in areas of higher sensitivity for Verreaux's Eagle and Cape Vulture, but have included two seasons for the Verreaux's Eagle breeding surveys.

Furthermore, the spatial modelling that has been undertaken has provided much more insight into the birds' behaviour and site use, than the basic baseline monitoring, which has provided an enhanced, more reliable, baseline for the assessment.

The application of these guideline documents in the context of the wind farm site design and mitigation are dealt with in the relevant sections below.

2.3. Terms of reference of the Bird Study

The scope of this report is to assess all expected impacts on birds of the proposed 400kV MTS, power lines and additional infrastructure, including:

- the effects of the habitat loss on birds;
- the disturbance and displacement of birds during the construction and the dismantling;
- the effect during operation in the substation yard and the equipment; and
- the problems that birds can cause to the quality of the power supply.

This Avifauna Impact Assessment Report is required to inform and contribute towards the Basic Assessment phase of the environmental application in terms of NEMA, 1998, and also to satisfy the requirements of Appendix 6 of GN.R982 of NEMA, 1998 (as amended).

SANBI's (2020) National Environmental Screening Reports were not available to inform the baseline survey protocol as they post-date the time that those surveys were designed. It is not considered that they would have materially affected the monitoring strategy had they been available. The survey design pre-dates the avifaunal protocol published under Government Notice No. 320 in The National Gazette, No. 43110 of 20 March, 2020: "National Environmental Management Act (107/1998) Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of sections 24 (5) (a) and (h) and 44 of the Act, when applying for Environmental Authorisation" the compilation of the report post-dates the publication of this legislation and has taken into account the terms of reference relevant to the reporting requirement.

2.4. Pre-construction monitoring Methods

2.4.1. Development of the Survey Methods

The baseline surveys for the 400kV MTS and power lines formed part of the wider baseline surveys for the whole of the Choje Western block of renewable energy development. The pre-construction bird monitoring methodology was designed at the first stage to address the fact that it was not practically possible to cover the whole of the initial proposed 494-turbine development area across the Western Block. Surveys were designed to collect data on (a) key species abundance/distribution, and (b) key species flight activity, to determine the numbers at risk from disturbance and collision.

A site visit was undertaken in January 2019 to inform the initial survey methodology, which was followed up by four visits during February-May 2019 to ground truth the information from the desk study and confirm current eagle and other important raptor breeding locations (to feed into the wind farm site design). The main baseline surveys commenced in June 2019.

Following the revision of the wind turbine layout in August 2019 (reducing the number of turbines in the Western Block to 297), it was possible to achieve a fuller coverage of the potential impact zone of the whole development, and the previous sampling methodology was refined to provide a level of coverage in line with BLSA's recommended minimum 75%, through a combination of a reduction in the size of the overall wind farm and an increased number of Vantage Points in the Western Block from 27 to 39. This survey protocol was continued through to August 2020 to give 12 months' coverage from all VPs (surveys were suspended in April 2020 due to Covid-19 restrictions before restarting in May 2020).

The following principles were adopted for the survey design:

- The initial site design has avoided higher sensitivity ornithological features, (where these are known, as identified in the SEA). This continued as an iterative process as more data became available from baseline surveys;

- Key ornithological risks from the project were identified as collision and disturbance. Priority species at risk were identified, and updated as more baseline data became available. These species were the focus of the assessment;
- The surveys followed BLSA (Jenkins *et al*. 2015) recommended survey methodologies where possible. Initially a sampling regime was developed to inform modelling of ornithological risks. This specifically included spatial modelling of flight density, flight heights, flights at risk of collision with wind turbines and overhead lines, and bird populations at risk of disturbance (and availability of alternative habitat to better understand impacts of that disturbance). The work drew on the available literature for current developments in bird-habitat modelling, and predicting flight activity (including McLeod *et al.* 2002, Reid *et al*. 2015 and BirdLife South Africa 2017, Fielding *et al.* 2019, and lastly Murgatroyd *et al.* 2021 when it became available). This same analytical approach was followed through the baseline data collection and assessment process, though with coverage meeting the BLSA guidance after the layout had been reduced in August 2019 and more VPs had been incorporated into the surveys.

2.4.2. Survey Area

The survey area was defined to cover the maximum extent of the possible wind turbine envelope (plus relevant buffers as appropriate) and other associated development including the 400kV MTS site. It was updated in August 2019 to the area shown in Figure 3, to reflect the reduction in the extent of the proposed wind farm across the Western Block, and retained at that extent through the remainder of the surveys (to give 12 months' coverage of this survey area).

2.4.3. Control site

An extensive reference area around the Choje Renewable Energy Development Area (outside the potential impact zone of the 400kV MTS and wind farms) was surveyed and will be available for post-construction before/after comparison, for example, for before/after gradient analysis for all elements of the Choje renewable energy development, including the 400kV MTS and power lines. This is shown in Figure 3 as the grey VP viewsheds that lie outside the development. A minimum 48 hours' surveys were carried out at each of 5 VPs to the south-west of the Hamlett site (covering an area of about 24km^2), 7 VPs to the south of the Rippon site (covering an area of about 37km^2), 3 VPs to the east of the Redding site (covering an area of about 12km^2).

These areas were also surveyed by 12 monthly vehicle transect and 12 monthly walking transects (located at each VP, as for the main site surveys).

2.4.4. Vantage Point Surveys

Vantage point (VP) surveys were carried out taking into account the BLSA-recommended survey methodology, based on sample plots viewing to 2km over approximately 180° arcs (giving about 6km^2 coverage per VP). The specific aim of the surveys was to collect data on key species flight activity to enable estimates to be made of:

- The time each species spends flying over the survey area;
- The relative use each species makes of different parts of the survey area; and
- The proportion of flying time each species spends at different elevations above the ground.

All flight lines of target species were mapped, and the flight height of each flock recorded. As 360° viewing was not required at any VP, so a single observer was considered sufficient at each.

The following species were recorded as target species, defined to include all species that could be at risk of collision with the wind turbines:

- All birds of prey and owls;

- All cranes and bustards;
- Large flocks (>100 birds) of other species;
- Other species/sightings considered of note.

A total of 39 VPs were used for the Western Block, two of which covered the MTS400 Site. The location of the vantage points and the computer-generated prediction of viewsheds from those VPs (showing the areas visible at 40m above the ground, the lowest point that the rotor sweep of the proposed turbines would reach, from each VP) are shown in Figure 3.

Current BLSA guidance recommends at least 48 hours per VP, with 12 hours minimum over each of the four seasons, so for the surveys a minimum of four hours surveys have been carried out per VP per month. This target was met for all VPs.

All target birds were recorded, irrespective of their distance from the vantage point. Observations were carried out throughout daylight hours (to cover the full daylight period over the survey visits) but not in periods of severely reduced visibility (<3km). Vantage point surveys were usually carried out for a 4-hour block, with a gap of at least 30 minutes for a rest period between surveys to avoid observer fatigue.

During the observation periods all target species flights were mapped and cross-referenced to a standard recording form using a numbering system, and the flight height of each recorded. To estimate flight height as accurately as possible, available reference features (e.g. met masts, summit/ridgelines) were used. Flight heights were estimated as accurately as possible, i.e. not summarised to height classes. Below 10m it was possible to estimate to 1m, between 10 and 20m to 2m, between 20m and 50m to 5m, and above 50m to 10m. In any case of uncertainty, an estimate of the upper and lower range of height were recorded. When birds were observed over an extended period, estimates of flight height were recorded every 30 seconds. The activity during each flight (e.g. striking prey, displaying, food passing) was also recorded.

2.4.5. Raptor Surveys

Breeding raptor surveys were carried out between March 2019 and August 2020, checking all known and other possible raptor nest sites within a 5km buffer of the Choje Renewable Energy Development Area. This included checks of all potential Black Harrier nesting habitat for the presence of this species across the survey area (Simmons *et al*. 2020). These included mini-VP surveys (VP-type watches but for shorter time periods) and walkover surveys, focussing on likely habitat/nesting sites (which were initially identified from the site visit and from inspection of aerial photographs of the area). Repeat visits were made to monitor range occupancy and breeding success. The following visit protocol for each range was implemented through the breeding period: visit 1 to check for occupancy of the range, visit 2 to locate active nests, visit 3 to check for young, and visit 4 to check for fledged young. This included surveys for all key raptors breeding in the survey area, but with particular focus on Verreaux's and Martial Eagle. A first visit during March 2019 to inform the scoping process was followed up with at least three further visits through 2019 and another four in 2020, focusing on key species' breeding periods. Cape Vulture do not breed in the region, so were not included in these surveys.

2.4.6. Vehicle Transect Surveys

Vehicle Transect Surveys were driven along all of the accessible roads within both sections of the Choje Renewable Energy Development Area (83km in the Eastern Block and 150km in the Western Block), stopping at regular intervals to scan open habitats, counting and mapping the location of all target species encountered. This enables rapid coverage of wide areas, where vegetation allows adequate viewing, to obtain data particularly on raptors, bustards, storks and cranes. The surveys were undertaken over two days each month for the Western Block and one day for the Eastern Block, to give a total of 12 surveys for each. The Western Block vehicle transect route is shown in Figure 3. There was a total length of 5.3km of road transect within the MTS site (plus a 500m buffer).

2.4.7. Wetland Surveys

Though there are no Coordinated Waterbird Counts (CWAC) wetlands of importance within the Choje Renewable Energy Development Area Western Block, there are several areas of wetland habitat present (predominantly around reservoirs for agricultural irrigation, along river corridors). Each wetland site was visited at least once each month to undertake a count of all of the waterbirds present.

In addition to the wetland areas, it became apparent during the initial surveys that many of the irrigated agricultural areas ('pivots') also supported a range of larger terrestrial bird species, so these were also covered as part of these surveys. None of these areas were, however, within the 400kV MTS Site.

2.4.8. Small Terrestrial Bird Surveys (Walking Transect Surveys)

Walking transects were undertaken at each VP location (i.e. two for the 400kV MTS Site) to provide sample data on the abundance of small terrestrial birds within the survey area. Transects were walked for 20 minutes at a rate of 5 minutes per 100m at each VP each month, to provide an index of small bird abundance across the survey area. This gave a total of 0.8km of walking transect within the 400kV MTS Site.

2.5. Screening for Assessment

A two-stage screening exercise was undertaken to determine the bird species to take forward for more detailed assessment. Firstly all '**Species of Conservation Concern'** using the study area were identified on the basis of their conservation value. This included all South African red-listed species and those on the IUCN red list (near-threatened status and higher concern).

The second stage identified the '**Priority Species'** for the 400kV MTS and power lines assessment, i.e. the 'Species of Conservation Concern' that were potentially vulnerable to impacts from the wind farm and its associated infrastructure. This includes those species that were at risk of collision with overhead lines or could be at risk of disturbance (i.e. those that occurred within the potential impact zone of the wind farm and were potentially vulnerable to these impacts).

3. POLICY AND LEGISLATION

The legislation relevant to this specialist field and development include the following:

- National Environmental Management Act, No 107 of 1998 (NEMA). South Africa's framework environmental act was established to provide for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; and to provide for matters connected therewith. Through the Environmental Impact Assessment (EIA) Regulations (2014, as amended), the Act requires certain activities and developments to undergo an EIA process. Certain specialist studies are required, depending on the development type, scale and location. In the case of a wind farm development, and avifaunal specialist study is required.
- The Convention on Biological Diversity (CBD): dedicated to promoting sustainable development. The Convention recognizes that biological diversity is about more than plants, animals and micro-organisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. It is an international convention signed by 150 leaders at the Rio 1992 Earth Summit. South Africa is a signatory to this convention and should therefore abide by its' principles.
- An important principle encompassed by the CBD is the precautionary principle which essentially states that where serious threats to the environment exist, lack of full scientific certainty should not be used as a reason for delaying management of these risks. The burden of proof that the impact will not occur lies with the proponent of the activity posing the threat.
- The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention): aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include 117 (as of 1 June 2012) Parties from Africa, Central and South America, Asia, Europe and Oceania. South Africa is a signatory to this convention.
- The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA): is the largest of its kind developed so far under the CMS. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including many species of divers, grebes, pelicans, cormorants, herons, storks, rails, ibises, spoonbills, flamingos, ducks, swans, geese, cranes, waders, gulls, terns, tropic birds, auks, frigate birds and even the South African penguin. The agreement covers 119 countries and the European Union (EU) from Europe, parts of Asia and Canada, the Middle East and Africa.
- The National Environmental Management – Biodiversity Act - Threatened or Protected Species list (TOPS).
- The Provincial Nature Conservation Ordinance (Nature Conservation Ordinance 19 of 1974) identifies very few bird species as endangered, none of which are relevant to this study. Protected status is accorded to all wild bird species, except for a list of approximately 12 small passerine species, all corvids (crows and ravens) and all Mousebirds.

4. LIMITATIONS AND ASSUMPTIONS

The presence of the observers on site will have an effect on the birds. For example, during walked transects, certain bird species will flush more easily than others (and therefore be detected), certain species may sit undetected, certain species may flee, and others may be inquisitive and approach the observers. Likewise with the vantage point counts, observers sitting in position for four hours at a time will likely affect bird flight activity. Some species may avoid the vantage point position because there are people there, and others may approach out of curiosity. In almost all data collection methods larger birds will be more easily detected, and their position in the landscape more easily estimated. This is particularly relevant at the vantage points where a large eagle may be visible several kilometres away, but a smaller Rock Kestrel will be detectable over a smaller distance. A particularly important challenge is that of estimating the height at which birds fly above the ground where there were no reference points against which to judge. For this reason, the flight height data were treated cautiously in this report, and collision modelling has been based on conservative estimates of the percentage of birds flying at rotor height.

Spotting and identifying birds whilst walking is a significant challenge, particularly when only fleeting glimpses of birds are obtained. As such, there is variability between observers' ability and hence the data obtained. The above data is therefore by necessity subjective to some extent. In order to control for this subjectivity, the same team of observers was used for all the baseline surveys. Despite this subjectivity, and a number of assumptions that line transects rely on (for more details see Bibby *et al*. 2000), this field method returns the greatest amount of data per unit effort (Bibby *et al*. 2000) and was therefore deemed appropriate for the purposes of this programme. Likewise, in an attempt to maximise the returns from available resources, the walked transects were located close to each Vantage Point. This systematic selection may result in some as yet unknown bias in the data but it has numerous logistical benefits.

Limitations in relation to BLSA guidance included use of a single year's baseline and less than the full recommended 72 hours' surveys recommended in some of the more sensitive areas are discussed in section 2.2 above. It is considered that the extensive nature of the data collection from a large number of VPs, in combination with spatial modelling of these data, has provided a robust baseline for the assessment.

5. DESCRIPTION OF HABITAT

5.1. Topography and vegetation

The Preferred substation site lies 250m north of the Beenleegte gravel road and about 3km from its turnoff (west) from the N10 motorway (see Figures 3, 3a and 3b), about 1km north of the Little Fish River. The substation yard will be 600m west of the REDZ 3 power corridor where two existing Eskom 400kV powerlines run south to Port Elizabeth.

The Preferred site lies on flat natural Karoo 'dwarf' shrubland (bossieveld) vegetation. This was classified by Mucina and Rutherford (2006) as "Lower Karoo NKl4 Albany broken veld" in the Nama-Karoo Biome. Vegetation structure is more important in determining bird species abundance than vegetation species composition (Harrison *et al*. 1997). For the purpose of this study it is therefore appropriate to separate the various vegetation types into structural units such as shrubland and bushveld as these can be more important in determining bird distribution and abundance than vegetation type.

With this said, a higher limestone koppie 300m further north of the Preferred substation yard has larger trees, therefore it should be avoided as an alternative site. However, the Preferred site only has the Albany broken veld vegetation, which is short and therefore open, and this includes only one micro habitat available to birds, dwarf shrubland.

5.2. Bird micro-habitats

The dwarf shrubland vegetation illustrates the semi-aridness of the landscape and is the habitat preferred by large terrestrial birds including Blue Crane, several bustard species, Secretarybird and storks. Small open veld bird species include larks and pipits.

The nearby existing powerlines will attract birds such as raptors that use the pylons as hunting perches while the nearby irrigated croplands will attract many large bird and water bird species; therefore, these birds will fly near or cross over the affected area, however, water birds and birds using the riparian habitats of the nearby Little Fish river will not be affected.

6. RESULTS OF THE PRE-CONSTRUCTION BIRD MONITORING (JUNE 2019 – AUGUST 2020)

The field surveys covered a wide area to inform the assessment of all the Choje renewable energy developments, including six wind farms and two solar farms. Data from these surveys that are relevant to the MTS application have been extracted and presented in the Tables and Figures below in this section.

Table 3 below, lists the target species and their flight rates over VP8 and VP31, both VPs were on the limestone koppie and Table 4 gives the small birds recorded during 400m 'walking transects' at these VP sites. Table 5 gives the Priority species recorded on the Road Transect count within 500m of the proposed MTS400 Site. The Tables also list the conservation status of these species. All data were collected between June 2019 and August 2020

The Southern Black Korhaan occurred in high densities in the wider area of the proposed substation site (see Figure 4 and 7) during the VP and the Vehicle Transect surveys. This makes the MTS400 Site a sensitive area for this species (see Figure 7). This species will be affected by the loss of 600m x 600m Karoo shrubland habitat where the Preferred substation site is proposed, as well as at the power line tower footprints. However, more korhaan activity was recorded north of the Preferred site (Figure 7). Besides the habitat loss for Southern Black Korhaan and in terms of the other potential effects of the substation, this species is likely to habituate to maintenance and the normal operations of the substation.

The relatively small area of bird habitat lost will not be a significant loss to all the other Priority species. Displacement due to the disturbance of birds during construction will probably have a temporary effect. In the longer-term during operation the birds will likely habituate to the normal maintenance and operations of the substation.

Ludwig's Bustards and Blue Cranes were both regularly recorded (see Figure 5 and 6) but no breeding was noted in proximity to the MTS400 Site. Both these species were seen at the irrigation centre-pivots 2km west of the proposed substation site, and Blue Cranes regularly cross the MTS site en route to the pivots. There are historic records of Ludwig's bustard mortalities under the large Eskom powerlines in the general area of the proposed yard. Figure 10 shows the importance of this area for these two species. Ludwig's Bustards do, however, follow a nomadic existence moving unpredictably depending on rainfall (which triggers increases in their insect prey populations). Blue Cranes can be similarly nomadic, but they are more dependent on the germination of seeds, and herbs and forbs after such rain.

A Martial Eagle nest was found 4.6km south-east from the proposed MTS yard and the eagles were often recorded (see Figure 8), probably because of more constant thermals over the large flat areas at this location. Nevertheless many medium-sized mammals, such as Ground Squirrel, Suricate and Yellow Mongoose (all Martial Eagle prey) occur in these flat areas. However, these eagles are expected to avoid the substation yard during construction and operation.

Unusually high numbers of Cape Vultures visited the general area for about three months during the summer of 2019/20. They roosted at night on the pylons of the powerline west of the proposed substation yard and a maximum of 74 were counted one night. Figure 9 shows their flight lines and pylon roosting positions.

The vultures were often observed leaving their pylon roosts in late morning and then searching for thermals (rising hot air) to fly further. The sun's solar radiation heats up some areas faster than others. The limestone koppie mentioned above was one of these, where the vultures were regularly seen. However, occurrence of Cape Vultures in the area was an unprecedented occurrence (see Boshoff *et al*. 2009a) and likely because of the extreme drought in the larger region at the end of 2019. Appendix F explains the mitigation and management plan where staff will do daily carcass search (birds/bats and domestic stock), the stock carcasses will be removed from the substation and wind farm areas.

Table 4 lists the small passerine birds recorded during the walking transects at each of the two VPs. No significant interaction between these species and the proposed substation is expected, but common species such as Cape Sparrow might nest in the eaves of building. Generally all the passerine species (especially pipits and larks) that are well adapted to the Karoo shrublands vegetation will disappear from the cleared area of the yard and probably will avoid the yard area during the operation phase.

Although our sampling methods did not include night recording, several owl species were recorded during incidental sightings. The proposed substation and power lines could hold risks to owls. Spotted eagle-owls in particular could be attracted to the substation for daily roosting sites.

It is important to remember the present dry climatic state of the study area. This can change with weather patterns and conditions and these can change from year to year or even decade to decade. This will in turn influence the ecological state of the area, the soil conditions, every biological organism, the plants and the animals. For example during our surveys not many migratory bird species were recorded, and this could change in the future. At the current time, the entire Karoo region has received very little rain therefore the region and this study area is in a very dry period. Plants adapt to such conditions and growth is limited therefore insects and other animals adapt similarly and their population numbers are probably low which in turn influence the higher animals e.g. eagle reproductive success.

Similarly, birds are attracted to an area for food and especially insects because birds clean plants of insects. Hence a general bird principle in this region that results from the large contrast between the height difference of bushveld and shrub vegetation, small birds forage in the bush and large birds forage in the flat, open Karoo shrubland vegetation.

Table 3. Flight rates (number per hour) of target species over the proposed 400kV substation (VPs 8 and 31), June 2019 - August 2020 and their conservation status (IUCN and South Africa Red Data Book Listings) ['-' = no records in that month].

			2019							2020							TOTAL FLIGHTS OBSERVED
Speceies	**IUCN**	**SA**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**	**Jul**	**Aug**	
Egyptian goose	LC		-	-	-	-	-	-	-	-	0.25	-	1.07	-	2.88	29.44	305
South African shelduck	LC		0.25	0.50	-	-	0.25	-	-	-	-	-	0.07	-	-	-	6
Spur-winged goose	LC		-	-	0.25	-	-	0.13	-	-	0.25	-	0.29	-	0.88	-	15
Blue crane	VU	NT	-	-	3.50	-	0.25	0.25	-	-	0.25	-	0.29	-	-	-	24
Ludwig's bustard	EN	EN	0.75	1.00	1.00	-	-	0.25	-	-	0.13	-	0.07	-	0.13	0.78	23
Denham's bustard	NT		-	-	-	-	-	-	-	-	-	-	-	-	-	0.33	3
Kori Bustard	NT	NT	-	-	-	-	-	-	-	-	-	0.07	-	-	-	-	1
Southern black korhaan	VU	VU	1.00	0.75	0.25	0.50	0.75	0.25	0.38	0.25	0.50	0.07	0.14	0.38	0.38	0.22	40
White stork	LC		3.00	-	-	-	-	-	-	-	0.63	-	-	-	-	-	17
African sacred ibis	LC		-	-	-	0.25	-	-	-	-	0.13	-	-	-	-	-	3
Hadada ibis	LC		-	-	-	-	-	-	-	-	-	-	2.14	-	-	-	30
Secretarybird	VU	VU	-	-	-	-	-	-	-	-	-	-	-	-	-	0.22	2
African harrier-hawk	LC		-	-	-	-	0.75	-	-	-	-	0.07	0.07	-	-	-	8
Cape vulture	EN	VU	-	-	-	-	-	-	-	3.50	15.38	0.47	-	-	-	-	158
Martial eagle	VU	EN	0.75	-	-	-	-	-	-	-	-	0.13	0.14	0.13	0.13	0.11	10
Verreaux's eagle	LC	VU	-	0.75	-	-	-	-	-	-	-	-	-	-	-	-	3
Pale chanting-goshawk	LC		-	-	-	1.13	-	0.25	0.25	-	0.13	0.13	0.21	-	0.63	-	24
African fish-eagle	LC		-	-	0.50	-	-	0.13	-	0.13	-	-	0.07	-	-	-	5
Jackal buzzard	LC		-	-	0.75	-	-	-	-	-	-	-	-	-	-	-	3
Eurasian buzzard	LC		-	-	-	-	-	0.25	-	-	-	-	-	-	-	-	2

Speceies	IUCN	SA	2019							2020							TOTAL FLIGHTS OBSERVED
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	May	Jun	Jul	Aug	
Rock kestrel	LC		-	0.75	0.25	-	0.50	0.88	1.38	-	-	-	0.07	0.25	0.38	0.44	36

Note: LC = least concern, NT - near threatened, VU = vulnerable, EN = endangered.

Table 4. Walking transect survey counts (birds per km transect) by month in the proposed 400kV substation site, June 2019 - August 2020.

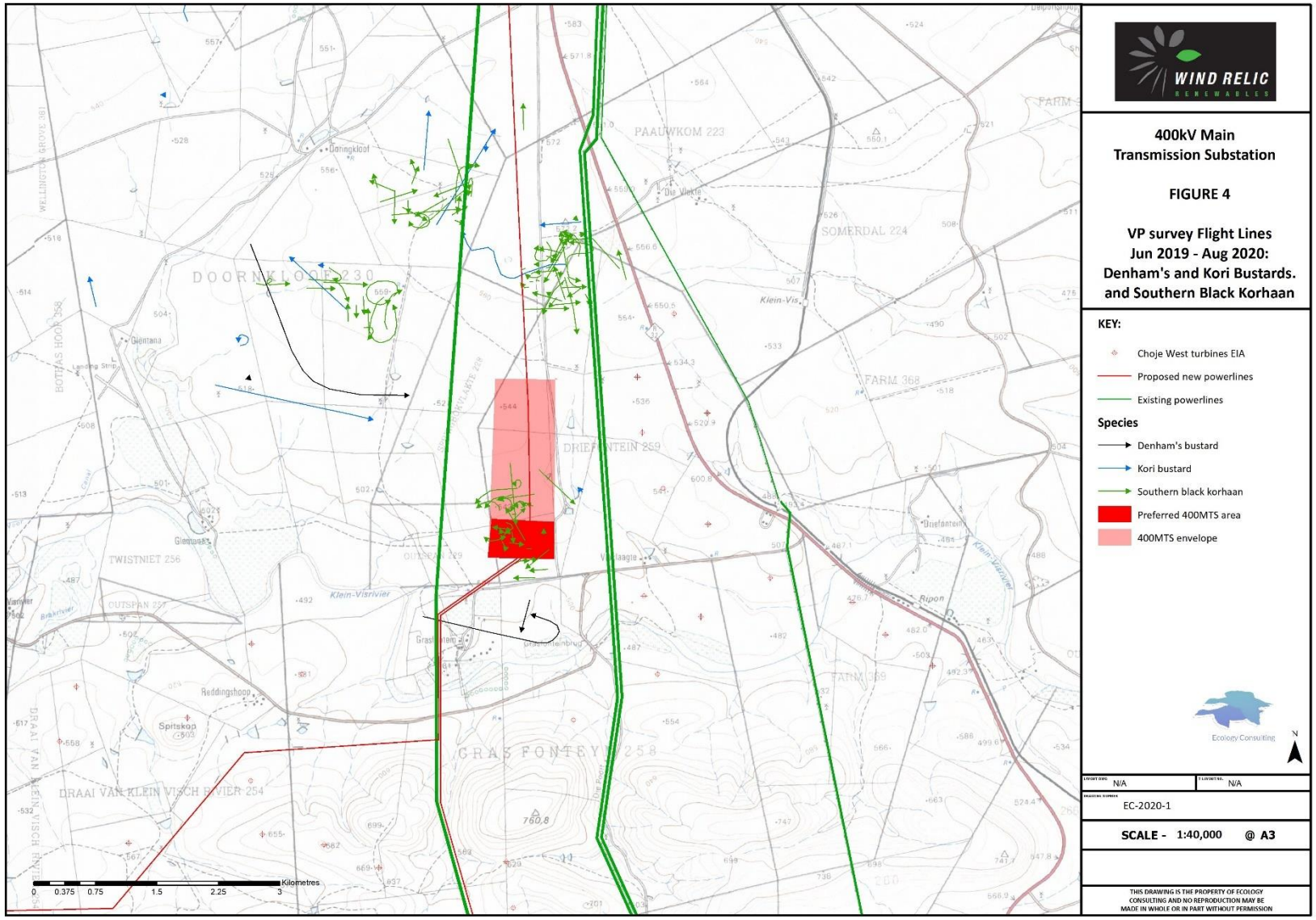
Species	IUCN	SA RDB	Jun 2019	Jul	Aug	Sep	Oct	Nov	Dec 2019	Jan 2020	Feb	Mar	May	Jun	Jul	Aug 2020
Ludwig's bustard	EN	EN	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
Southern black korhaan	VU	VU	2.5	2.5	-	-	2.5	-	1.3	-	2.5	-	-	-	-	-
Red-faced mousebird	LC		-	12.5	-	-	-	-	-	-	-	-	-	-	2.5	3.8
Chinspot batis	LC		-	-	-	-	-	-	2.5	-	-	-	-	-	-	-
Bokmakierie	LC		1.3	-	2.5	-	-	-	-	-	-	-	-	-	-	-
Fork-tailed drongo	LC		-	-	-	-	-	-	1.3	-	-	-	-	-	-	-
Common fiscal	LC		2.5	1.3	1.3	2.5	1.3	-	1.3	-	-	-	1.3	1.3	-	-
Cape crow	LC		-	-	-	-	-	-	-	1.3	2.5	-	-	-	-	-
White-necked raven	LC		-	-	-	-	-	-	-	-	-	-	-	-	3.8	-
Pied crow	LC		-	1.3	-	-	-	-	-	-	3.8	-	-	-	-	-
Grey tit	LC		1.3	-	-	-	-	3.8	-	3.8	-	1.3	2.5	-	-	-
Cape penduline-tit	LC		-	-	-	-	1.3	-	-	-	-	-	-	-	-	-
Spike-heeled lark	LC		-	-	2.5	2.5	6.3	-	-	8.8	1.3	-	5.0	8.8	5.0	-
Grey-backed sparrow-lark	LC		-	-	3.8	-	-	-	-	-	-	-	-	-	-	-
Sabota lark	LC		-	-	-	3.8	-	-	-	-	-	-	1.3	-	-	-

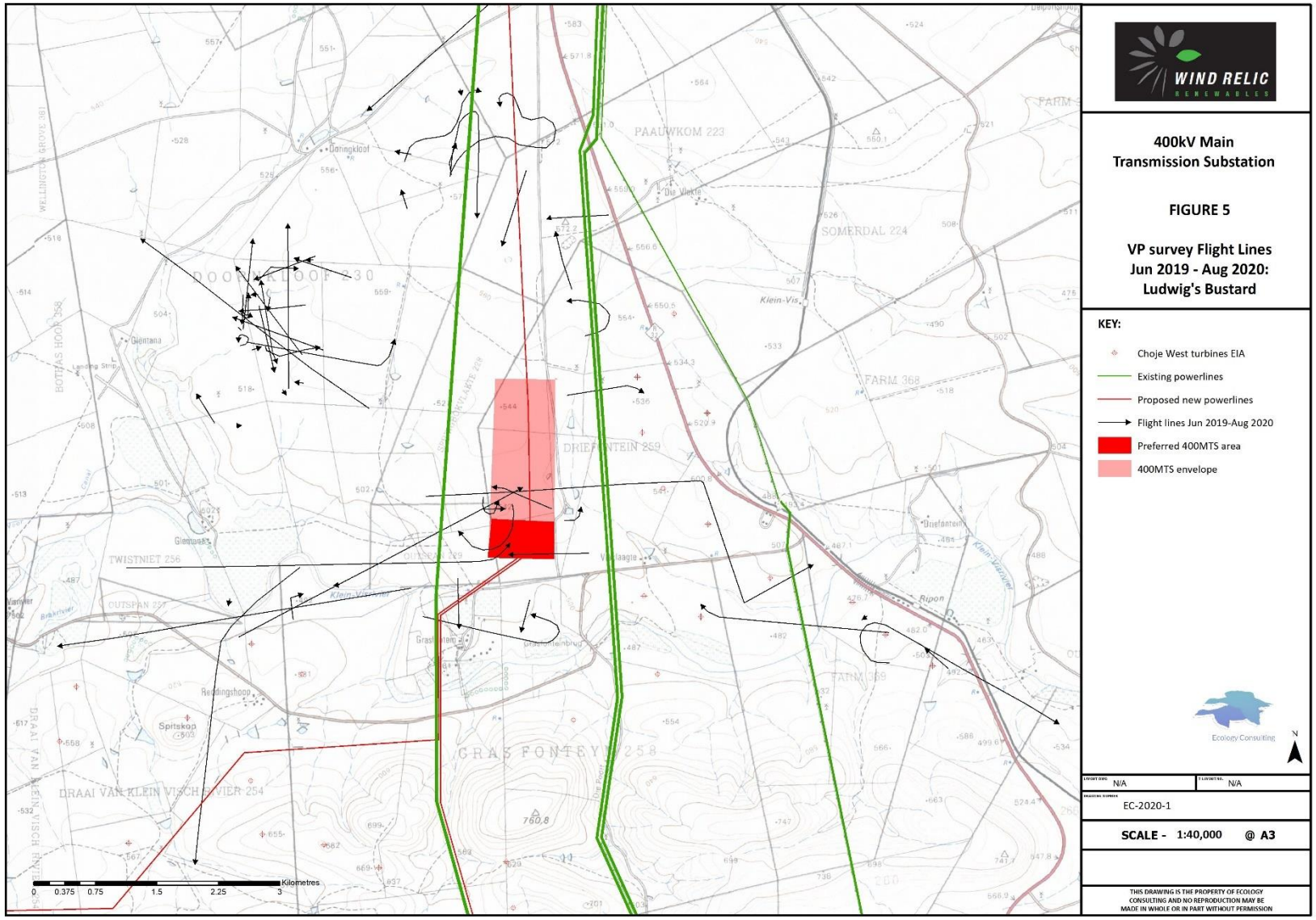
Species	IUCN	SA RDB	Jun 2019	Jul	Aug	Sep	Oct	Nov	Dec 2019	Jan 2020	Feb	Mar	May	Jun	Jul	Aug 2020
Eastern clapper lark	LC		-	-	-	-	3.8	-	-	-	3.8	-	-	-	1.3	-
Yellow-bellied eremomela	LC		-	-	-	-	-	-	-	-	2.5	1.3	2.5	-	-	-
Rufous-eared warbler	LC		3.8	2.5	3.8	3.8	7.5	1.3	2.5	1.3	3.8	2.5	1-	1.3	2.5	2.5
Grey-backed cisticola	LC		-	-	-	-	-	-	-	-	-	-	-	-	-	2.5
Neddicky	LC		-	-	-	-	-	-	-	-	-	-	-	-	1.3	1.3
Karoo prinia	LC		3.8	1.3	-	1.3	2.5	-	-	-	1.3	2.5	2.5	-	-	-
Greater striped swallow	LC		-	-	-	-	3.8	-	-	-	-	-	-	-	-	-
Barn swallow	LC		-	-	-	-	-	3.8	12.5	-	-	8.8	-	-	-	-
Pearl-breasted swallow	LC		-	-	-	-	1.3	-	-	-	1.3	-	-	-	-	-
Common bulbul	LC		-	-	-	-	-	-	-	-	-	-	-	-	1.3	-
Chestnut-vented warbler	LC		-	1.3	-	3.8	1.3	2.5	-	1.3	1.3	-	1.3	1.3	-	1.3
African pied starling	LC		-	6.3	-	-	-	-	-	-	-	-	-	2.5	5.0	7.5
Karoo scrub-robin	LC		2.5	1.3	2.5	3.8	5.0	2.5	3.8	-	5.0	-	7.5	-	5.0	1.3
Fiscal flycatcher	LC		-	-	1.3	2.5	-	-	-	-	-	-	-	-	1.3	1.3
Sickle-winged chat	LC		-	-	-	-	-	-	-	-	-	-	-	-	-	1.3
Malachite sunbird	LC		-	-	-	1.3	1.3	2.5	1.3	1.3	2.5	-	-	5.0	1.3	1.3
Greater double-collared sunbird	LC		-	-	-	-	-	-	-	-	-	-	1.3	-	-	-
Red-billed quelea	LC		5.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Southern red bishop	LC		-	-	-	-	5.0	-	-	-	-	-	-	-	-	-
Cape weaver	LC		-	8.8	-	5.0	41.3	-	-	-	-	-	-	1.3	-	1.3
Southern masked weaver	LC		1.3	-	-	-	-	-	-	-	-	-	-	-	-	-
African quailfinch	LC		-	-	-	-	-	-	-	-	-	-	5.0	1.3	-	-

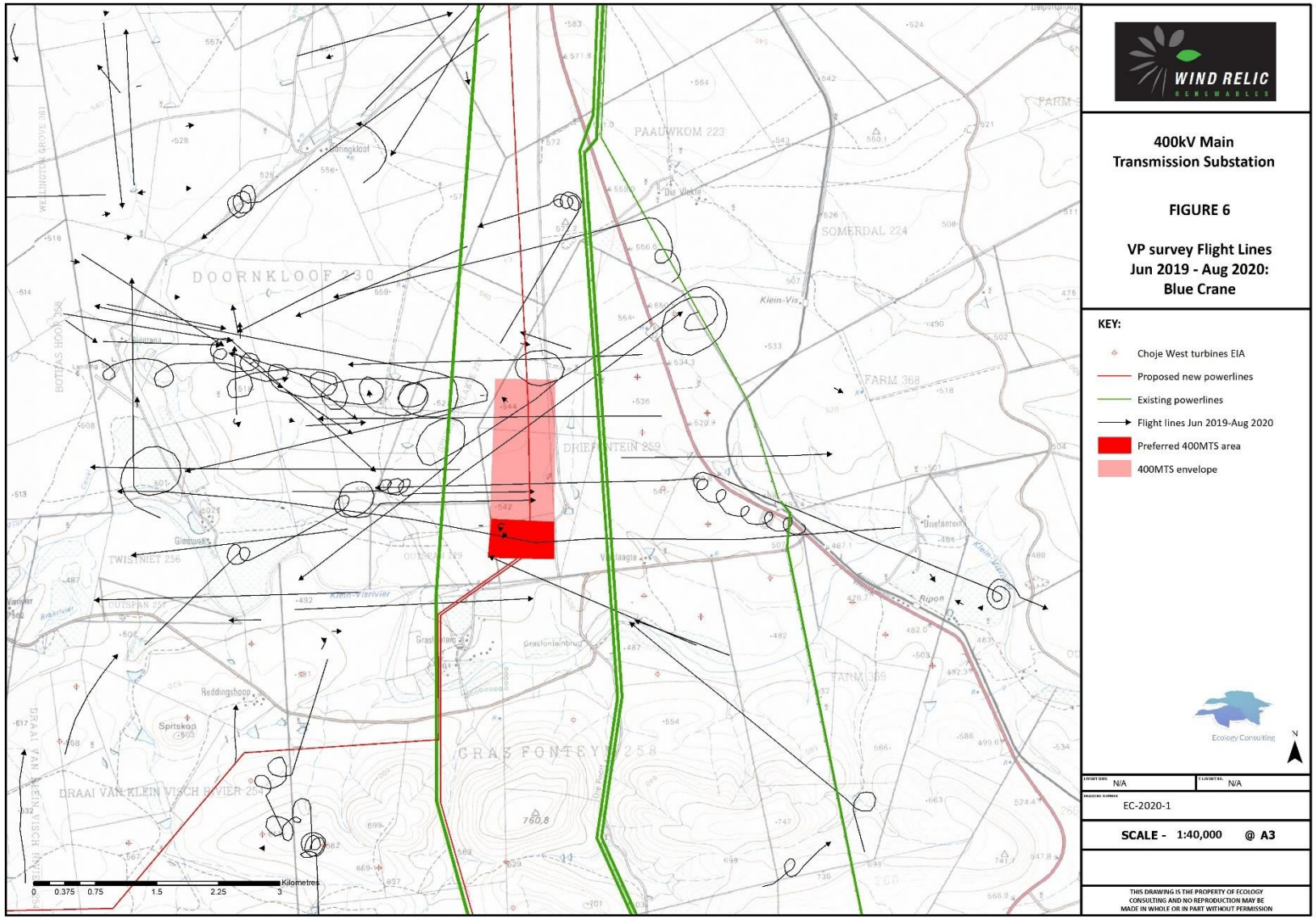
Species	IUCN	SA RDB	Jun 2019	Jul	Aug	Sep	Oct	Nov	Dec 2019	Jan 2020	Feb	Mar	May	Jun	Jul	Aug 2020
Cape sparrow	LC		6.3	2.5	-	5.0	-	-	3.8	2.5	2.5	-	-	1.3	-	-
African pipit	LC		5.0	-	-	-	-	-	-	-	5.0	-	1.3	1.3	-	-
Long-billed pipit	LC		2.5	2.5	2.5	-	1.3	-	-	-	-	-	-	-	-	-

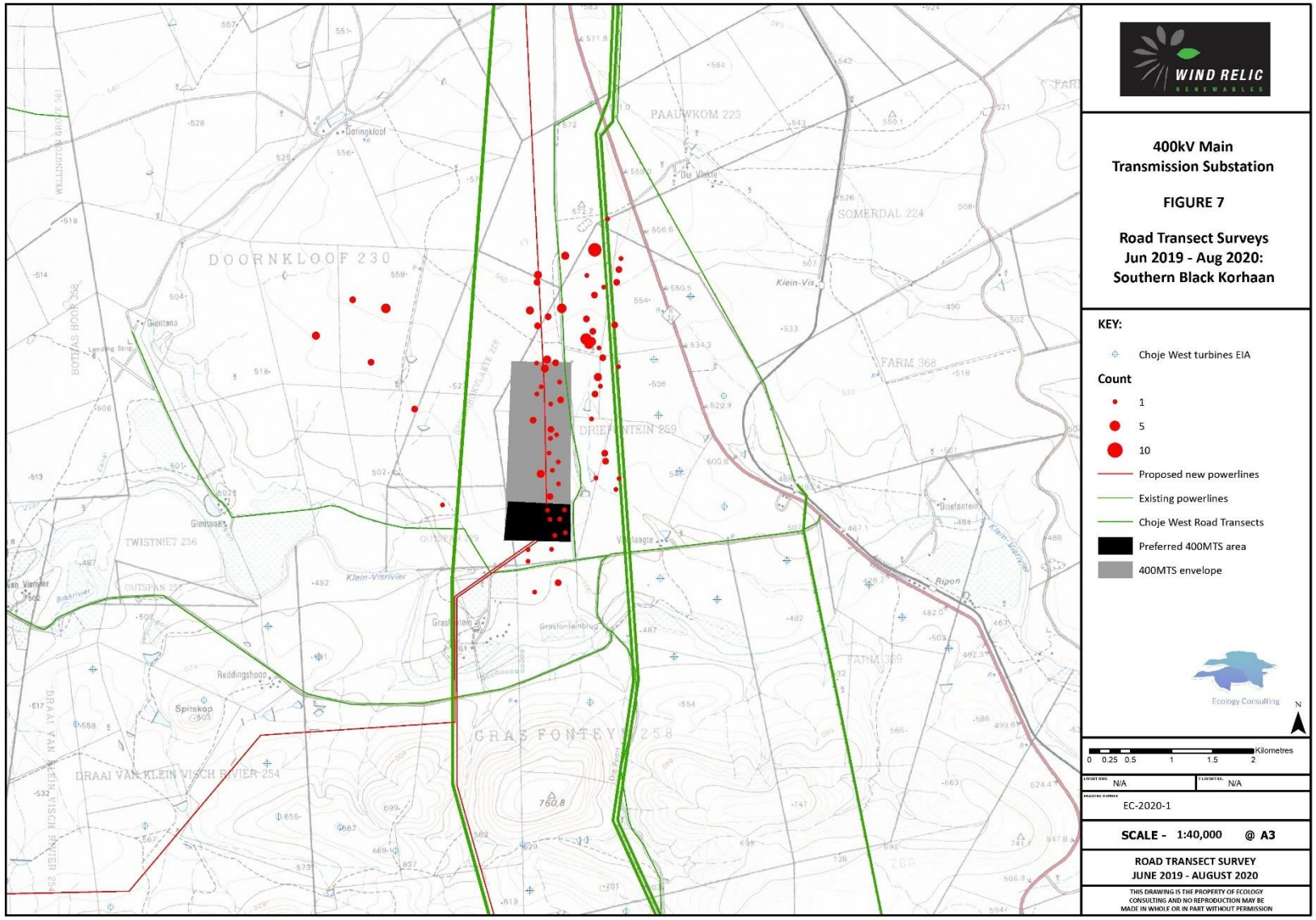
Table 5. Vehicle transect survey counts (birds/km transect) by month in the proposed 400kV substation site (plus 500m buffer), June 2019-August 2020.

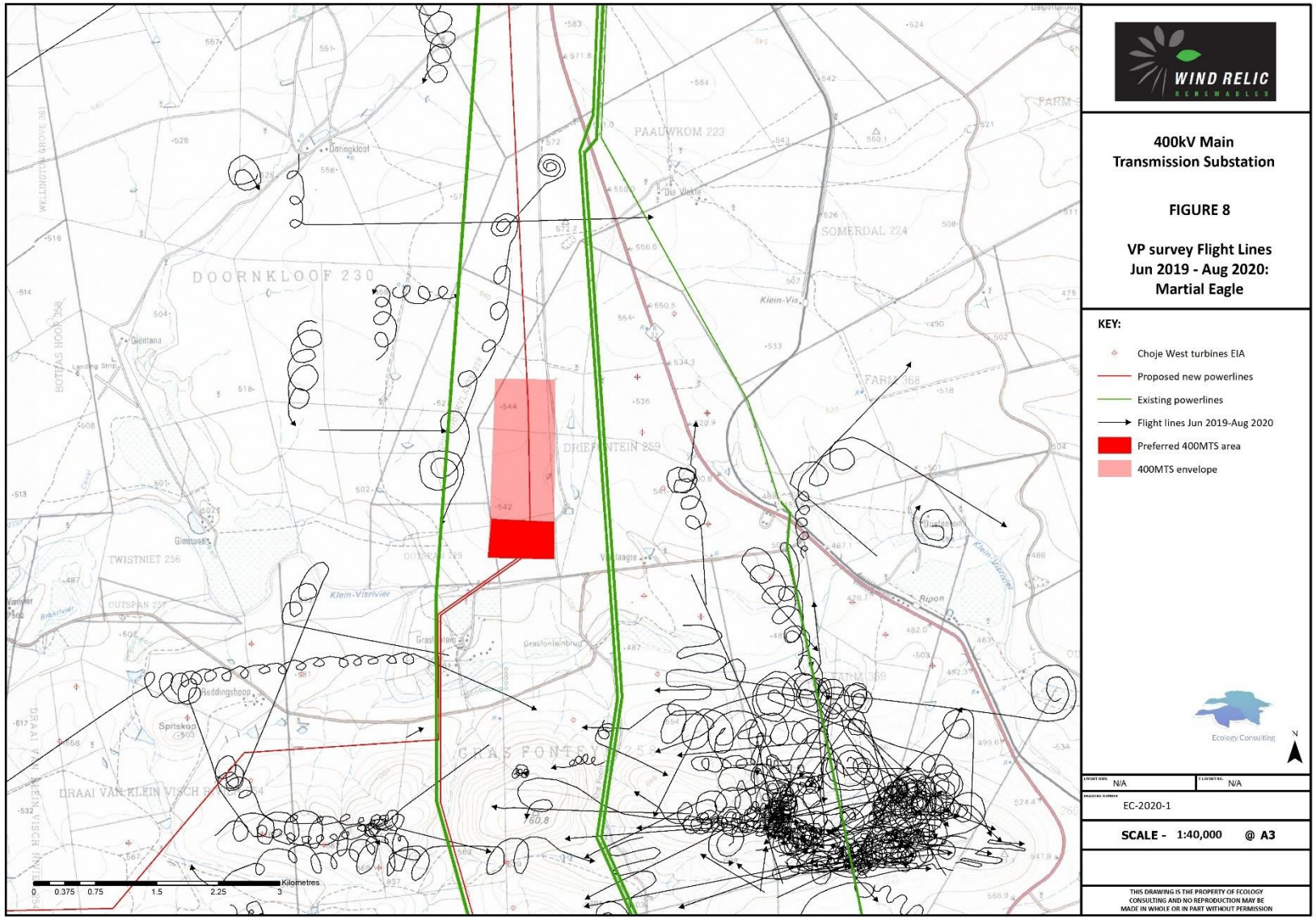
Species	IUCN	SA	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	May	Jun	Jul	Aug
Blue crane	VU	NT	-	-	-	-	0.38	0.38	0.38	0.57	0.38	-	-	-	-	-
Ludwig's bustard	EN	EN	-	4.72	-	-	-	0.19	0.19	-	-	-	-	1.13	-	-
Kori bustard	NT	NT	-	-	-	-	-	-	-	-	-	-	-	0.57	-	-
Southern black korhaan	VU	VU	-	-	2.26	1.89	1.70	0.75	1.70	1.51	0.19	1.13	1.89	1.13	-	-
Cape vulture	EN	VU	-	-	-	-	-	-	-	-	0.19	-	-	-	-	-
Verreaux's eagle	LC	VU	-	0.19	-	-	-	-	-	-	-	-	-	-	-	-
Pale chanting-goshawk	LC		-	-	0.19	-	-	-	-	-	0.19	0.19	0.19	-	-	-
Rock kestrel	LC		-	-	-	-	-	-	0.19	-	-	-	-	-	-	-

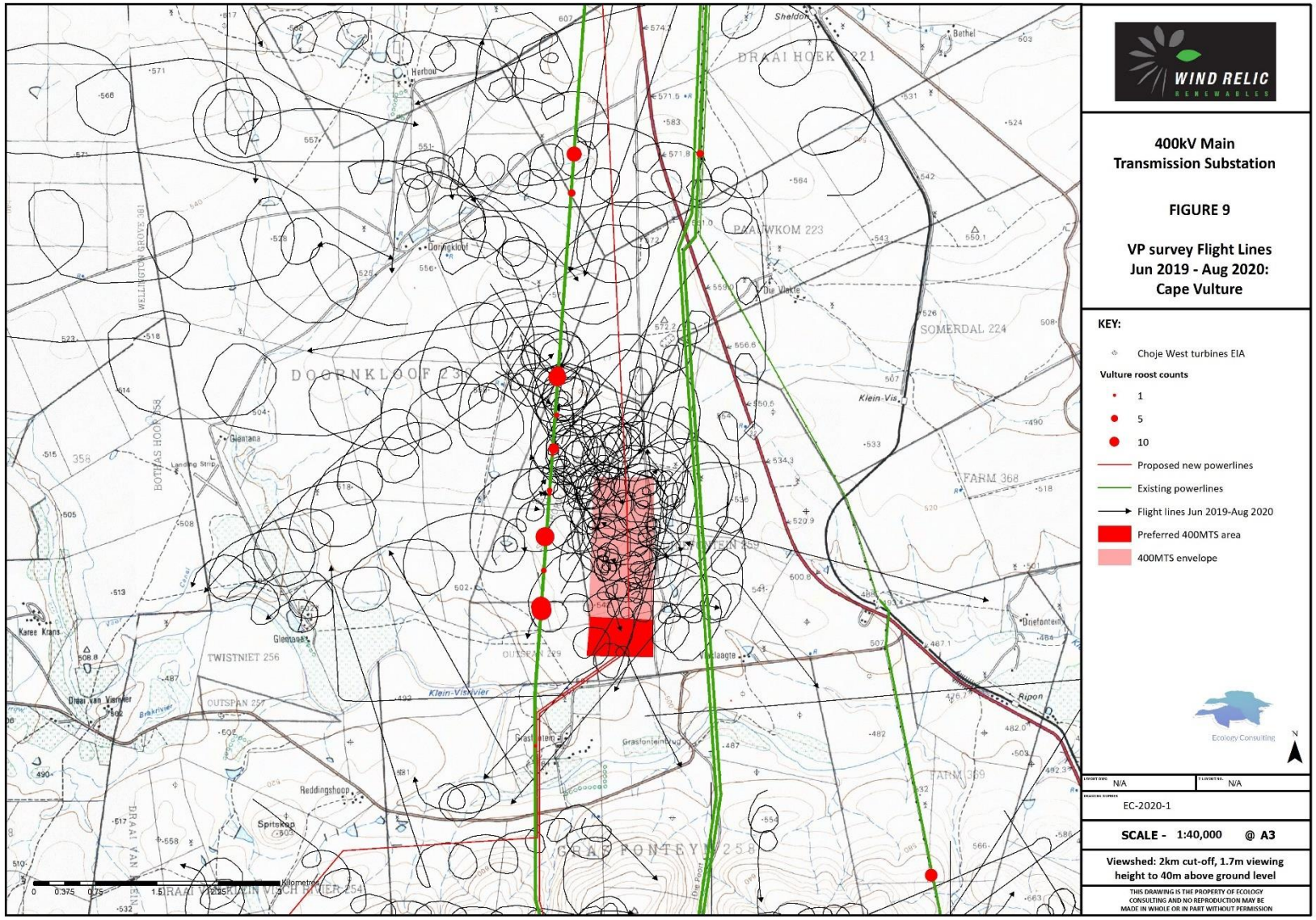

WIND RELIC
RENEWABLES
400kV Main
Transmission Substation
FIGURE 4
VP survey Flight Lines
Jun 2019 - Aug 2020:
Denham's and Kori Bustards.
and Southern Black Korhaan
KEY:
Choje West turbines EIA
Proposed new powerlines
Existing powerlines
Species
Denham's bustard
Kori bustard
Southern black korhaan
Preferred 400MTS area
400MTS envelope
Ecology Consulting
N
N/A
N/A
EC-2020-1
SCALE - 1:40,000 @ A3
THIS DRAWING IS THE PROPERTY OF ECOLOGY CONSULTING AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION
Kilometres
0 0.375 0.75 1.5 2.25 3
PAAUWKOM 223
SOMERDAL 224
DOORNKLOOF 230
FARM 368
DRIEFONTEIN 259
TWISTNIET 256
GRAS FONTEYN 258
DRAAI VAN KLEIN VISCH RIVIER 254
Klein-Visrivier
Spitskop
Reddingshoop
Ripon
760.8


WIND RELIC
RENEWABLES
400kV Main
Transmission Substation
FIGURE 5
VP survey Flight Lines
Jun 2019 - Aug 2020:
Ludwig's Bustard
KEY:
Choje West turbines EIA
Existing powerlines
Proposed new powerlines
Flight lines Jun 2019-Aug 2020
Preferred 400MTS area
400MTS envelope
Ecology Consulting
N
N/A
N/A
EC-2020-1
SCALE - 1:40,000 @ A3
THIS DRAWING IS THE PROPERTY OF ECOLOGY CONSULTING AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION
0 0.375 0.75 1.5 2.25 3 Kilometres
PAAUWKOM 223
SOMERDAL 224
FARM 368
DRIEFONTEIN 259
TWISTNIET 256
GRAS FONTEYN 258
DRAAI VAN KLEIN VISCHFONTEIN 254
Daringkloof
Die Vlekte
Glentana
Landing Strip
Glenmoss
Ripon
Spitskop
Redlingshoop
760.8


WIND RELIC
RENEWABLES
400kV Main
Transmission Substation
FIGURE 6
VP survey Flight Lines
Jun 2019 - Aug 2020:
Blue Crane
KEY:
Choje West turbines EIA
Proposed new powerlines
Existing powerlines
Flight lines Jun 2019-Aug 2020
Preferred 400MTS area
400MTS envelope
Ecology Consulting
N
N/A
N/A
EC-2020-1
SCALE - 1:40,000 @ A3
THIS DRAWING IS THE PROPERTY OF ECOLOGY CONSULTING AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION
DOORNKLOOF 230
PAAUWKOM 223
SOMERDAL 224
FARM 368
DRIEFONTEIN 259
TWISNIET 256
GRAS FONTEYN 258
DRAAI VAN KLEIN VISCH RIVIER 254
Spitskop
Reddingshoop
Ripon
Kilometres
0 0.375 0.75 1.5 2.25 3


WIND RELIC
RENEWABLES
400kV Main
Transmission Substation
FIGURE 7
Road Transect Surveys
Jun 2019 - Aug 2020:
Southern Black Korhaan
KEY:
Choje West turbines EIA
Count
1
5
10
Proposed new powerlines
Existing powerlines
Choje West Road Transects
Preferred 400MTS area
400MTS envelope
Ecology Consulting
N
Kilometres
0 0.25 0.5 1 1.5 2
N/A
N/A
EC-2020-1
SCALE - 1:40,000 @ A3
ROAD TRANSECT SURVEY
JUNE 2019 - AUGUST 2020
THIS DRAWING IS THE PROPERTY OF ECOLOGY CONSULTING AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION
DOORNKLOOF 230
PAAUWKOM 223
SOMERDAL 224
DRIEFONTEIN 259
TWISTNIET 256
GRAS FONTEYN 258
DRAAI VAN KLEIN VISCH RIVIER 254
FARM 368
FARM 369
Klein-Visrivier
Brakrivier
Reddingshoop
Spitskop
Glentana
Ripon
760.8


WIND RELIC
RENEWABLES
400kV Main
Transmission Substation
FIGURE 8
VP survey Flight Lines
Jun 2019 - Aug 2020:
Martial Eagle
KEY:
Choje West turbines EIA
Proposed new powerlines
Existing powerlines
Flight lines Jun 2019-Aug 2020
Preferred 400MTS area
400MTS envelope
Ecology Consulting
N
N/A
N/A
EC-2020-1
SCALE - 1:40,000 @ A3
THIS DRAWING IS THE PROPERTY OF ECOLOGY CONSULTING AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION
DOORNKLOOF 230
PAAUWKOM 223
SOMERDAL 224
TWISTNIET 256
DRIEFONTEIN 259
GRAS FONTEIN 257
DRAAI VAN KLEIN VISCH RIET 254
Klein-Visrivier
Spitskop
Ripon
Kilometres
0 0.375 0.75 1.5 2.25 3


WIND RELIC
RENEWABLES
400kV Main
Transmission Substation
FIGURE 9
VP survey Flight Lines
Jun 2019 - Aug 2020:
Cape Vulture
KEY:
Choje West turbines EIA
Vulture roost counts
1
5
10
Proposed new powerlines
Existing powerlines
Flight lines Jun 2019-Aug 2020
Preferred 400MTS area
400MTS envelope
Ecology Consulting
N
N/A
N/A
EC-2020-1
SCALE - 1:40,000 @ A3
Viewshed: 2km cut-off, 1.7m viewing
height to 40m above ground level
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DRAAI HOEK 221
DOORNKLOOF 231
SOMERDAL 224
FARM 368
TWISTNIET 256
GRASFONTEIN 258
Herbou
Donkiekloof
Die Vlakte
Glentana
Klein-Vis
Driefontein
Ripon
Reddingshoop
Spitskop
Kilometres

7. AVIFAUNAL SENSITIVITIES

7.1. Species of Conservation Concern

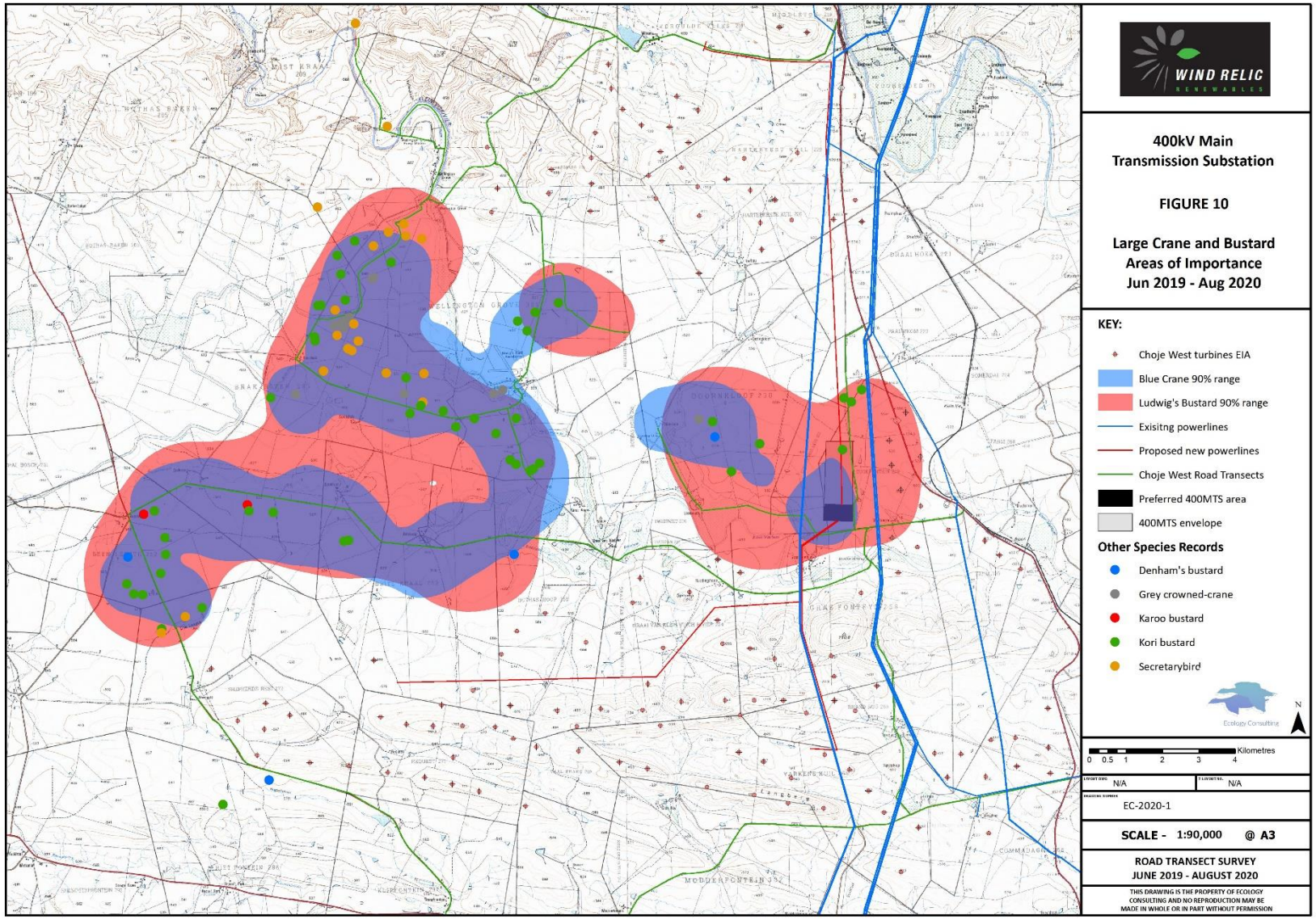
Nine Species of Conservation Concern were recorded during the Pre-construction bird monitoring study in proximity to the MTS site. These were Blue Crane, Ludwig's Bustard, Denham's Bustard, Kori Bustard, Southern Black Korhaan, Secretarybird, Cape Vulture, Martial Eagle and Verreaux's Eagle.

- **Martial Eagle** - two territories were located in proximity to the Western Block (both of which were confirmed as active), with one of these 4.6km from the proposed 400kV MTS (the other was 14km to the north-west). A third (also active) was found further to the north-west (30km from the MTS400 Site). A fourth potential range was identified 11km south-west from the site, where a recently fledged juvenile was observed on one occasion, but no further evidence of occupation of a range in this area was found (so it was concluded that it was not active). VP surveys recorded higher flight activity in proximity to the two active nests, but the MTS400 Site lay outside this higher flight activity zone (Figure 8).
- **Verreaux's Eagle** - three active nests were confirmed in the Western Block, at distances of 13km, 18km and 28km from the MTS400 Site (all active in 2019 and the two more distant ones in 2020 - the closer north-eastern site was occupied by a pair of Lanner Falcons in that year). Flight activity within the MTS site was very low, with only three flights in total observed (Table 3).
- **Cape Vulture** - this species was found in the Western Block in nationally important numbers during November 2019 - March 2020, with a peak of 74 in February 2020. Use of this area by vultures is thought to be very unusual because the landowners have not seen these vultures here before with only one historic record 50 years ago mentioned by a deceased grandfather. Only one single bird was recorded in the SABAP1 & 2 (SA Bird Atlas Project) before this study. The nearest regularly-used roost identified in the SEA (DEA 2015) is located about 58km north-east from the MTS400 Site. Flight densities were highest in proximity to the birds' roost sites on the powerlines running north-south through the eastern part of the Western Block, with the birds dispersing widely to forage on the surrounding land (Figure 9).
- **Cranes, Bustards and Secretarybird** - Blue Crane, Ludwig's Bustard, Denham's Bustard, Kori Bustard, Southern Black Korhaan and Secretarybird were all recorded during the baseline surveys. All are species of conservation concern. They were all more abundant in the central part of the Choje Western Block survey area. Many were associated with irrigated agricultural grassland, and the more open flatter areas in the central part of the Choje West Block (Figure 10).

  Areas of higher importance for cranes and bustards were identified using the road transect data. An analysis was undertaken focussing on the two more abundant larger terrestrial species, Blue Crane and Ludwig's Bustard, as the two species most at risk from the wind farm, then considered how these areas included areas used by other less abundant species. This 'area of higher importance' was determined firstly by calculating the 90% utilisation range of the each of these two species, using kernel density estimation (Worton 1989), then merging those two areas. The results are shown in Figure 10. A check was then made against the records from the other large crane and bustard species recorded, to see whether their distribution was included in this area. Very few records lay outside this merged range, so no further extension of that area was required. The proposed MTS400 Site is located on the eastern edge of this area of importance (Figure 10).

7.2. Priority Species for Assessment

All nine Species of Conservation Concern were taken forward for more detailed assessment as Priority Species for Assessment.


WIND RELIC
RENEWABLES
400kV Main
Transmission Substation
FIGURE 10
Large Crane and Bustard
Areas of Importance
Jun 2019 - Aug 2020
KEY:
Choje West turbines EIA
Blue Crane 90% range
Ludwig's Bustard 90% range
Exisitng powerlines
Proposed new powerlines
Choje West Road Transects
Preferred 400MTS area
400MTS envelope
Other Species Records
Denham's bustard
Grey crowned-crane
Karoo bustard
Kori bustard
Secretarybird
Ecology Consulting
N
0 0.5 1 2 3 4 Kilometres
N/A
N/A
EC-2020-1
SCALE - 1:90,000 @ A3
ROAD TRANSECT SURVEY
JUNE 2019 - AUGUST 2020
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8. CONSIDERATION OF ALTERNATIVES

The National Environmental Management Act (NEMA) requires the consideration and assessment of feasible and reasonable alternatives in the BA process. Alternatives can include: Location of the proposed activity; Type of activity; Layout alternatives; Technology alternatives; and 'do-nothing' alternative.

In relation to this MTS assessment, a Preferred location has been considered, together with a wider potential area in which the MTS could be located. This AIA report selected the Preferred 600m x 600m site as the most appropriate site for the proposed 400kV substation, because it is closest to the public road for access (therefore less habitat loss) and large terrestrial birds tend mostly to avoid foraging near main roads, so the Preferred site is considered to be the location with the lowest ornithological impact in that less bird habitat will be lost that includes the two short powerlines linking the substation to the grid. The location of the proposed powerlines (ca. each up to 660m in length but next to each other) should follow a route that has the minimum ornithological impact and being largely within the corridor of the existing powerlines passing through the area (see Figure 3, 3a and 3b).

With regard to the 'do-nothing' alternative, there would be no negative impact on the avifauna of the proposed development site.

9. POTENTIAL IMPACTS OF THE 400kV MTS AND ASSOCIATED POWERLINES

Because of its size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Wildlife interactions with power lines or other infra structures (transformers, supporting structures, connection loops, air switches) are almost all negative, with the two main problems caused by electrocution of birds (and other animals) and birds colliding with power lines (APLIC 1994, Bevanger 1998, Kruger 1999, van Rooyen and Ledger 1999, Jenkins *et al*. 2010, Shaw *et al*. 2010, APLIC 2012, Shaw 2013).

Other issues are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure (van Rooyen and Ledger 1999), and disturbance and habitat destruction during construction and maintenance activities (e.g. Silva *et al*. 2010, Raab *et al*. 2011).

The first five impacts identified below, could impact on the birds' survival or their physical condition while the last four impacts could impact on the quality of the power supply due to flash-over that could be caused by birds.

9.1. Substation impacts

9.1.1. Habitat loss

During the construction phase of the substation, habitat loss and damage will inevitably take place. This will occur during the construction of the access road and of the substation yard. The Preferred site is relatively flat and open, and only has Karoo shrubland vegetation (bossieveld), so only this vegetation would be cleared for the substation yard. This vegetation attracts mainly the large terrestrial birds such as cranes, bustards, Secretarybird and storks. Removal of the 36ha of this Karoo shrubland will affect this group of Priority species. However, the amount of habitat loss is relatively small and near existing power lines hence an already transformed landscape.

9.1.2. Disturbance of birds during the Construction phase

Construction activities associated with the proposed 400kV substation will cause disturbance to birds. The reaction of birds to disturbance depends on a variety of factors and is species and situation dependent (Ruddock and Whitfield 2007). Disturbance effects are likely to be more important when birds are breeding close to the source of disturbance. In these instances disturbance may result in loss of breeding productivity, failed breeding, and short term or permanent abandonment of breeding sites.

9.1.3. Disturbance of birds during the Operational phase

During operation, as part of annual grounds maintenance, the substation yard and track servitude under the two powerlines will be cleaned of growing vegetation, to prevent vegetation from growing over a required clearance gap between the ground and the 'live' conductors, and to minimise the risk of fire under the line which can result in electrical flashovers.

These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude, both through modification of habitat and disturbance caused by human activity.

9.1.4. Effect of noise associated with substation

Ortega (2012) presents a useful summary of the effects of noise on birds. According to this author, noise affects birds in the following ways: physical damage to ears; stress responses; fright–flight responses; avoidance responses; changes in other behavioural responses, such as foraging; changes in reproductive success; changes

in vocal communication; interference with the ability to hear predators and other important sounds; and potential changes in populations. Relevant characteristics of noise include: type; frequency; loudness; duration and consistency. Birds react differently to noise, with colonial or gregarious birds thought to be particularly affected since when one bird reacts to a noise the others follow suit (Burger 1998). Naguib *et al*. (2013) showed that even individual birds also react differently to noise stimuli.

9.1.5. Effect of electromagnetic fields on birds

Electromagnetic fields are present everywhere in our environment. They are invisible lines of force that emanate from both natural (e.g. solar radiation and a build-up of electric charges in the atmosphere associated with thunderstorms) and anthropogenic sources, most commonly from high voltage power lines, television and radio transmitters, radar and several domestic appliances. Electric fields (measured in kV/m) are produced by electric charges and therefore differences in voltage, while magnetic fields (measured in µT – micro tesla) are produced by the flow of electric current (http://www.who.int/peh-emf/about/WhatisEMF/en/). The greater the voltage or current, the stronger are the resultant magnetic fields.

Alternating current (AC) power systems such as the proposed transmission 400kV MTS and the powerlines operate at 50 Hz (Wolhuter and Holtzhausen 2015). Fields with frequencies such as this (less than 300 Hz) are classified as Extremely Low Frequency and are more 'penetrating' than higher frequencies. High frequency phenomena can also occur on power lines due to secondary effects such as corona. Corona occurs when the electric field strength on the conductors exceeds the corona inception level. Small discharges or sparking occur on the line, causing high frequency current spikes. Corona is more pronounced in wet conditions when discharges form on water droplets on the line. The corona interference and interference due to sparking may interfere with some radio communication systems.

In conclusion, most of the above identified impacts 9.11 to 9.19 will be very small or noted only on the physiological state of an influenced bird therefore to assess the impacts on birds only the first six (9.1.1 to 9.1.6) were selected in going forward with the assessment.

9.1.6. Impact of birds on quality of supply

Birds can cause electrical faults on substations as described above with nests or streamers (streams of faeces). The more faults that occur on a line, the lower the quality of electrical supply to the end customers. This is not desirable from Eskom's perspective. In the case of a bird streamer induced fault, the fault is caused by the bird releasing a "streamer" of faeces which can constitute an air gap intrusion between the conductor and the earthed structure. The fault appears to flash across the air gap and does not follow an insulator creepage path as observed on pollution faults (van Rooyen 2004). Bird pollution (faeces) is a form of pre-deposit pollution. A flashover occurs when an insulator string gets coated with pollutant, which compromises the insulation properties of the string. When the pollutant is wetted, the coating becomes conductive, insulation breakdown occurs and a flashover result.

9.1.7. Effect of MTS yard lights on birds

The MTS will be lit at night, and the introduction of artificial lighting can affect bird behaviour. The effects of lighting on birds have been widely studied and can have ecological consequences, though limited experimental work has been undertaken (Titulaer *et al*. 2012). Such effects can include:

- Attraction to lights at night, potentially bringing birds into areas where they could be at higher risk of electrocution and collision (Evans and Manville 2000).
- Changes to the duration of daytime activity due to the introduction of new light sources;
- Disruption to a bird's response to seasonal changes in day length (Titulaer *et al* 2012)

- Increased nocturnal foraging opportunity (feeding time) and increased food intake rate (Santos et al 2010); and
- Increased predation risk for nocturnal birds as a result of artificial light (Decandido and Allen 2006).

9.1.8. Bird nesting and roosting near Substation equipment

Common birds such as crows and sparrows build nests on or near substation equipment. The nesting material can cause flash-overs when near or touching live conductors or equipment. Removal of such nests are required.

Bird nests may also cause faults through nest material protruding and constituting an air gap intrusion. Crows often incorporate wire and other conductive material into their nests. When nests cause flashovers, the nesting material may catch fire. This in turn can lead to equipment damage or a general veld fire. Apart from the cost of replacing damaged equipment, the resultant veld fire can lead to claims for damages from landowners. Both bird streamers and bird pollution happen because of birds perching on supporting structures, often directly above live conductors. The guyed V and self-support towers have suitable perching space above conductors and so are likely to be affected.

9.1.9. Bird electrocution on MTS

Electrocution of birds in substation yards can occur, but is likely to affect more common bird species such as crows and Hadeda Ibis because Red Listed species are less likely to frequent these areas (van Rooyen and Ledger 1999). These common bird species regularly roost on or near substation equipment because such infrastructure create a safe-haven for wildlife hence accidents and flash-overs can occur to the cost of the bird's life and to electricity failure or trips.

9.2. Effects of Power lines on Birds

In addition to the above-mentioned effects, powerlines can also impact on birds. Two short stretches of 400kV power line (ca. 660m each) will be constructed to connect the electricity generated to the national grid. The construction of the power line will add extra impacts on birds, these can include the disturbance of birds during construction activities and the loss of breeding or feeding habitat.

During the operation of the 400kV MTS, birds can collide with power line conductors or get electrocuted on pole structures (Percival 2005, Drewitt and Langston 2006, Gove *et al*. 2013).

9.2.1. Direct effects: loss of habitat

The construction of the power lines will result in some disturbance and habitat destruction at pylon footprints. New service roads/tracks to be constructed will also have a disturbance and habitat destruction impact. A 300m corridor is proposed for the micro-siting of the powerlines and pylons before construction starts.

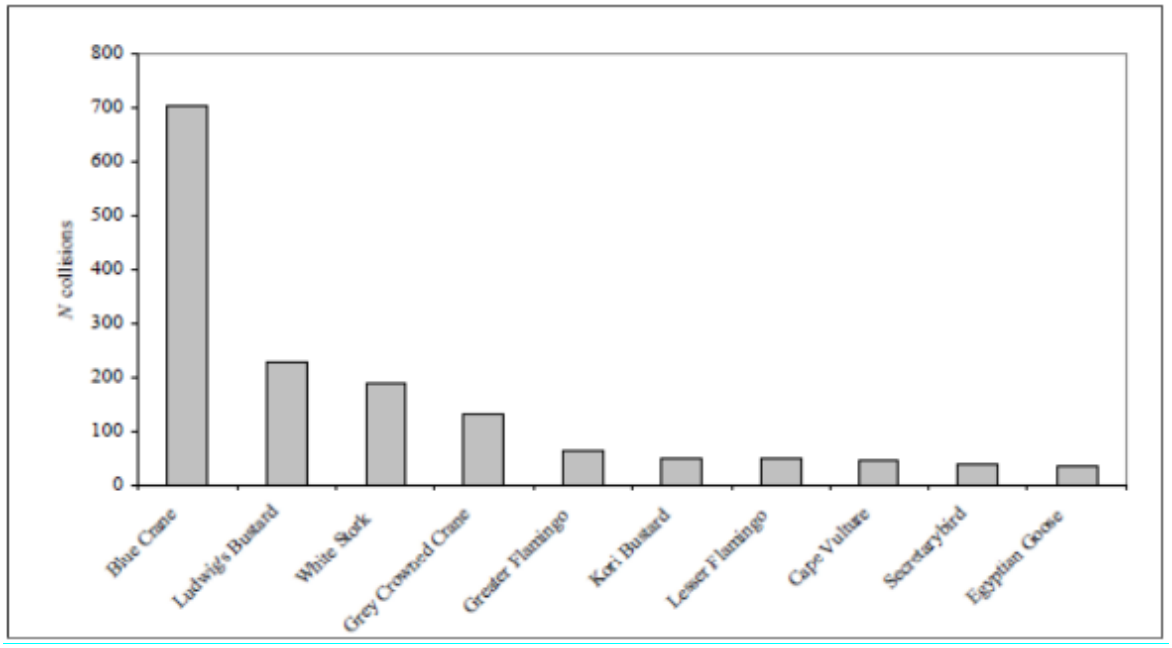
9.2.2. Direct effects: from operating power lines

Overhead power lines pose a collision and an electrocution threat to certain bird species (depending on the pole top configuration).

Collision with power lines is one of the biggest single threats facing birds in southern Africa (van Rooyen 2004). Species most affected include bustards, storks, cranes and various species of water birds (Figure 11). These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take

the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of these collision sensitive species are considered threatened in southern Africa. The Red List species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions.

Figure 11. The top ten power line collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2008 (Jenkins et al. 2010)



Electrocution refers to the scenario where a bird perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). The larger bird species (such as eagles and vultures) are most vulnerable, as they are most capable of bridging critical clearances on the hardware.

10. IMPACT ASSESSMENT

Nine Species of Conservation Concern were recorded during the baseline surveys on or near the proposed MTS site (Martial Eagle, Verreaux's Eagle, Cape Vulture, Blue Crane, Secretarybird, Ludwig's Bustard, Southern Black Korhaan, Denham's Bustard and Kori Bustard).

All nine these species were classed as Priority species because of their higher potential to interact with the identified impacts at this substation site. The proposed MTS and its associated infrastructure could affect the nine Priority species in eight potential ways:

During Construction

- habitat destruction risk (long-term habitat loss);
- risk of disturbance (noise and machinery) and displacement (shorter-term indirect impact).

During Operation

- electrocution of birds on the substation equipment;
- disturbance and displacement of birds during operation;
- disturbance of birds at night caused by lights in the MTS yard;
- risk of powerline collision; and
- risk of electrocution on the powerline structures.

During Decommissioning

- dismantling of the substation and the powerlines.

10.1. Description of the Nine Priority Species

10.1.1. Blue Crane

The Blue Crane is classed as Near-threatened regionally by Taylor *et al*. (2015) and Vulnerable globally (IUCN, 2017). It is almost endemic to South Africa (a small population exists in Namibia) and is our national bird. It has the most restricted range of any of the 15 crane species worldwide. The population is estimated at a minimum of 25,000 birds (Taylor *et al.* 2015). This species is highly susceptible to collision with overhead power lines.

This species was recorded in relative low numbers at both the nearby vantage points (VP8 and 31) during the 14-months of surveys (Figure 6). No large roost sites were recorded but they gather in large flocks of centre-pivot croplands near the proposed site. However, although Blue Cranes were recorded in low prevalence here, the habitat loss of the proposed substation will not affect their foraging area, but the existing and proposed powerlines could place these cranes at risk using the 400kV MTS Site and its surrounds.

10.1.2. Ludwig's Bustard

The Ludwig's Bustard is classified as Vulnerable by Taylor *et al*. (2015) and Near-threatened globally (IUCN 2017) and its population and range has decreased over the last few decades due to habitat destruction and disturbance. The southern African population of this species is estimated at less than 10,000 birds (Allan 2003, in Hockey *et al*. 2005). The arid or semi-arid areas of Eastern Cape, to our knowledge, has a relative moderate abundance.

Ludwig's Bustard could be susceptible to habitat destruction, disturbance, and displacement. This species was often seen near centre-pivot croplands but always on the edge of these sometimes-green areas. We recorded this species at relatively low flight rates at the two vantage points (VP8 and 31) overlooking the proposed MTS

site during the baseline surveys (Figure 5). The habitat at this proposed site is suitable open areas (Karoo shrublands) but the site is relatively small. However, although the habitat loss here will be minimal, the existing and new proposed powerlines around the MTS400 Site and its surrounds could place these bustards at increased risk to collision.

10.1.3. Southern Black Korhaan

This smaller bustard species occurred in high abundance to the north of the proposed MTS site. It forages mainly by walking inconspicuously on the ground, but it displays by making short, low display flights and flapping its wings more rapidly. They seem not to be prone to the powerline conductor collisions (van Rooyen 2004).

At the 400kV MTS Site, however, it is likely that they will be disturbed during the Construction period. Fortunately, they seem to habituate relatively easily to human presence and human-induced transformations such as the 400kV MTS and power lines. However, because of the high abundance of this species here, they could be susceptible to habitat loss at the proposed 400kV MTS Site.

10.1.4. Denham's Bustard

The Denham's Bustard is classified as Vulnerable by Taylor *et al.* (2015) and Near-threatened globally (IUCN 2017) and its population and range has decreased over the last few decades due to habitat destruction and disturbance. Allan and Anderson (2010) considered the Denham's Bustard to be the highest priority amongst bustards for conservation attention, on account of it facing the widest range of known threats. The southern African population of this species is estimated at less than 5,000 birds (Allan 2003, in Hockey *et al*. 2005). In 1984 the Eastern Cape population was estimated at 100-200 birds (Brooke 1984) and there does not appear to be a more recent provincial estimate.

At the 400kV MTS Site, the habitats present are less suited to this species as it prefers coastal grasslands rather than semi-arid Karoo regions of the Eastern Cape, therefore due to its low occurrence at this site, it is unlikely to be affected negatively.

10.1.5. Kori Bustard

This species occurs generally in low abundance and at the 400kV MTS site, very few were recorded during the surveys (Figure 4) and no potential nest sites were noted in that time. Considering the small area of habitat loss,this species will probably avoid the general area during both the construction and operational phases, therefore is likely to be at low risk at the proposed 400kV MTS Site.

10.1.6. Secretarybird

This species occurs generally in low abundance and very few were recorded during the surveys and no potential nest site were noted in that time. Considering the small area of habitat loss this species will probably avoid the general area during both the construction and operational phases, therefore it is likely to be at low risk at the proposed 400kV MTS Site.

10.1.7. Martial eagle

The Martial Eagle is classified as globally Vulnerable and regionally Endangered (Taylor *et al*. 2015, IUCN 2017). Martial Eagle has proven susceptible to collision with wind turbines (Ralston-Paton *et al.* 2017) particularly in close association with nests (MacEwan and Smallie, 2016). This is a wide-ranging species and has many other human-induced threats that could threaten their existence and need every possible protection, especially close to its breeding sites. One breeding site exists 4.6km south of the 400kV MTS Site, so the MTS likely lies on the

fringe of this range. As only a small area of habitat loss will occur and the extent of any displacement around the MTS is likely to be small during both the construction and operational phases, it is likely to be at low risk at the proposed 400kV MTS site.

10.1.8. Verreaux's eagle

The habitat of the wider 400kV MTS Site is not really suited for Verreaux's Eagle and considering the small area of habitat loss, this species will probably avoid the general area during both the construction and operational phases; therefore it is likely to be at low risk at the proposed 400kV MTS Site.

10.1.9. Cape Vulture

Cape vulture was only recorded for three months during the summer season of 2019/20. Whilst during this period large numbers roosted on the 400kV power lines near the proposed 400kV MTS Site and soared over the site often, it is unlikely that the small area of habitat loss will impact on these birds, and it is likely that they will avoid the general area during both the construction and operational phases. However, as this influx of Cape vultures was an uncommon occurrence, probably as a result of the drought in the region which caused high domestic stock losses (and therefore abundant food sources for the vultures), it is assessed to be at low risk at the proposed 400kV MTS Site.

10.2. Assessment of Impacts of the 400kV substation and power lines on Birds

A basic principle of impact assessment is to compare the levels of impacts under current (pre-development) conditions, with those levels anticipated post-development. The relative change in impact levels attributable to the development is the key factor to assess. This principle has been applied throughout this report to the various receptors.

Using the data and risk for each Priority species, the potential impacts of the proposed 400kV substation and associated infrastructure (powerlines) have been formally assessed and rated according to the criteria (supplied by Savannah and shown in Appendix A). The following Tables in this section present these assessments. This includes the additional effects of the Powerline infrastructure on birds for the two approximately 660m lengths of new powerlines (incoming and outgoing) that will be constructed from the 400kB MTS to the existing 400kV Eskom powerline (east of the MTS). Habitat will be lost for the footing areas of the pylons and the service roads. During the operation of these powerlines, birds can get electrocuted on the pylons or collide with the earth-wires/conductors.

Prior to each overall impact table, a species-by-species analysis is presented, rating the risk of each Priority species for that impact and taking into consideration their abundance on the MTS400 Site (Tables 3, 4 and 5) and the vulnerability for that impact.

10.2.1. Habitat loss during Construction

The 36ha of natural veld (Karoo shrubland vegetation) to be cleared is likely to only affect large terrestrial walking birds, including Ludwig's Bustard, Blue Crane, Kori Bustard and Secretarybird, and Southern Black Korhaan. The latter species will probably be affected more due to habitat loss, because of their high abundance in the area north of the site. However, this species appears to habituate relatively easy to low amounts of human activity therefore it should adjust to the substation yard after construction.

Habitat will also be lost for the footing areas of the pylons of the two 660m 400kV powerlines and the service roads. While the habitat will be cleared during the Construction phase, the impact will last through the lifespan of the project. Below is a list of the species with a Low, Medium and High score as their risk to Habitat loss.

Table 7. Priority Species Assessment for Habitat Loss during Construction

Species	Before mitigation	After mitigation
Martial Eagle	Low	Low
Verreaux's Eagle	Low	Low
Cape Vulture	Low	Low
Blue Crane	Low	Low
Ludwig's Bustard	Low	Low
Denham's Bustard	Low	Low
Kori Bustard	Low	Low
Southern Black Korhaan	Medium	Low
Secretarybird	Low	Low

Based on the relatively small area (36ha) to be cleared, habitat destruction will have a LOW overall impact on the birds at the proposed MTS yard (Table 8).

Table 8. Impact Table Habitat destruction during the Construction

Project phase: Construction				
Nature: Displacement of Priority Species due to Habitat loss during the Construction of the 400kV substation (36ha) and footing areas of the pylons of the two 400kV powerlines				
	Without mitigation		**With mitigation**	
Extent	Local	2	Local	2
Duration	Long-term	5	Long-term	4
Magnitude	Medium	4	Low	3
Probability	Probable	4	Probable	3
Significance	**Medium**	**44**	**Low**	27
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Yes		No	
Can impacts be mitigated?	Yes			
Mitigation: - A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat; - Environmental Officers to oversee activities and ensure that the site-specific construction environmental management plan (CEMP) is implemented and enforced; - Existing roads and farm tracks should be used where possible; - The minimum footprint areas of infrastructure should be used, including road widths (two-wheel track) and lengths;				

- One week prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the power line routes, to identify any nests/breeding activity of Priority species, as well as any additional sensitive habitats within which construction activities may need to be excluded. Should priority species nests be located, a protective buffer may be applied, within which construction activities may need to be restricted during the breeding season for that species; - The construction Phase EO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) are to be trained to identify Red Data and priority bird species, as well as their nests. If any nests or breeding locations for this species are located, an avifaunal specialist is to be contacted for further instruction; - Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP.
Residual Impacts: The impact is likely to persist for the operational life-time of the project. Implementation of the proposed mitigation measures should reduce the probability and severity of the impact on priority species to such an extent that the overall significance of residual impact should be reduced to LOW.

10.2.2. Disturbance of birds during construction

During the Construction period all birds are likely to be displaced because of the human activity and machinery on site. The birds will likely return at the completion (see below). Below is a list of the Priority species with a Low, Medium and High score as their risk to Disturbance during Construction.

Table 9. Priority Species Assessment for Disturbance during Construction

Species	Before mitigation	After mitigation
Martial Eagle	Low	Low
Verreaux's Eagle	Low	Low
Cape Vulture	Low	Low
Blue Crane	Medium	Medium
Ludwig's Bustard	Medium	Medium
Denham's Bustard	Low	Low
Kori Bustard	Low	Low
Southern Black Korhaan	Medium	Medium
Secretarybird	Medium	Medium

Based on the severe activity during the construction but considering the temporary construction period (ca. two years), we consider this impact to be at MEDIUM risk for birds at this proposed site (Table 10).

Table 10. Impact Table for the disturbance of birds during construction of the 400kV substation and the powerlines.

Project phase: Construction

Nature: Displacement of priority species due to the disturbance during construction activities of the 400kV substation and the powerlines.				
	Without mitigation		**With mitigation**	
Extent	Local	3	Local	3
Duration	Short-term	2	Short-term	2
Magnitude	Moderate	6	Low	4
Probability	Probable	4	Probable	4
Significance	**Medium**	**44**	**Medium**	36
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Yes		No	
Can impacts be mitigated?	Yes			

Mitigation:

- Any likely breeding sites for key species will be identified during the avifaunal walk through as part of the site-specific EMP. Case specific recommendations on how best to manage the situation can then be developed. These may include timing construction activities at certain towers or sections of line to avoid the species breeding seasons;

- A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat;

- Environmental Officers to oversee activities and ensure that the site-specific construction environmental management plan (CEMP) is implemented and enforced;

Residual Impacts:

It is highly likely that most priority species will be temporarily displaced in the development area during the construction operations, due to the noise and activity, the significance will remain at a MEDIUM level collectively for the priority species after mitigation.

10.2.3. Displacement of birds due to disturbance during operations

The indications from operational substations are that this impact may be of fairly low importance, although it is acknowledged that a longer term or more detailed means of measuring this impact may be required and mitigations made as problems occur in substation yards, hence some bird species would be displaced and others will be attracted by new opportunities.

It is expected during the operation phase of substation that birds will eventually habituate to the running and working of the substation. Although most Priority species will probably avoid the immediate area of the substation yard in the future. Below is a list of the Priority species with a Low, Medium and High score as their risk to Disturbance during Operation.

Table 11. Priority Species Assessment for Disturbance during Operation

Species	Before mitigation	After mitigation
Martial Eagle	Low	Low
Verreaux's Eagle	Low	Low
Cape Vulture	Low	Low
Blue Crane	Low	Low
Ludwig's Bustard	Low	Low
Denham's Bustard	Low	Low
Kori Bustard	Low	Low
Southern Black Korhaan	Medium	Medium
Secretarybird	Low	Low

Based on the above, we consider this impact to be at MEDIUM risk for birds from the proposed 400kV MTS.

Table 12. Impact Table of the disturbance of birds during the operation of the 400kV substation.

Project phase: Operation				
Nature: Displacement of priority species due to disturbance during the operation activities of the 400kV substation.				
	Without mitigation		**With mitigation**	
Extent	Local	2	Local	2
Duration	Permanent	5	Permanent	5
Magnitude	Low	4	Low	3
Probability	Probable	4	Probable	4
Significance	**Medium**	**44**	**Medium**	**40**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Yes		No	
Can impacts be mitigated?	Yes			
Mitigation: - A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how the running of activities must be conducted to reduce unnecessary disturbance to birds; - Environmental manager to oversee activities and ensure that the site-specific operation environmental management plan (OEMP) is implemented and enforced;				
Residual Impacts: Disturbance will remain an impact for the duration of the operational life-time of the facility. However, the overall impact is estimated to be of a MEDIUM significance for the nine Priority species after the implementation of the mitigation measures.				

10.2.4. The electrocution of birds on the 400kV substation equipment

The electrocution of the birds can occur on the substation equipment, such as exposed live parts of transformers and switching equipment but proper engineering design and good staff vigilance and maintenance can prevent such incidents. However, this interaction occurs mainly with commoner species, such as Hadeda Ibis, crows and occasionally Spotted-eagle Owls. Therefore this problem is not likely to affect Species of Conservation Concern. Below is a list of the Priority species with a Low, Medium and High score as their risk to Electrocution on Substation equipment during Operation.

Table 13. Priority Species Assessment for Electrocution on the MTS equipment

Species	Before mitigation	After mitigation
Martial Eagle	Low	Low
Verreaux's Eagle	Low	Low
Cape Vulture	Low	Low
Blue Crane	Low	Low
Ludwig's Bustard	Low	Low
Denham's Bustard	Low	Low
Kori Bustard	Low	Low
Southern Black Korhaan	Low	Low
Secretarybird	Low	Low

Based on the above, we consider this impact to be at LOW risk for birds at this proposed site (Table 14.

Table 14. Impact Table for the electrocution of birds during Operation on the 400kV substation equipment.

Project phase: Operation				
Nature: the potential of the electrocution of birds during the operation of the 400kV substation.				
	Without mitigation		**With mitigation**	
Extent	Local	2	Local	2
Duration	Long-term	5	Long-term	5
Magnitude	Low	3	Minor	2
Probability	Probable	4	Probable	3
Significance	**Medium**	**40**	**Low**	**27**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Yes		No	
Can impacts be mitigated?	Yes			
Mitigation:				

- at commissioning, the substation and power lines would be handed over to Eskom (Transmission). Their daily routine maintenance will detect any potential risk that can pose an electrocution or a flashover. It is recommended that devices to discourage potential perches or roosting sites before the substation is in operation be installed.

- A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce potential problems. However Eskom staff are trained and understand the potential effect of such incidents for a constant power supply. All staff are to adhere to the OEMP and should apply good environmental practice during all operations.

Residual Impacts:

The electrocution risk will persist as long as there are insulators, switching gear outside and accessible or perch-able to birds. Where possible Eskom should monitor and, bird-friendly structures or devices should be used. Highly specialised high voltage construction team will need to comply to extreme safety measures and Compliance Certification. The impact is rated as LOW after the implementation of mitigation measures.

10.2.5. Effect of MTS yard lights on birds

The running and operation of a Substation yard at night requires the use of lights, permanently and temporary, these can influence birds in the wider area of such substation. As explained in the Impact identification section above, these can affect birds on a physiological level. However, this will mainly affect more common species and is not likely to affect Species of Conservation Concern. Because no SCC is likely to roost or even perch in or even near the substation yard, not even at night when the yard lights are on. Below is a list of the Priority species with a Low, Medium and High score to their disturbance to yard lights during Operation.

Table 15. Priority Species Assessment for Artificial Lighting during Operation

Species	Before mitigation	After mitigation
Martial Eagle	Low	Low
Verreaux's Eagle	Low	Low
Cape Vulture	Low	Low
Blue Crane	Low	Low
Ludwig's Bustard	Low	Low
Denham's Bustard	Low	Low
Kori Bustard	Low	Low
Southern Black Korhaan	Medium	Low
Secretarybird	Low	Low

Based on the above, we consider this impact to be at LOW risk for birds at the proposed site (Table 16).

Table 16. Effect of lighting associated with substations on birds.

Impact phase: Operation				
Nature: the potential effect of light associated with substations on birds.				
	Without mitigation		**With mitigation**	
Extent	Local	2	Local	2
Duration	Long-term	5	Long-term	5
Magnitude	Low	4	Minor	2
Probability	Probable	3	Probable	3
Significance	**Medium**	**33**	**Low**	**27**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Yes		No	
Can impacts be mitigated?	Yes			
Mitigation: - Mitigation includes careful planning of the light system (direction, wattage, etc.). All lighting should be down-lighting, not exceeding the lux required for safe operation of the MTS and not illuminating areas more than 2m outside of the boundary fence. These will be specified in the Contractor Tender documents 's as per Eskom specifications.				
Residual Impacts: As described in the Mitigation above, the use of yard lights will be minimised. Some species are likely to habituate to light conditions or use the light conditions to their benefit. Overall, this impact will be a LOW risk for birds at the proposed site after these mitigations are implemented.				

10.2.6. Powerline Electrocution

It is very unlikely that electrocution of birds will occur on the new 400kV powerline structures because distance between insulators is too large, but bird guards need to be fitted on the horizontal member of the structures to restrict large birds such as eagles and vultures defecating over the insulators and causing build-up of whitewash, which can cause flash-overs during wet conditions. Eskom's tender documents will specify all required powerline designs, including safety and operational equipment, insulators lengths, bird guards, etc. Below is a list of the Priority species with a Low, Medium and High score as their risk to Electrocution on powerline structures during Operation.

Table 17. Priority Species Assessment for Electrocution on Powerlines during Operation

Species	Before mitigation	After mitigation
Martial Eagle	Medium	Low
Verreaux's Eagle	Medium	Low
Cape Vulture	Medium	Low
Blue Crane	Low	Low

Species	Before mitigation	After mitigation
Ludwig's Bustard	Low	Low
Denham's Bustard	Low	Low
Kori Bustard	Low	Low
Southern Black Korhaan	Low	Low
Secretarybird	Low	Low

Table 18. Impact Table for the Electrocution of birds on the powerline pylons/structures

Impact phase: Operation				
Nature: Direct mortality of priority species due to electrocution associated with the power line at the wind farm development area.				
	Without mitigation		**With mitigation**	
Extent	Local	2	Local	2
Duration	Permanent	5	Permanent	5
Magnitude	Low	4	Low	3
Probability	Improbable	2	Improbable	2
Significance	**Medium**	**22**	**Low**	20
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Yes		No	
Can impacts be mitigated?	Yes			
Mitigation: - Placement of electrical infrastructure should consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible (a walk-through by an avifaunal specialist); - Any new overhead power lines must be of a design that minimises electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components and possible bird perches (e.g. cross arms) of 1.8m or greater. Each pylon should be fitted with a safe bird perch; and - Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines (Jenkins et al. 2015). This program must include monitoring of overhead power lines.				
Residual Impacts: The potential for an electrocution risk will persist as long as the lines are operational, but it can be effectively eliminated at the onset, if bird-friendly hanging insulators and raptor-protectors pole structures are used. Electrocution of Priority species will be of LOW significance after the implementation of al the required mitigation measures.				

10.2.7. Powerline Collision

Large terrestrial birds are prone to collide with powerlines; however, this risk can be reasonably effectively eliminated with the installation of bird flight diverters while the lines are constructed. Blue crane and Ludwig's Bustard will be especially at risk due to their high abundance at this site, however the distance of the two (incoming and outgoing) powerlines will approximately 600m each therefore very short and unlikely to cause problems. Below is a list of the Priority species with a Low, Medium and High score as their risk to Collision with powerline wires and conductors during Operation.

Table 19. Priority Species Assessment for Collision with Powerlines during Operation

Species	Before mitigation	After mitigation
Martial Eagle	Low	Low
Verreaux's Eagle	Low	Low
Cape Vulture	Low	Low
Blue Crane	High	Medium
Ludwig's Bustard	High	Medium
Denham's Bustard	Low	Low
Kori Bustard	Low	Low
Southern Black Korhaan	Medium	Low
Secretarybird	Low	Low

Based on the above, we consider this impact to be at LOW risk for birds at the proposed site (Table 20).

Table 20. Impact Table for the Collision of birds with powerline earth wires/conductors

Impact phase: Operation				
Nature: Direct mortality of priority species due to collisions with the grid connection power line at the wind farm development area				
	Without mitigation		**With mitigation**	
Extent	Local	2	Local	2
Duration	Permanent	5	Permanent	5
Magnitude	Low	4	Minor	2
Probability	Probable	4	Probable	3
Significance	**Medium**	**44**	**Low**	27
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Yes		No	
Can impacts be mitigated?	Yes			
Mitigation:				

- Placement of electrical infrastructure should consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; - If some spans are to be above ground, where possible place new overhead power lines adjacent to existing power line or linear infrastructure (e.g. roads and fence lines);

- Attach appropriate marking devices or bird flight diverters (BFDs) on all new overhead power lines on the wind farm to increase visibility. The advice of a specialist should be sought regarding the type, placement and spacing of the BFDs to be used and the type of pylon structure to be used; and

- Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines (Jenkins et al. 2015). This program must include monitoring of overhead power lines.

Residual Impacts:

The application of BFDs should greatly reduce the collision impact but will not totally eliminate the risk. The collision risk will be LOW after the implementation of all the required mitigation measure.

10.2.8. Disturbance during the decommissioning phase

Disturbance and displacement of Priority Species during the decommissioning of the substation and the power lines will be short-term and it is likely to have a LOW significant impact on the birds after the implementation of mitigation. Below is a list of the Priority species with a Low, Medium and High score as their risk to the Disturbance during Decommissioning phase.

Table 21. Priority Species Assessment for Disturbance during Decommissioning

Species	Before mitigation	After mitigation
Martial Eagle	Low	Low
Verreaux's Eagle	Low	Low
Cape Vulture	Low	Low
Blue Crane	Medium	Low
Ludwig's Bustard	Medium	Low
Denham's Bustard	Low	Low
Kori Bustard	Low	Low
Southern Black Korhaan	Medium	Low
Secretarybird	Low	Low

Table 22. Disturbance of Priority Species due to Decommissioning of Substation and power lines.

Impact phase: Decommissioning				
Nature: Disturbance and displacement of birds				
	Without mitigation		**With mitigation**	
Extent	Local	3	Local	3

Duration	Short-term	2	Short-term	2
Magnitude	Moderate	6	Low	3
Probability	Probable	3	Probable	3
Significance	**Medium**	**33**	**Low**	**24**
Status (positive or negative)	Negative		Negative	
Reversibility	Yes but it will be temporary			
Irreplaceable loss of resources?	PARTIALLY– Some disturbance is inevitable with the activities associated with decommissioning.			
Can impacts be mitigated?	YES: To some extent,; however, the impact will be negated naturally after the closure phase.			

Mitigation:

- A site specific Environmental Management Plan must be implemented for the decommissioning phase, all equipment and infrastructure should be removed, and the vegetation should be rehabilitated to the original state;

- Environmental Officers to oversee activities and ensure that the site specific EMP is implemented and enforced;

- The appointed Environmental Officer (EO) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species.

The EO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.

Residual Impacts:

The dismantling activities associated with all wind farm infrastructure (substation equipment and powerlines included) could result in the short-term disturbance and displacement of priority species from the site. After the implementation of the proposed mitigation measures it will be of LOW significance for all Priority species.

10.2.9. Cumulative impacts of the proposed facilities on avifauna

The cumulative impact assessment considers the existing impacts of stock farming and habitat transformation in the region and the proposed Choje wind farms with their associated powerlines within the same Block as the 400MTS Site (i.e. the Western Block developments). These proposed developments comprise:

1. the new 400kV substation (this assessment),

2. the new loop-in and loop-out 400kV powerlines (ca. 660m) connecting the substation to the grid (this assessment),

3. the four proposed wind farms (separate assessments),

4. the six new 132kV powerline corridors connecting the renewable energy facilities to the 400kV MTS,

This AIA focusses on the 400kV substation and its two associated ca. 660m powerlines, in combination with the proposed wind farms because it would be almost insignificant, where adding the two solar farms, this cumulative assessment will be large, especially in terms of habitat loss (also see below).

Figure 12 gives a map of the proposed Choje wind farms as well as approved and operational wind farms mostly to the north of the proposed 400kV MTS. Using a 30km radius, the MTS will be the following distances away from the following operational wind farms, Cookhouse 29km north-east, Nojoli 30km north-east, Nxuba 33km north-east, Golden Valley 12.4km east, Amakala Emoyeni 24km east, Msenge Izidiuli 38km north-east and Highlands 37km north-west.

The cumulative habitat loss can be to an extent of 200ha, considering the 36ha for the 400kV MTS, 45.4ha for Aeolus wind farm, 88.2ha for Redding, 30.8ha for Rippon and 48.6ha for Hamlett for the proposed wind farms therefore this impact will be LOW. This impact has a LOW to MEDIUM rating..

The disturbances during the construction will be high and should be done in phases therefore a MEDIUM rating.

During the Operational phase if all infrastructure, including the grid connection power lines are built, it will have to be monitored extensively to quantify the total future impacts. However the impact is rated as MEDIUM when cumulatively assessed.

Species most likely to be affected by the cumulative impacts would be large terrestrial species, Southern Black Korhaan, Blue Crane, Ludwig's Bustard and Secretarybird, while the nearby Martial Eagle nest is 4.6km south of the 400kV substation, in the cumulative aspect, will push these eagles to forage further afield.

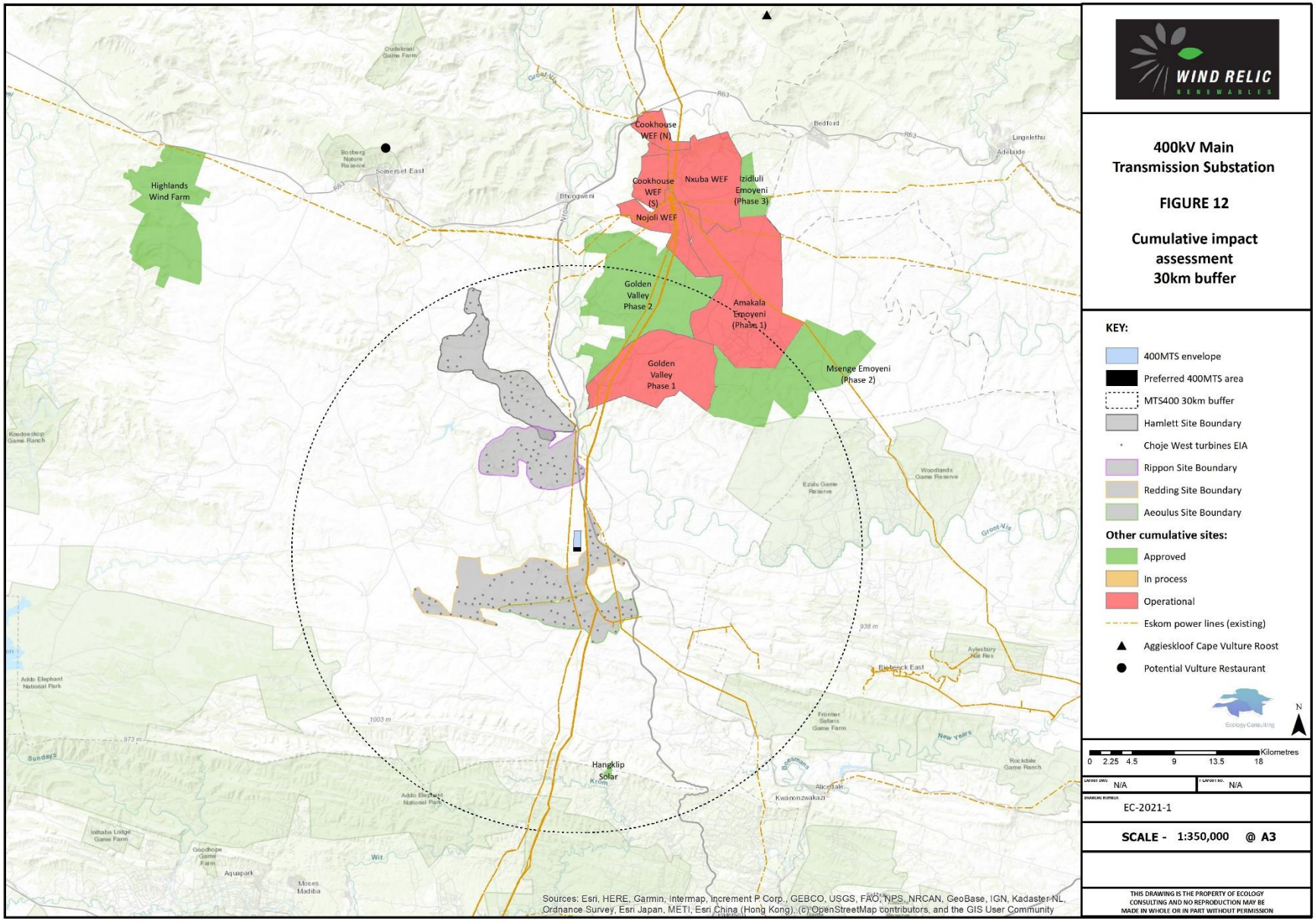
Based on the above, for the cumulative impacts, we consider this impact to be at MEDIUM for birds after the mitigation measures are implemented (Table 23).

Table 23 Cumulative impacts of the proposed facilities on avifauna.

Nature: Cumulative impact on birds from the proposed 400kV MTS, the operational and proposed wind farms and their associated grid connection infrastructure (excluding the habitat loss impact of the future proposed solar farms) in the Choje West energy complex.		
	Overall impact of the proposed project considered in isolation	***Cumulative impact of the project and other projects in the area***
Extent	Local (2)	Region (4)
Duration	Long-term (5)	Long-term (5)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (33)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: All mitigation measures listed above and recommended for other projects listed above must be adhered to.		

The applicant and operational neighbouring projects should proactively collaborate in research and mitigation if incidents involving Priority species occur. Data must be shared, and research efforts co-ordinated to reduce mortalities of Priority Species in the region. The renewable energy projects in the region must fund such research. Mitigation for cumulative impacts warrant a cumulative approach to mitigation to achieve maximum effectiveness. This substation project and the rest of the projects proposed in the Western Block of the Choje Renewable Energy Development Area, the four wind farms and the power lines will affect the birds in the area. Therefore, an opportunity exists to initiate a Stewardship programme by the local environmental groups. We recommend that the companies/wind farm owners should collaborate for the purpose of further research and mitigation into the impacts of wind farms on priority species in the southern Cookhouse area.
Residual Impacts: Although the assessed significance is of MEDIUM significance, if all the mitigation measures proposed for the various renewable projects are strictly implemented, the cumulative impacts of these developments, including the proposed wind farm, can be even more reduced.

In conclusion, Table 24 shows the predicted Cumulative risk categories assigned to each of the nine Species of Conservation Concern for the eight potential impacts if all four wind farms (Hamlett, Rippon, Redding and Aeolus) and the two solar farms are approved and operational, before and after all the recommended mitigation measures are implemented.



WIND RELIC RENEWABLES

400kV Main Transmission Substation

FIGURE 12

Cumulative impact assessment 30km buffer

KEY:

- 400MTS envelope
- Preferred 400MTS area
- MTS400 30km buffer
- Hamlett Site Boundary
- Choje West turbines EIA
- Rippon Site Boundary
- Redding Site Boundary
- Aeoulus Site Boundary

Other cumulative sites:

- Approved
- In process
- Operational
- Eskom power lines (existing)
- Aggieskloof Cape Vulture Roost
- Potential Vulture Restaurant

Ecology Consulting

N

0 2.25 4.5 9 13.5 18 Kilometres

LAYOUT DWG: N/A | LAYOUT NO.: N/A

DRAWING NUMBER: EC-2021-1

SCALE - 1:350,000 @ A3

Table 24. Cumulative risks of the MTS combined with all wind and solar farms on the Priority Species from the potential impacts at the MTS site, before and after mitigation

Species	Construction Phase				Operation Phase									
	Habitat loss		Disturbance		Disturbance		Electrocution on Substation Equipment		Disturbance due to yard lights		Powerline			
											Collision		Electrocution	
	before	after	before	after	before	after	before	after	before	after	before	after	before	after
Martial Eagle	low	low	medium	low	medium	low	low	low	low	low	low	low	medium	low
Verreaux's Eagle	low	low	low	low	low	low	low	low	low	low	low	low	medium	low
Cape Vulture	low	low	low	low	low	low	low	low	low	low	low	low	medium	low
Blue Crane	medium	low	medium	medium	medium	medium	low	low	low	low	high	low	low	low
Ludwig's Bustard	medium	low	Medium	medium	medium	low	low	low	low	low	high	low	low	low
Denham's Bustard	low	low	low	low	low	low	low	low	low	low	low	low	low	low
Kori Bustard	low	low	low	low	low	low	low	low	low	low	low	low	low	low
Southern Black Korhaan	medium	low	medium	medium	medium	medium	low	low	med	low	low	low	low	low
Secretarybird	medium	low	medium	medium	medium	low	low	low	low	low	low	low	low	low

11.RECOMMENDATIONS

The required and recommended measures to mitigate ornithological impacts of the 400kV MTS are set out below, for the Construction and for the Operational Phases of the development.

11.1. Mitigation of the Construction Phase

The developer has committed to the production of a Construction Method Statement that would be agreed with BLSA and other relevant stakeholders before construction commences and would follow industry best practice. Additionally, an Ornithological Mitigation Plan is being developed through consultation with stakeholders to refine and implement the required mitigation measures set out in this assessment (see Appendix F), though this focusses on the wind farm developments that would be likely to have a greater ornithological impact than the MTS.

Designated working areas, storage areas and access routes would be identified at the commencement of the construction phase. The proposed works will be phased so that access tracks/roads are constructed early in the construction programme. Vehicular access would be restricted to designated routes throughout construction and operation, thereby minimising potential disturbance of birds.

Several Priority species potentially vulnerable to construction disturbance were recorded during the surveys, including Verreaux's Eagle, Martial Eagle, Cape Vulture, Blue Crane, Ludwig's Bustard, Southern Black Korhaan and Secretarybird. Whilst the eagles and vultures do not nest in this area, the other Priority species should not be disturbed at any nest site during breeding, particularly during the construction phase of the MTS. Further surveys for these species (i.e. Blue Crane, Ludwig's Bustard, Southern Black Korhaan and Secretarybird). will therefore be undertaken immediately prior to construction if construction were planned for the relevant breeding periods. If any are found, then potentially disturbing activities would be suspended until the breeding had been completed dependent on the location of the birds and the species involved).

It is also possible that Cape Vultures could be disturbed whilst roosting on the power lines near to the site. BLSA (2018) recommends a 5km buffer between construction activity and vulture roosts to avoid the possibility of any disturbance.

Where a disturbance impact on nesting birds is possible, site groundworks will be scheduled to take place where possible outside the breeding period. Where works affecting habitats that could be used by nesting birds must take place during the breeding season, they should only be carried out following an on-site check for nesting birds by an experienced avifauna specialist. If this indicates that no nesting birds are likely to be harmed by the works, then the works can proceed.

If nesting birds are found to be present, work will not take place in that area until the adult birds and young have left the nest. A protection zone will be clearly marked around the nest site to prevent accidental disturbance or damage.

It is proposed to clearly mark the extent of the working area to minimise the risk of machinery encroaching onto adjacent habitat. It is important to protect habitats adjacent to the working area, since they might be used by nesting birds.

11.2. Mitigation of the Operation Phase (to reduce powerline collision and electrocution)

Mitigation of power line impacts will require design measures to ensure that the risk of electrocution is minimised (insulators hanging down from crossbars, rather than pointing upwards, i.e. smaller powerlines), and fitting of new overhead lines in higher risk areas with Bird Flight Diverters to increase visibility and reduce collision risk. This must include all lines within 5km of vulture roosts, 5km from eagle nests and all areas

identified as important for blue crane and bustards (as shown in Figure 10). Existing power lines within these zones must also be retrofitted with bird flight diverters where possible.

Additionally, vulture roost deterrents (Eskom employ 'bird-guards' above the hanging insulators to restrict large birds/vultures perching in these areas on the cross-member, however a newer design of lattice pole-structure replaces the cross-member with a hanging cable that prevents birds perching there) must be fitted to all pylon towers within 5km of the main vulture roosts identified in the baseline surveys (as part of the Ornithological Mitigation Plan - see Appendix F).

11.3. Mitigation of the Decommissioning Phase

In order to ensure that none of the decommissioning effects on the site's ornithological interest are significant, the same mitigation measures must be implemented as for the construction phase of the development.

11.4. Post-construction Monitoring

Ongoing monitoring during and after completion of construction must be undertaken as part of an ornithological management plan, and to inform ornithological mitigation measures through the lifetime of the substation and power lines. Additional baseline data will help better understand the risk at those specific locations and inform the management of those risks. This must follow the BLSA Best Practice Guidelines (Jenkins *et al*. 2015). A detailed post-construction monitoring programme will be an essential and integral part of the mitigation package, to ensure that it both delivers the required results and is managed in the optimal way. This will include, specifically relating to this proposal:

- comprehensive collision checks along overhead powerlines (i.e. the two 660m sections that form part of the MTS400 Site assessment);
- monitoring of key species flight activity in/around the MTS400 Site;
- key species nest site and breeding success;
- large terrestrial bird vehicle transects;
- Cape Vulture roost counts.

The operational phase bird collision monitoring should follow BLSA Best Practice Guidelines (Jenkins *et al*. 2015). The new powerline route should be slowly searched for collisions, taking particular care to search any taller clumps of vegetation, rocks and openings of animal burrows. The precise location of any dead birds found should be recorded and mapped (using GPS). All carcasses should be photographed as found then placed in a plastic bag, labelled as to the location and date, and preserved (refrigerated or frozen) until identified. Feather spots (e.g., a group of feathers attached to skin) and body parts should also be collected. For all casualties found, data recorded should include species, sex, age, date and time collected, location, distance and direction (degrees) to nearest powerlines, condition, and any comments regarding possible causes of death. The condition of each carcass found should be recorded using the following condition categories:

- Intact - carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.
- Scavenged - entire carcass that shows signs of being fed upon by a predator or scavenger or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.).
- Feather Spot - 10 or more feathers at one location indicating predation or scavenging.

A sample of 50 dead birds (e.g. dark-feathered chickens) should be obtained in order to study the rate of carcass removal and to test observer search efficiency, repeated four times annually. These should be placed within the search area at intervals through the study by someone independent of the carcass searcher, at precise recorded locations, and marked appropriately (e.g. with coloured tape) to identify them as experimental birds. They should then be recorded by the observer on all subsequent visits, noting their precise location and condition,

and left in place on site until they disappear. The amount of scavenger activity should inform the survey frequency, but an initial programme of weekly visits is recommended as a starting point.

12. CONCLUSION AND IMPACT STATEMENT

Nine Species of Conservation Concern were recorded during the pre-construction surveys on or near the proposed Substation site (Martial Eagle, Verreaux's Eagle, Cape Vulture, Blue Crane, Secretarybird, Ludwig's Bustard, Southern Black Korhaan, Denham's Bustard and Kori Bustard).

All nine were classed as Priority species for the impact assessment because of their higher potential to interact with the eight identified impacts at this Substation site with its two short (ca. 660m) sections (in and out) of powerlines. Six of these are large terrestrial birds (Blue Crane, Ludwig's Bustard, Denham's Bustard, Kori Bustard, Southern Black Korhaan and Secretarybird) that forage by walking and feeding on the ground, which is mainly in the Karoo bossieveld where the substation and powerlines will be built. Martial eagle, Verreaux's Eagle and Cape Vulture are unlikely to be affected by this Substation development because they are likely to avoid the substation but might perch/roost on the pylons, however is also unlikely because of the close distance to the main gravel road and the operational substation. Precautionary mitigation measures will, though, be implemented in case the vultures do return to the area in the future, including pylon mitigation measures to reduce their attractiveness to roosting vultures.

Southern Black Korhaan is the species that will be most affected as result of the proposed substation development, mainly because of their high density north of the site and habitat loss, but at least the Preferred site is close to a public road and further from these birds' core activity area.

During the Construction phase, Loss of Habitat will have LOW effects on all species, except for Southern Black bustard while disturbance due to the construction will have a MEDIUM effect on all species.

During the Operation phase the disturbance effect was assessed to be MEDIUM, while all other impacts will be LOW, even considering the short stretch of powerlines will be likely to effect Ludwig's Bustard and Blue crane.

The cumulative impacts of the entire Choje West energy complex were judged as a MEDIUM impact.

This proposed project can be approved considering all the recommendations and suggested mitigation are accepted and implemented.

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APPENDICES

Appendix 1 Choje wind farms – Survey Hours for VP surveys – West block Wind farms

Appendix A Impact Assessment Methodology from Savannah

Appendix B Avifaunal Management Plan

Appendix C Declaration of Specialist

Appendix D CV of the Specialist

Appendix E Statement - referring to the commencement of the Wind Relic wind farm projects

APPENDIX 1: CHOJE WIND FARMS (WEST)

SURVEY HOURS FOR VANTAGE POINT SURVEYS – WESTERN BLOCK (HAMLETT, RIPPON, REDDING AND AEOLUS, SUBSTATION AND POWERLINES)

Wind Farm	VP	Jun 2019	Jul	Aug	Sep	Oct	Nov	Dec 2019	Jan 2020	Feb	Mar	Apr	May	Jun	Jul	Aug 2020	TOTAL HRS
Redding	1	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
Redding	2	4	4	4	4	4	4	4	4	4	4	0	4	4	8	8	**64**
Redding	3	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
Redding	4	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
Aeolus	5	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
None	6	4	4	4	4	4	4	4	4	4	8	0	9	4	8	8	**73**
None	7	4	5	4	3	4	4	4	4	4	4	0	8	8	8	8	**71**
Redding	8	4	4	4	4	4	4	4	4	4	7	0	5	4	0	0	**52**
Redding	9	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
None	10	4	4	4	4	4	4	4	4	4	4	0	8	4	0	0	**52**
None	11	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
None	12	4	4	4	4	4	0	0	0	0	4	0	0	0	0	0	**24**
Rippon	13	4	4	4	4	4	4	4	4	4	0	0	8	4	0	0	**48**
Rippon	14	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
Rippon	15	4	4	4	4	4	4	4	4	4	8	0	8	4	8	8	**72**
Hamlett	17	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
Hamlett	18	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
Hamlett	19	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
Hamlett	20	4	4	4	4	3	5	4	4	4	4	0	4	4	0	1	**49**
Hamlett	21	4	4	4	4	4	4	4	4	4	4	0	4	0	4	0	**48**
Hamlett	22	4	4	4	4	4	4	4	4	4	4	0	4	0	4	0	**48**
Aeolus	23	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
Redding	24	4	4	4	4	4	4	4	4	4	8	0	9	4	8	8	**73**
None	25	3	4	4	4	4	4	4	4	4	4	0	4	4	0	1	**48**
None	26	4	4	4	4	4	4	4	4	4	8	0	8	4	8	8	**72**
Redding	27	4	4	4	4	4	4	4	4	4	4	0	4	4	0	0	**48**
Hamlett	28	0	0	0	4	4	4	4	4	4	4	0	4	4	8	8	**52**
Rippon	29	0	0	0	4	4	4	4	4	4	8	0	8	4	8	8	**60**
Rippon	30	0	0	0	4	4	4	4	4	4	4	0	4	4	4	8	**48**
None	31	0	0	0	4	4	4	4	4	4	8	0	9	4	8	9	**62**

Wind Farm	VP	Jun 2019	Jul	Aug	Sep	Oct	Nov	Dec 2019	Jan 2020	Feb	Mar	Apr	May	Jun	Jul	Aug 2020	TOTAL HRS
Aeolus	32	0	0	0	4	4	4	4	4	4	4	0	4	4	8	8	**52**
Aeolus, Redding	33	0	0	0	4	4	4	4	4	4	4	0	4	4	8	8	**52**
None	34	0	0	0	4	4	4	4	4	4	4	0	4	4	8	8	**52**
Hamlett	35	0	0	0	4	4	4	4	4	4	4	0	5	4	8	8	**53**
Aeolus	37	0	0	0	4	4	4	4	4	4	4	0	4	4	8	8	**52**
None	38	0	0	0	4	4	4	4	4	4	4	0	4	4	8	4	**48**
None	39	0	0	0	4	4	4	4	4	4	4	0	4	4	8	8	**52**
Aeolus	40	0	0	0	0	4	4	4	4	4	4	0	4	4	8	8	**48**
Redding	41	0	0	0	0	4	4	4	4	4	4	0	4	4	8	8	**48**
Aeolus, Redding	42	0	0	0	0	4	4	4	4	4	4	0	8	4	8	8	**52**
Hours/mo		*103*	*105*	*104*	*147*	*159*	*157*	*156*	*156*	*156*	*183*	*0*	*201*	*152*	*164*	*159*	*2102*
Aeolus total		*8*	*8*	*8*	*20*	*28*	*28*	*28*	*28*	*28*	*28*	*0*	*32*	*28*	*40*	*40*	*352*
Hamlett total		*24*	*24*	*24*	*32*	*31*	*33*	*32*	*32*	*32*	*32*	*0*	*33*	*24*	*24*	*17*	*394*
Redding total		*32*	*32*	*32*	*36*	*44*	*44*	*44*	*44*	*44*	*51*	*0*	*54*	*44*	*40*	*40*	*581*
Rippon total		*12*	*12*	*12*	*20*	*20*	*20*	*20*	*20*	*20*	*24*	*0*	*32*	*20*	*20*	*24*	*276*

Appendix A - Savannah – Impact Assessment Methodology

Assessment of Impacts

Direct, indirect and cumulative impacts associated with the projects must be assessed in terms of the following criteria:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
  - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - medium-term (5–15 years) – assigned a score of 3;
  - long term (> 15 years) - assigned a score of 4; or
  - permanent - assigned a score of 5;
- The **magnitude**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- the **status**, which will be described as either positive, negative or neutral.
- the degree to which the impact can be reversed.
- the degree to which the impact may cause irreplaceable loss of resources.
- the *degree* to which the impact can be *mitigated.*

The **significance** is calculated by combining the criteria in the following formula:

$$S=(E+D+M)P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Appendix B - AVIFAUNAL MANAGEMENT PLAN

POST-CONSTRUCTION BIRD MONITORING PROGRAMME

The work done to date on the 400kV MTS site has established a baseline understanding of the distribution, abundance and movement of key bird species on and near the site. However this is purely the 'before' baseline and aside from providing input into the micro-siting, it is not very informative until compared to post-construction data. The following programme has therefore been developed to meet these needs. It is recommended that this programme be implemented by the 400kV MTS if constructed.

During construction monitoring

It will be necessary to implement a thorough walk through by a bird specialist after the final layout was marked on the site but before any clearing or construction starts. This will ensure that any breeding birds and their nest are recorded, especially if these are Species of Conservation Concern. These will need to be monitored through the progress of the site construction and if there are nests of SCC, construction need to be delayed until the outcome of such nest is completed. These birds/nests are likely to be large terrestrial birds that breed mainly on the ground, therefore it will not be Martial or Verreaux's eagle nests.

Post-construction monitoring

The intention with post-construction bird monitoring is to repeat as closely as possible the methods and activities used to collect data pre-construction. This work will allow the assessment of the impacts of the proposed facility and the development of active and passive mitigation measures that can be implemented in the future where necessary.

One very important additional component needs to be added, namely mortality estimates through carcass searches in the substation yard and under the associated powerlines. The following programme has therefore been developed to meet these needs, and should start as soon as possible after the operation of the MTS (not later than 3 months):

Note that this framework is an interim draft. The most up to date version of the best practice guidelines (Jenkins et al 2015) should inform the programme design at the time.

Live bird monitoring:

» The two Walking transect surveys of 400m each that have been done during pre-construction monitoring should be continued.

» The Road transect surveys should be continued and conducted twice on each site visit.

» The Focal points that were surveyed along the Road transect route need to be continued. If any sensitive species are found breeding on site in future, these nest sites should be defined as focal sites.

» The two Vantage Point surveys (VP2 and 31) already established, should be used to continue data collection for the post-construction. The exact positioning of these may need to be refined based on the presence of new substation, powerlines and roads. A total of 12 hours of observation should be conducted at each vantage point on each site visit, resulting in a total of 48 hours direct observation on site per site visit.

Bird Fatality estimates

This is now an accepted component of the post construction monitoring program and the newest guidelines (Jenkins et al, 2015) will be used to design the monitoring program. It is important that in addition to searching for carcasses under turbines, an estimate of the detection (the success rate that monitors achieve in finding carcasses) and scavenging rates (the rate at which carcasses are removed and hence not available for detection) is also obtained (Jenkins et al, 2015). Both of these aspects can be measured using a sample of carcasses of birds placed out in the field randomly. The rate at which these carcasses are detected and the rate at which they decay or are removed by scavengers should also be measured.

Operational staff should be trained according to a protocol. The area surrounding and inside the substation and associated powerlines should be searched for collision victims. The frequency at which these searches

need to be conducted will be at least every 10 working days (or effective two weeks). Any suspected collision casualty should be comprehensively documented (for more detail see Jenkins et al, 2015). A team of carcass searchers will need to be employed and these carcass searchers will work on site every day searching the turbines for mortalities. It is also important that associated infrastructure such as power lines and wind masts be searched for collision victims according to similar methods.

A more detailed postconstruction monitoring programme can be designed once the full layout is finalised. The most up to date version of the best practice guidelines (Jenkins et al, 2015) should inform the programme design at the time.

A Cumulative ORNITHOLOGICAL MITIGATION PLAN AND METHOD STATEMENT for the Choje energy complex

The purpose of this document is to set out a framework to develop and agree mitigation measures and their implementation for the Choje wind farm cluster with stakeholders, including BirdLife South Africa, EWT and Vulpro. It is a working document that will be updated as the mitigation plan is developed. The mitigation package will be implemented to ensure that all of the Choje wind farms, alone and in-combination, do not result in any significant ornithological impacts. Implementation of these measures is considered to be a prerequisite for a positive Environmental Authorisation.

The ornithological assessments for these six wind farms have identified a range of key species of conservation concern that could be at risk from the developments, including:

- Martial Eagle
- Verreaux's Eagle
- Cape Vulture
- Secretarybird
- Blue Crane
- Ludwig's Bustard

The following potential impacts have been identified that could adversely affect these species:

- Collision with wind turbines
- Collision with overhead powerlines
- Electrocution on overhead powerlines
- Disturbance during operation
- Disturbance during construction/decommissioning
- Habitat loss through construction

The Mitigation Hierarchy is being followed during the development design process, sequentially reducing impacts through a process of avoidance, minimisation, mitigation, compensation and enhancement measures (CIEEM 2018).

Design Mitigation – Avoidance

Ornithological baseline data have been used to establish the optimal extent of turbine-free buffers around the most important centres of flight activity around key species' nest and roost sites, where flight activity was significantly higher than over the site as a whole.

- Verreaux's Eagle – 1.5km from nest sites (in line with BLSA recommended minimum buffer)
- Martial Eagle – 2.5km from nest sites
- Cape Vulture – 2km from main roost sites

These buffers were defined using the baseline survey data and spatial modelling of the key species' habitat preferences and flight densities in relation to distance from the nest (Verreaux's and Martial Eagle) and roost sites (Cape Vulture). Martial Eagle flight density was strongly related to distance from the nest, with the highest densities recorded within 500m and a steady decline in flight density up to 2.5km from the nest but beyond 2.5km flight density was consistently lower. This provided strong evidence to support a 2.5km turbine exclusion zone around Martial Eagle nests, as flight activity is clearly considerably higher within that zone. Any exclusion of turbines beyond 2.5km would be of much less benefit in reducing collision risk.

For Verreaux's Eagle, a buffer zone of 1.5km from nests was applied, in line with BLSA guidance, BLSA 2017). The baseline data showed flight activity within the 1.5-3km zone around nests was not higher than that at greater distance from the nest, so extending a turbine-free buffer to 3km would not be likely to deliver any significant reduction in collision risk.

Cape Vultures did not breed within the survey area, so their flight distribution was not associated with any nest sites, but they were strongly associated with their night roost sites (with higher flight densities within 2km of the roosts). This distance was therefore applied as a buffer zone.

Design Mitigation – Minimisation

Amber caution zones have been identified around locations where turbines have been minimised, and where mitigation measures would need specific focus:

- Verreaux's Eagle – 1.5-3km around nest sites
- Martial Eagle – 2.5-5km around nest sites
- Large terrestrial birds (blue crane and bustards) higher density areas[2]

PROPOSED ORNITHOLOGICAL MITIGATION PACKAGE

Mitigation of the Construction Phase

The developer has committed to the production of a Construction Method Statement that would be agreed with BLSA and other relevant stakeholders before construction commences and would follow industry best practice.

Designated working areas, storage areas and access routes would be identified at the commencement of the construction phase. The proposed works will be phased so that access tracks are constructed early in the construction programme. Vehicular access would be restricted to designated routes throughout construction and operation as far as possible, thereby minimising potential disturbance of birds.

Several key species potentially vulnerable to construction disturbance were recorded during the surveys, including Verreaux's Eagle, Martial Eagle, Blue Crane and Secretarybird. These should not be disturbed at the nest site during breeding, particularly during the construction phase of the wind farm. Further surveys for these will therefore be undertaken immediately prior to construction if construction were planned for the relevant breeding periods. If any were found then potentially disturbing activities would be suspended until the breeding had been completed within an appropriate zone (dependent on the location of the birds and the species involved, to be agreed with BLSA). This would form part of a Breeding Bird Protection Plan.

Where a disturbance impact on nesting birds is possible, site ground works (i.e. laying of site tracks, laying out of the temporary construction compound and excavation of the turbine foundations and footings for the substation and meteorological mast) will be scheduled to take place where possible outside the breeding

[2] Areas of higher importance for cranes and bustards were identified from the 90% utilisation range of the blue crane and Ludwig's bustard, using kernel density estimation (Worton 1989), checked against the records from the other large crane and bustard species to ensure all important area were included.

period. Where works affecting habitats that could be used by nesting birds must take place during the breeding season, they will only be carried out following an on-site check for nesting birds by an experienced ecologist. If this indicates that no nesting birds are likely to be harmed by the works, then the works will proceed.

If nesting birds are found to be present, work will not take place in that area until the adult birds and young have left the nest. A protection zone will be clearly marked around the nest site to prevent accidental disturbance or damage.

It is proposed to clearly mark the extent of the working area to minimise the risk of machinery encroaching onto adjacent habitat. It is important to protect habitats adjacent to the working area, since they might be used by nesting birds.

Operational Phase Mitigation

Cape Vulture Collision Risk Reduction

1. Removal of suitable roost sites

Currently a string of powerline towers provides attractive roost sites for the vultures within the Choje West area, enabling them to access areas that otherwise they may not use (in the absence of natural cliff roost sites). These measures will reduce the availability of those artificial roost sites, through the fitting of anti-vulture perching measures on pylons, measures that are a proven and well-established management measure in South Africa. It is proposed that these should be fitted to all pylon towers within 5km of the proposed wind turbine locations.

2. Removal of vulture food resources within wind farm properties

A detailed carrion search management plan will be implemented for all farms associated within the wind and solar developments. This will involve weekly checks of all properties for dead stock animals, and removal of any carcasses located.

General Collision Risk Reduction

1. Increase turbine blade visibility

Recent trials of increasing blade visibility by painting one of the three turbine blades black have been successful in reducing collision risk to white-tailed eagles in Norway, a species that is known to be particularly vulnerable to collision (May *et al.* 2020). Collision risk to this species was reduced by 70%.

It is proposed that this mitigation measure will be initially trialled on turbines located in more sensitive areas, i.e. those within the amber zones defined above. Additionally, the trial will also include turbines within 5km of main vulture roosts. All these will have single black blades fitted during construction.

As this is a trial deployment, it will be monitored in detail to determine effects on bird behaviour and efficacy as a mitigation measure at this site.

2. Reduce overhead line collision risk

Bird flight diverters will be fitted onto all new 132kV and 400kV overhead lines within the project development footprint, in line with the measures recommended in the Eskom/EWT Wildlife and Energy partnership. Opportunities will also be identified where the same measures can also be retrofitted to existing overhead lines in areas with higher densities of species at risk of collision.

3. On-site Habitat Management

The raptor food resource must not become more attractive within the wind farm site, drawing foraging birds into the site, as this would increase collision risk. For instance, during access track construction, there may be periods of time where imported or excavated aggregate is stockpiled forming potentially attractive habitat for Rock Hyrax. During construction of the wind farm all mounds of aggregate or rocks which could serve as hyrax habitat will be removed prior to the commencement of operation of the turbines and through

the operational phase of the wind farm. In addition, the proposed turbine bases should not serve as a refuge for small mammals, and thus the turbines themselves will not create attractive habitat for potential prey species such a hyrax.

4. Off-site Habitat Management

A management programme will be implemented to enhance the food resources away from the wind farms, to reduce eagle flight activity within those wind farms. Management measures that could improve raptor prey populations and habitat over a large area that, if managed appropriately, could deliver a net gain to the local raptor populations. A specific management plan will be drawn up and implemented to integrate the ecological requirements of the local raptors into the management of this area. Range management plans will be developed for each Verreaux's Eagle and Martial Eagle range that could be affected by the developments, which will include measures to offset losses of existing range habitat through disturbance and direct loss to the developments. Measures to enhance local crane and bustard populations will also be implemented.

Collision Risk Management: Shutdown-on-Demand

As a further backup to ensure significant numbers of bird collisions do not occur at the site, a Shut-Down-On-Demand (SDOD) programme will be implemented for all six wind farms.

The initial focus of this work wil be the higher risk areas, i.e. the amber buffer zones for Verreaux's and Martial Eagles (1.5-3km and 2.5-5km respectively), 2-5km buffer around Cape Vulture roosts, and the large terrestrial bird (blue crane and bustard) higher sensitivity areas.

This would then be extended as necessary over the site in an adaptive management programme, informed by the results of a collision monitoring programme.

Shutdown-on-demand is a proven method to reduce collision risk (BirdLife 2015). SDOD is currently being implemented in South Africa, for example at the Excelsior wind farm.

The base case for a SDOD scheme at Choje would be one using field observers to manually shut down turbines when 'at risk' flights of key species were identified.

Technology-assisted systems would also be investigated to develop the system further. Radar-based and camera imaging systems have both been shown to be effective (BirdLife 2015). Some systems are now fully automated, and have been successfully deployed, reducing eagle collision risk by 82% (McClure et al. 2020).

A successful SDOD system will need clear shutdown criteria. An initial precautionary approach is proposed, such that whenever any key species was seen within 500m of a wind turbine, at risk height, that turbine would be shut down until the bird had passed out of the risk zone. This process would be refined as more knowledge from the site was built up of the risk factors. And how best to manage these. It will initially include all key species, i.e. all species listed above, though this will be reviewed in light of the results of the system in operation.

Security of Mitigation

It is critically important that the delivery of the required mitigation package is guaranteed. It is proposed that this should be achieved through condition of consent but also through legal commitment for delivery. The mitigation package will be set out in a legally binding method statement when the measures are finalised, with the aim to achieve net zero loss of priority species through these innovative solutions and collaboration with stakeholders (including BLSA, EWT, and University research departments/institutes).

Measures to avoid construction disturbance

The implementation of turbine-free buffers in the areas of highest ornithological sensitivity means that specific measures to protect these areas from disturbance during construction should not be necessary (as those areas are already sufficiently buffered from disturbance). However, a watching brief will be

maintained in case there are any changes that could result in any construction disturbance to nesting bird or bustard leks.

Monitoring of Mitigation Effectiveness and Ornithological Impacts

A detailed post-construction monitoring programme will be an essential and integral part of the mitigation package, to ensure that it both delivers the required results and is managed in the optimal way. This will include:

- comprehensive collision checks (on at least a weekly basis for an agreed sample of at least 25% of turbines, including all those within amber zones);
- monitoring of key species flight activity in/around the wind farm;
- key species nest site and breeding success;
- large terrestrial bird vehicle transects;
- Cape vulture roost counts;
- Monitoring of flight behaviour in relation to single black blade painting;
- Effectiveness of SDOD, including recording of near-misses and 'false positive' shutdown events;
- Monitoring of effectiveness of habitat management measures;
- Detailed tracking of key species, with specific tracking programmes tusing appropriate technology (e.g. fitting of GPS tags) to better understand flight behaviour in proximity to wind turbines, and also to test and develop the spatial modelling undertaken as part of the baseline assessment work.

References

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Worton, B. 1989. Kernel methods for estimating the utilization distribution in home-range studies. Ecology 70:164–8.

Appendix C – the Specialist's Declaration

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Proposed 400kV Main Transmission Substation development, south of Cookhouse, in the Blue Crane Route Local Municipality, Eastern Cape

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	East Cape Diverse Consultants			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	1	Percentage Procurement recognition	20
Specialist name:	Adri Barkhuysen			
Specialist Qualifications:	MSc			
Professional affiliation/registration:	Pr.Nat.Sc. 400/350/13			
Physical address:	34 Scanlen Street, Mount Croix, Port Elizabeth			
Postal address:	As above			
Postal code:	6001	Cell:	082 630 2448	
Telephone:	041-373 2047	Fax:	n/a	
E-mail:	adriba@telkomsa.net			

2. DECLARATION BY THE SPECIALIST

I, __Adri Barkhuysen_____, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

East Cape Diverse Consultants

Name of Company:

1 Dec 2020

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Adri Barkhuysen swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

East Cape Diverse Consultants

Name of Company

1 Dec 2020

Date

7180532 CM n. Compher

Signature of the Commissioner of Oaths

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
GEMEENSKAPSDIENS SENTRUM
2020 -12- 01
STATION COMMANDER
MOUNT ROAD
SUID-AFRIKAANSE POLISIEDIENS

2020/12/01.

Date

Appendix D – the Specialist's CV

Curriculum Vitae

Adri Barkhuysen

Date of Birth: 1 December 1959

Specialist Field: Avifauna
Consultant: Environmental Assessment Practitioner

Professional Natural Scientist: *Pr. Sci. Nat. (400350/13)*

Contact Details:
34 Scanlen Street, Mount Croix, Port Elizabeth 6001 Email: adriba@telkomsa.net
Tel: 041-373 2047 Fax: 041-991 0551 Cell: 082 630 2448

QUALIIFICATIONS
MSc (Zoology) – University of Port Elizabeth – 2000-2002
MSc thesis - evaluate and compare the prey/food availability of eagles and large terrestrial birds that are prone to power line interactions – electrocutions and collisions - between transformed and untransformed habitats in a Karoo landscape near Somerset-East.

BSc Honours in Zoology – Potchefstroom University – 1998-1999
BSc Zoology and Botany – Unisa (part-time) 1990-1996

RELEVANT WORK EXPERIENCE

- 1994-2002: Volunteer Raptor Conservation Group of the Endangered Wildlife Trust (EWT).
- 2002-2010: Field biologist with EWT in the Eastern Cape. Duties included: eagle/farmer conflict resolution, surveying and monitoring breeding success of Cape vulture for the Vulture Study Group and Black eagle for the Raptor Conservation Group.

Project Coordinator of the Birds of Prey Working Group and Oribi Working Group for EWT in the Eastern Cape, which included various Oribi translocation initiatives to reintroduce Oribi into areas where it disappeared from.

- Since August 2010 to present: Environmental Consultant and bird specialist for East Cape Diverse Consultants.

BUSINESS PROFILE:

I am the Director and owner of East Cape Diverse Consultants CC (ECDC) since August 2010. The business provides a professional environmental consulting service to a wide variety of clients while I conduct regular assessments and studies as an avifauna specialist.
The income of ECDC is mainly generated from the cellular industry, as environmental assessment practitioner to obtain environmental authorization from competent authorities for projects that require basic assessment and EIA reports. But we supply services in the agricultural, power line and wind farm sectors.

CLIENTS:
Industry:

- Eskom Distribution Division - power line
- Eskom Transmission Division - power line
- Cellular - Vodacom, MTN, CellC and Telkom 8Ta

- Cellular – American Tower Company, Atlas Tower, Eaten Towers, BJB Project Services, Senzile Infrastructure Consultants, Analytics Hive.
- Wind farm - Newcombe Wind Developments and Woodlands Trust

Consultants:

- Bohlweki Environmental
- Royal HaskoningDHV
- JAH Environmental Consulting
- SKR Consulting
- Environmental CEN
- Wild Skies Ecological Services
- Ecology Consulting in the UK
- Phila Environmental Services

Our cellular clients and work include Vodacom, MTN, CellC, American Tower Company (ATC) and Telkom/8-ta, with projects in the Eastern Cape (and in the former Transkei region), KwaZulu-Natal (Zululand and Midlands) and Western Cape (south Cape region). These include the public participation process and visual impact assessments.

The agricultural work include, impact assessments for environmental authorization for a variety of projects, including:

- Centre-pivot irrigation development – dairy farming;
- Extension to Feathers Egg laying plant - poultry farming;
- Road and fire break – timber plantation;
- Culvert river crossing and soil erosion/stabilizing – dairy farming;
- Bush clearing – citrus farming;
- Charcoal/Briquette plant/factory

A variety of works, acting as Environmental Control Officer were completed, mainly for the construction of cellular towers.

Section 24G applications for non-compliance of NEMA environmental regulations by farmers/landowners. This sector of work was based in the Eastern and Western Cape Provinces.
An application for Sand Mining permits in the former Transkei to the Department of Minerals Resources.
Water Use Licence Applications for landowners/clients to the Department Water and Sanitation in the Cacadu district region.
Secondly, my work as avifauna specialist, include conducting bird field studies and bird impact assessments for the wind farm industry, Eskom power lines, universities, environmental organisations and environmental consultants in the private sector.

Bird studies include:

- Bird Impact assessment desktop study for scoping report - for the proposed 400kV Eskom power line from Grassridge near Port Elizabeth to Poseidon substation near Bedford – for Bohlweki Environmental;
- Bird habitat assessment report for the existing 132kV Eskom power line to fit bird flight diverters from Grassridge to Humansdorp – for Royal HaskoningDHV;
- avifauna pre-construction monitoring for proposed wind farms;
    - Spitskop WEF near Riebeeck-East - for JAH Environmental Consulting.
    - Banna Ba Pifhu WEF near Humansdorp – for Woodlands Trust.
    - Roodeplaat WEF near Uitenhage – for Newcombe Wind Developments.

- Bird Impact Assessment report for proposed wind powered generation facilities
    - Spitskop near Riebeech-East with JAH Environmental Consulting
    - Banna Ba Pifhu WEF near Humansdorp – for Woodlands Trust.

- Black eagle nest surveys and monitoring between Uitenhage and Steytlerville during 2003 to 2007 for EWT;
- African Barred owl surveying project in the Albany district and in the former Transkei – 2007-2009 for EWT;
- Bird study - Jacobin cuckoo / Cape bulbul brood parasite field study at NMMU Reserve, Port Elizabeth - for Prof Oliver Kruger, Bielefeldt University, Germany;
- Monitoring of Cape vulture roosting and breeding colonies in the former Transkei 2006-2007 - for Dr Andre Boshoff of Nelson Mandela Metropolitan University;
- Bird Impact Assessment for the proposed Wing Park airstrip development EIA near Port Elizabeth - 2014;
- Large eagle nests and breeding success surveys and monitoring for Wild Skies Ecological services – 2013;
- Black eagle, African Crowned eagle and Martial eagle nest searching surveys and monitoring for the continuation of the EIA process of the proposed Roodeplaat WEF - 2015-2018;
- Avifauna baseline assessment and a year pre-construction monitoring: for Transnet Manganese Export Terminal in the Coega IDZ and Port of Ngqura – Phila Environmental Services 2015-2016.

Other bird related work:
Professional assistance to American, Bill Clark, an author of a book on African birds of prey – 2007
Consultant for Birding EcoTours Chris Lotz – African Barred owl research and exploring – 2007-2009
Professional assistance to Marie-Sophie Garcia-Heras and Dr Rob Simmons from UCT on Black harrier research for her PhD - 2014
Professional assistance to Gareth Tate from UCT on Black sparrowhawk research for his PhD - 2014
Consultant for the Wildlife film makers – Talking Picture Films - 2003-2005 and Home Brew Films - 2016-2017
Professional assistance to Dr Guy Castley of the Griffith University, Australia with forest bird surveys and monitoring - 2017

Collaborations:
In the successful operation of our business, we employ the serves of many professional scientists to conduct specialist studies, e.g. wetland ecologist Dr Brian Colloty, ecologist Jesse Jegles, plant specialist Dr Marietjie Landman, Jamie Pote, archeological Dr Billy de Klerk, Dr Celeste Booth, paleontological Dr Johan Binneman, Dr Francois du Rand, historians Gerrie Horn, etc. which broadens our understanding of sensitive sites or issues under assessment.

Other Environmental work:
Consultations with a variety of clients in the industrial/commercial sector for potential and future developments such as a hydroponic establishment, coal-driven electric generators, charcoal/briquette plant, poultry farming, fruit juice extraction plant, bird pest control, waste water analysis for a house hold chemical manufacturer, etc.
I am still regularly consulted on eagle/farmer conflict resolutions.

Appendix D – the Specialist's CV

East Cape
DIVERSE
CONSULTANTS
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6001
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Cell: 082 630 2448
CC 2006 / 039496 / 23

Date: 26 July 2021

To whom it may concern

RE: Statement to Avifaunal Impact Assessments of Wind Relic wind farms

Adri Barkhuysen (East Cape Diverse Consultants) and Steve Percival (Ecology Consulting) were appointed by Savannah Environmental (Pty) Ltd to prepare an Avifaunal Impact Assessment report for the Wind Relic wind farm projects, in the Makana and Blue Crane Route Local Municipalities, Eastern Cape. The project site is located within the Cookhouse Renewable Energy Development Zone (REDZ). Due to the location of the project site within the REDZ, a Basic Assessment (BA) process is being pursued.

The pre-construction bird monitoring field work started in June 2019 and ended in August 2020 (14months) and followed the requirements of Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6 and also using the BirdLife South Africa (BLSA) guidance, and South African best practice (Jenkins et al. 2015) and international best practice (Scottish Natural Heritage 2017).

Consultations with Savannah started in January 2020 and in March 2020 we received the requirements prescribed by Government Gazette 43110 (Published in Government Notice No. 320) of 20 March 2020 "Protocol for The Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Avifaunal Species by Onshore Wind Energy Generation Facilities where the electricity output is 20 Megawatts or more".

Therefore, this Notice was not available to us during the design and planning stage before the bird study.

Sincerely

Adri Barkhuysen

082 630 2448