AVIFAUNAL IMPACT ASSESSMENT

Camden I Wind Energy Facility, Grid Connection and Battery Storage Facility

Mpumalanga Province

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EXECUTIVE SUMMARY

1 BACKGROUND

The proposed Camden Renewable Energy Complex (the 'Complex') is being developed by ENERTRAG South Africa (Pty) Ltd ("ENERTRAG" or "Developer") in the context of the Department of Mineral Resources and Energy's (DMRE) Integrated Resource Plan, and the Renewable Energy Independent Power Producer Procurement Programme (REIPPP).

The Complex can be divided into eight (8) Projects, namely:

- Camden I Wind Energy Facility (up to 200MW).
- Camden I Wind Grid Connection (up to 132kV).
- Camden up to 400kV Gid Connection and Collector substation.
- Camden I Solar up to 100MW.
- Camden I Solar up to 132kV Gid Connection.
- Camden Green Hydrogen and Ammonia Facility, including grid connection infrastructure and water pipeline.
- Camden II Wind Energy Facility (up to 200MW).
- Camden II Wind Energy Facility up to 132kV Grid Connection.

<u>This impact report deals with the Camden I Wind Energy Facility (WEF), Battery Energy Storage System (BESS) and 132kV grid connection.</u>

2 AVIFAUNA

The SABAP2 data indicates that a total of 234 bird species could potentially occur within the broader area – Appendix 1 provides a comprehensive list of all the species. Of these, 37 species are classified as wind priority species and 78 as powerline sensitive species. Of the 37 wind priority species, 16 are South African Red List species, and of the 78 powerline sensitive species, 15 are South African Red List species. Of the wind priority species, 25 are likely to occur regularly in the development area, and 55 powerline sensitive species are likely to occur regularly in the project area.

3 SUMMARY AND CONCLUSION

3.1 Wind Energy Facility

The proposed Camden 1 WEF will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the construction phase.
- Collision mortality caused by the wind turbines in the operational phase.
- Electrocution on the medium voltage overhead lines in the operational phase.
- Collisions with the medium voltage overhead lines in the operational phase.
- Displacement due to disturbance linked to dismantling activities in the decommissioning phase.

3.1.1 Displacement of priority species due to disturbance linked to construction activities in the construction phase

It is inevitable that a measure of displacement will take place at the WEF for all priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species in the remaining high-quality grassland, wetlands and wetland fringes the most, as this could temporarily disrupt their reproductive cycle. Some species might be able to recolonise the area after the completion of the construction phase, but for some species, this might only be partially the case, resulting in lower densities than before once the WEFs are operational, due to the disturbance factor of the operational turbines, and the habitat fragmentation. In summary, the following species could be impacted by disturbance during the construction phase African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Spotted Eagle-Owl and White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and will be reduced but remain at a **moderate** level post-mitigation.

3.1.2 Displacement of priority species due to habitat transformation in the construction phase

The network of existing roads at the WEF has likely resulted in significant habitat fragmentation. This, together with the disturbance factor of the operating turbines, could have an effect on the density of several species, particularly larger terrestrial species and owls which would utilise the remaining high-quality grassland, wetlands and wetland fringes as breeding habitat. Given the conceptual turbine layout and associated road infra-structure, it is not expected that any priority species will be permanently displaced from the development site, but densities may be reduced. In summary, the following species are likely to be most affected by habitat transformation: African Grass Owl, Black-bellied Bustard, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Secretarybird and White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and will be reduced but remain at a **moderate** level post-mitigation.

3.1.3 Collision mortality of priority species caused by the wind turbines in the operational phase

The proposed Camden 1 Wind Energy Facility will pose a collision risk to several priority species which could occur regularly at the site. Species exposed to this risk are large terrestrial species and occasional long distance fliers i.e., bustards, cranes, flamingos, storks, Southern Bald Ibis and Secretarybird, although bustards and cranes generally seem to be not as vulnerable to turbine collisions as was originally anticipated (Ralston-Paton & Camagu 2019). Soaring priority species, i.e., species such as Cape Vulture and a variety of raptors, including several species of eagles, are highly vulnerable to the risk of collisions. The following priority species could be at risk of collisions with the turbines: Common Buzzard, Jackal Buzzard, Blue Crane, Brown Snake Eagle, Black-chested Snake Eagle, Long-crested Eagle, Martial Eagle, Peregrine Falcon, Lanner Falcon, Greater Flamingo, Lesser Flamingo, Montagu's Harrier, African Marsh Harrier, Black Harrier, African Harrier-Hawk, Cape Vulture, Secretarybird, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Wattled Crane, Grey Crowned Crane, African Fish Eagle, Spotted Eagle-Owl, Amur Falcon, Grey-winged Francolin, Southern Bald Ibis, Black-winged Kite, Northern Black Korhaan, Blue Korhaan, Black-winged Lapwing, Western Osprey, Marsh Owl, African Grass Owl, Black Sparrowhawk and White Stork. The impact is rated as **moderate** pre-mitigation but should be reduced to a **low** level post-mitigation.

3.1.4 Electrocution of priority species on the medium voltage overhead lines (if any) in the operational phase

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the electrical infrastructure could potentially pose an electrocution risk to several power line sensitive species that could on occasion perch on these poles. In summary, the following priority species are potentially vulnerable to electrocution in this manner: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite. The impact is rated as **moderate** pre-mitigation but should be reduced to a **low** level post-mitigation.

3.1.5 Collisions of priority species with the medium voltage overhead lines (if any) in the operational phase

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. These spans could pose a collision risk to virtually all powerline sensitive avifauna, depending on where those spans are located. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, Yellow-billed Duck. The impact is rated as **moderate** pre-mitigation but should be reduced to a **low** level post-mitigation.

3.1.6 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase

The impact is likely to be similar in nature and extent to the construction phase of the proposed WEF. The impact is rated as **medium** pre-mitigation and it will decrease to **low** post-mitigation.

3.2 Battery Energy Storage Facility (BESS)

The impact that is associated with the construction of the BESS is the potential displacement of priority avifauna due to disturbance associated with the construction and dismantling of the facility and habitat transformation in the footprint of the facility.

3.2.1 Displacement due to disturbance associated with the construction of the facility

Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be challenging to implement. The priority species which are potentially most vulnerable to the impact of displacement due to disturbance linked to the BESS are terrestrial species and owls. Priority species that could be most affected are the following: African Grass Owl, Black-bellied Bustard, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Secretarybird and White-bellied Bustard. The impact is rated as **low** pre- and post-mitigation.

3.2.2 Displacement due to habitat transformation associated with the construction of the facility

These construction activities will impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the 5ha proposed facility is likely to be relatively insignificant due to the relatively small size of the footprint (only 0.07% of the total project area, and 2.5% of the buildable area). The impact is rated as **low** pre-mitigation and it will decrease to **very low** post-mitigation.

3.2.3 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase

The impact is likely to be similar in nature and extent to the construction phase of the proposed BESS. The impact is rated as **low** pre-mitigation and it will decrease to **very low** post-mitigation.

3.3 The up to 132kV OHL

The following potential impacts on powerline sensitive avifauna are associated with the construction and operation of the up to 132kV grid connection related to the Wind Energy Facility:

- Displacement due to disturbance associated with the construction of the proposed OHL and on-site substation.
- Displacement due to habitat transformation associated with the construction of the proposed OHL and on-site substation.
- Mortality due to electrocution on the proposed OHL infrastructure
- Mortality due to electrocution on the electrical infrastructure within the proposed on-site substation.
- Mortality due to collisions with the proposed OHL.
- Displacement due to disturbance associated with the dismantling of the proposed OHL and on-site substation.

3.3.1 Displacement due to disturbance associated with the construction of the proposed OHL and on-site substation.

Construction activities could impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although this is often impractical to implement due to tight construction schedules. Powerline sensitive species which are potentially most vulnerable to displacement due to disturbance are mostly ground nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

3.3.2 Displacement due to habitat transformation associated with the construction of the proposed OHL and on-site substation.

During the construction of powerlines, service roads (jeep tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed OHL grid connection through the transformation of habitat. Relevant to this development, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the on-site substation is unavoidable. In the case of the OHL, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed OHL. The loss of habitat in the substation footprint (2 ha) will be a relatively insignificant percentage of the habitat that regularly supports powerline sensitive species, and the resultant impact is likely to be fairly minimal. Powerline sensitive species which are potentially most vulnerable to displacement due to habitat transformation are mostly ground nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and, White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

3.3.3 Mortality of powerline sensitive avifauna due to electrocutions on the OHL

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the voltage size of the proposed powerline and the pole/tower design. Should the proposed OHL be constructed using a 132kV tower specification, the electrocution impact for the majority of priority species will be negligible. The only priority species capable of bridging the clearance distances of an OHL constructed using this specification is the Cape Vulture, due to their size and gregarious nature. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

3.3.4 Mortality of powerline sensitive avifauna due to electrocutions in the onsite substation

Electrocutions within the proposed on-site substation are possible, however the likelihood of this impact on the more sensitive Species of Conservation Concern (SCC) is remote, as these species are unlikely to regularly utilise the infrastructure within the onsite substation station for perching or roosting. Powerline sensitive species that are more vulnerable to electrocutions are medium-sized raptors, corvids, owls and certain species of waterbirds. As far as the substation is concerned, the following species are potentially at risk of electrocution: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite. The impact is rated as **low** pre- and post-mitigation.

3.3.5 Mortality of powerline sensitive avifauna due to collisions with the OHL

The up to 132kV OHL could pose a collision risk to virtually all powerline sensitive avifauna, depending on where the spans are located. Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions, powerline configuration and visual capacity. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, Yellow-billed Duck. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

3.3.6 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase

The impact is likely to be similar in nature and extent to the construction phase of the proposed OHL and onsite substation. The impact is rated as **medium** pre-mitigation and it will decrease to **low** post-mitigation.

3.4 Cumulative impacts

3.4.1 Wind Energy Facility

The proposed Camden I WEF will consist of up to 37 turbines in total. According to information that that is available, the number of additional wind turbines that are planned within a 30km radius in broadly similar habitat around the proposed WEF is another (up to) 45 i.e. for the proposed Camden II WEF. If both the Camden I and Camden II projects are approved, a total of up to 82 turbines may be developed, of which the Camden I will contribute approximately 45%. As such, the WEFs' contribution to the total number of turbines, and by implication to the cumulative impact of all the planned turbines, is **High,** but could be reduced to **Moderate** with appropriate mitigation**.** The total area of similar habitat (excluding opencast mining and urban areas) available to birds in the 30km radius around the project area (including the project area) is approximately 4 258 km². This translates into approximately 1 turbine/52km² which is a low density. The turbine density, if all the turbines are constructed, and by implication the cumulative impact on avifauna of the currently planned wind energy projects within this area, is therefore considered to be **Low**, and the impact could be reduced if the recommended mitigation at the two Camden wind projects (suggested here and in the associated Camden II Wind Energy Facility avifaunal report by this author) is diligently implemented.

3.4.2 Up to 132kV OHL

The combined length of the grid connections for the Camden I and II renewable energy projects listed above, and the 400kV OHL to Camden Power Station Substation, is approximately 26.4km. The proposed Camden I grid connection will be a maximum of 5.3km long. The existing high voltage lines in the 30km radius around the proposed Camden I WEF run into hundreds of kilometres (see Figure 12). The Camden I grid OHL contribution to the total length of high voltage lines within a 30km radius, and by implication to the cumulative impact of all the planned and existing high voltage lines, is thus **Low** in comparison. However, the density of planned and existing high voltage lines within a 30km radius, and by implication the cumulative impact on avifauna, is considered to be **Moderate**.

3.4.3 Battery Energy Storage Facility

The BESS will transform an area of approximately 5 ha. Given the available habitat of 4 258km² within a 30km radius around the project site, the cumulative impact of displacement and habitat transformation caused by the BESS is **Low** due to the small footprint.

4 CONCLUSION AND IMPACT STATEMENT

4.1 Wind Energy Facility

The proposed wind energy facility will have a moderate impact on priority avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation, although some instances moderate residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed WEF development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

4.2 The up to 132kV OHL

The proposed up to 132kV OHL will have a mostly impact on priority avifauna which, in all instances, could be reduced to a low impact through appropriate mitigation. No fatal flaws were discovered during the onsite investigations. The proposed development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

4.3 Battery Energy Storage Facility (BESS)

The proposed BESS will have a low impact on priority avifauna which, could be reduced to a very low level in most instances through appropriate mitigation, although some instances low residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed BESS development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

5 ENVIRONMENTAL SENSITIVITIES

The following specific environmental sensitivities were identified from an avifaunal perspective:

- A 100m **all infrastructure exclusion zone** must be implemented around drainage lines and associated wetlands (except essential road and gridline crossings). Wetlands are important breeding, roosting and foraging habitat for a variety of SCC, most notably for African Grass Owl (SA status Vulnerable), Grey Crowned Crane (SA status Endangered) and African Marsh Harrier (SA status Endangered). Where unavoidable, road and grid line crossings across these features should be restricted to the immediate footprint of the infrastructure only.

A 1km **turbine exclusion zone** must be implemented around large pans (other infrastructure allowed). The most significant landscape features from a collision risk perspective are the large pans. Pans attract many birds, including SCC such as Greater Flamingo (SA status Near-threatened), Lesser Flamingo (SA status near-threatened), Martial Eagle (SA Status Endangered), Cape Vulture (SA Status Endangered) and Secretarybird (SA status Vulnerable).

Development in the remaining **high sensitivity grassland must be limited as far as possible (limited infrastructure zone)**. Where possible, infrastructure must be located near margins, with shortest routes taken from the existing roads. The grassland is vital breeding, roosting and foraging habitat for a variety of SCC. These include Blue Crane (SA status near-threatened), Blue Korhaan (Global status near -threatened), White-bellied Bustard (SA Status Vulnerable), Denham's Bustard (SA Status Vulnerable).

See Figure (i) for the avifaunal sensitivities identified from a wind energy perspective.

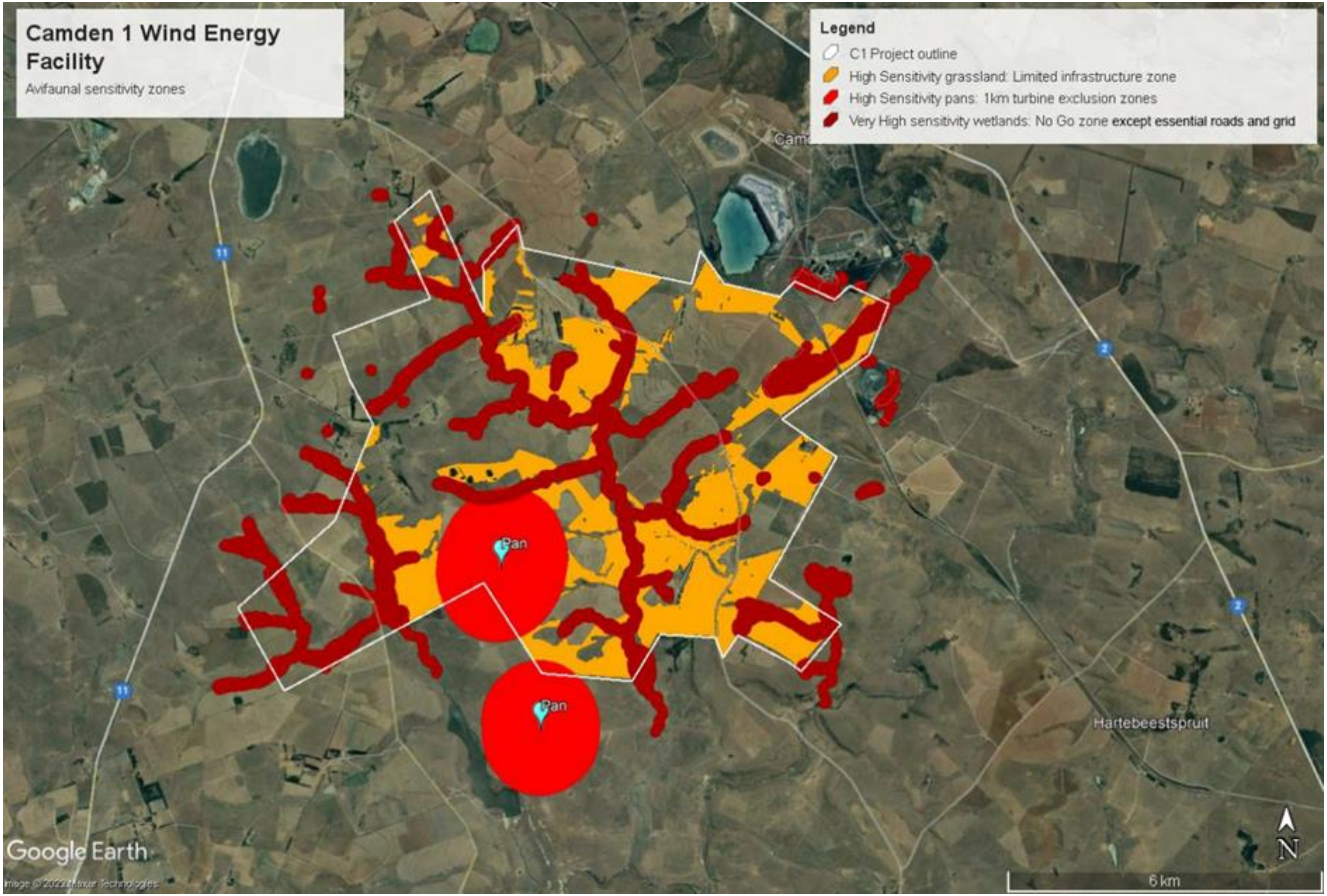

Figure (i): Proposed avifaunal exclusion zones at the Camden I Wind Energy Facility

CONTENTS

DETAILS OF THE SPECIALIST

Chris van Rooyen (Bird Specialist)

Chris has 25 years' experience in the management of wildlife interactions with electricity infrastructure. He was head of the Eskom-Endangered Wildlife Trust (EWT) Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has worked in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. Chris also has extensive project management experience and has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author of 15 academic papers (some with co-authors), co-author of two book chapters and several research reports. He has been involved as ornithological consultant in numerous power line and wind generation projects. Chris is also co-author of the Best Practice for Avian Monitoring and Impact Mitigation at Wind Development Sites in Southern Africa, which is currently (2016) accepted as the industry standard. Chris also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

Albert Froneman (Bird and GIS Specialist)

Albert has an M. Sc. in Conservation Biology from the University of Cape Town and started his career in the natural sciences as a Geographic Information Systems (GIS) specialist at Council for Scientific and Industrial Research (CSIR). In 1998, he joined the Endangered Wildlife Trust where he headed up the Airports Company South Africa – EWT Strategic Partnership, a position he held until he resigned in 2008 to work as a private ornithological consultant. Albert's specialist field is the management of wildlife, especially bird related hazards at airports. His expertise is recognized internationally; in 2005 he was elected as Vice Chairman of the International Bird Strike Committee. Since 2010, Albert has worked closely with Chris van Rooyen in developing a protocol for pre-construction monitoring at wind energy facilities, and he is currently jointly coordinating pre-construction monitoring programmes at several wind farm facilities. Albert also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

1 INTRODUCTION

The proposed Camden Renewable Energy Complex (the 'Complex') is being developed by ENERTRAG South Africa (Pty) Ltd ("ENERTRAG" or "Developer") in the context of the Department of Mineral Resources and Energy's (DMRE) Integrated Resource Plan, and the Renewable Energy Independent Power Producer Procurement Programme (REIPPP).

The Complex can be divided into eight (8) Projects, namely:

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- Camden II Wind Energy Facility up to 132kV Gid Connection.

This impact report deals with the Camden I Wind Energy Facility (WEF), Battery Energy Storage System (BESS) and 132kV grid connection.

1.1 Wind Energy Facility and Battery Energy Storage Facility

Table 1 summarises the main features of the proposed WEF, relevant to potential avifaunal impacts.

Table 1: Camden I Energy Facility summary

Facility Name	Camden I Wind Energy Facility
Applicant	Camden I Wind Energy Facility (RF) Propriety Limited
Municipalities	Msukaligwa Local Municipality of the Gert Sibande District Municipality
Extent	6 700 ha
Buildable area	Approximately 200 ha, subject to finalization based on technical and environmental requirements
Capacity	Up to 200MW
Number of turbines	Up to 37
Turbine hub height:	Up to 200m
Rotor Diameter:	Up to 200m
Operations and Maintenance (O&M) building footprint:	Located in close proximity to the substation. Septic/conservancy tanks with portable toilets Typical areas include: - Operations building – 20m x 10m = 200m^2 - Workshop – 15m x 10m = 150m^2 Stores - 15m x 10m = 150m^2
Construction camp laydown	Typical area 100m x 50m = 5000m^2. Sewage: Septic/conservancy tanks and portable toilets
Temporary laydown or staging area:	Typical area 220m x 100m = 22000m². Laydown area could

	increase to 30000m² for concrete towers, should they be required.
Cement batching plant (temporary):	Gravel and sand will be stored in separate heaps whilst the cement will be contained in a silo.
Internal Roads:	Width of internal road – Between 5m and 6m. Length of internal road – Approximately 60km. Where required for turning circle/bypass areas, access or internal roads may be up to 20m to allow for larger component transport.
Cables:	The medium voltage collector system will comprise of cables up to and including 33kV that run underground, except where a technical assessment suggest that overhead lines are required, within the facility connecting the turbines to the onsite substation.
Independent Power Producer (IPP) site substation and battery energy storage system (BESS):	Total footprint will be up to 6.5ha in extent (5ha for the BESS and 1.5ha for the IPP portion of the substation). The substation will consist of a high voltage substation yard to allow for multiple (up to) 132kV feeder bays and transformers, control building, telecommunication infrastructure, access roads, and other substation components as required. The associated BESS storage capacity will be up to 200MW/800MWh with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology however the specific technology will only be determined following EPC procurement. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers.

1.2 Up to 132kV Grid Connection

It is proposed that Camden I Wind Energy Facility will connect to the nearby Camden Collector substation (which in turn will connect to the Camden Power Station), through an up to 132kV powerline (either single or double circuit) between the grid connection substation portion (immediately adjacent the Camden I on-site IPP substation portion) and that of the Camden Collector substation. The powerline will be approximately 14km in length, depending on the authorized location of the collector substation. The onsite grid connection substation will consist of high voltage substation yard to allow for multiple (up to) 132kV feeder bays and transformers, control building, telecommunication infrastructure, access roads, etc. The area for the onsite substation will be up to 1.5ha. The up to 132kV powerline and substation will have a 250m assessment corridor for the purposes of micro-siting. This application includes the necessary up to 132kV voltage electrical components required for connection at the Collector Substation.

See Figures 1 and 2 for a map of the development area.

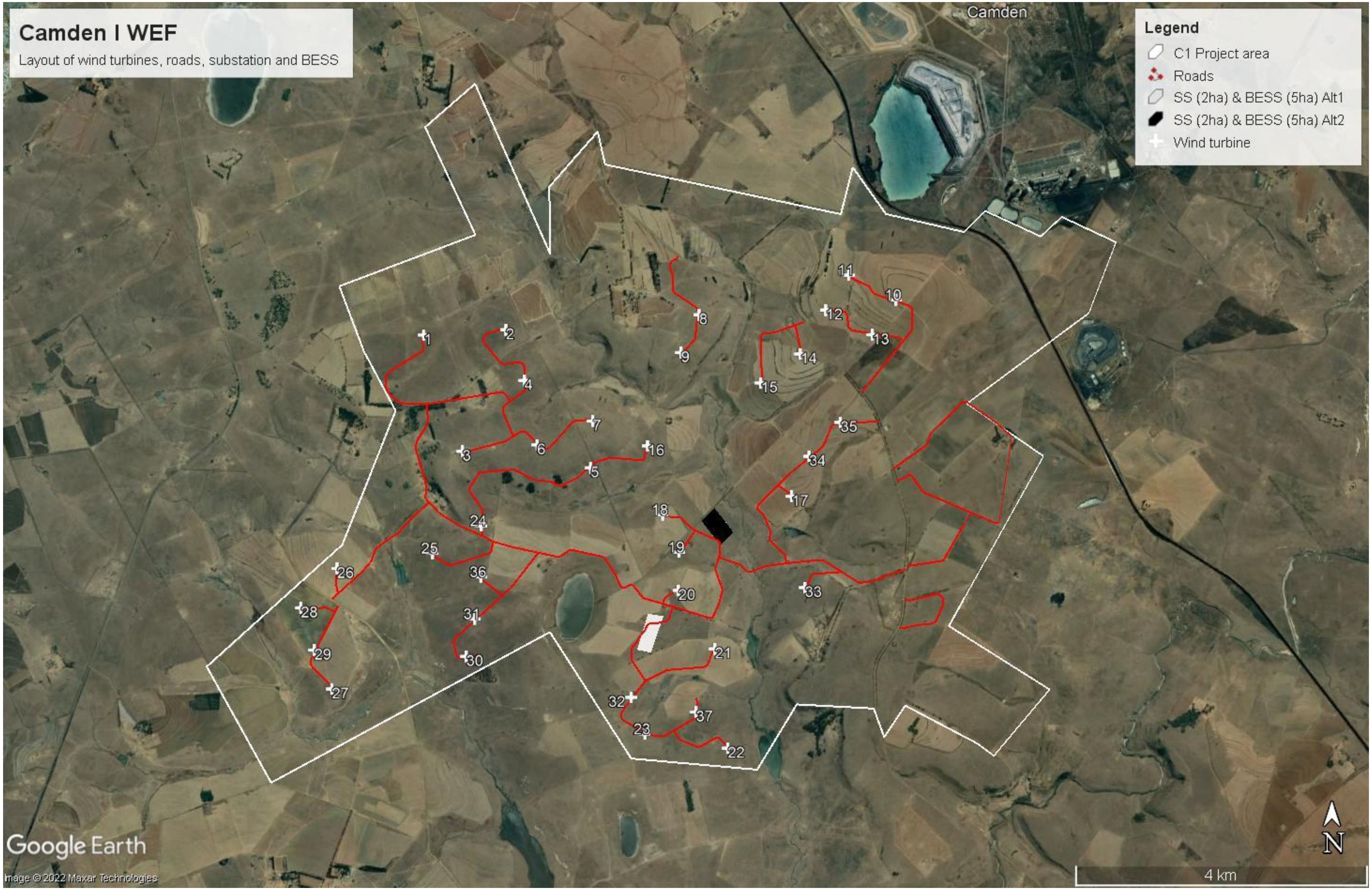


Figure 1: Proposed layout of the project area of the proposed Camden I WEF and BESS alternatives.

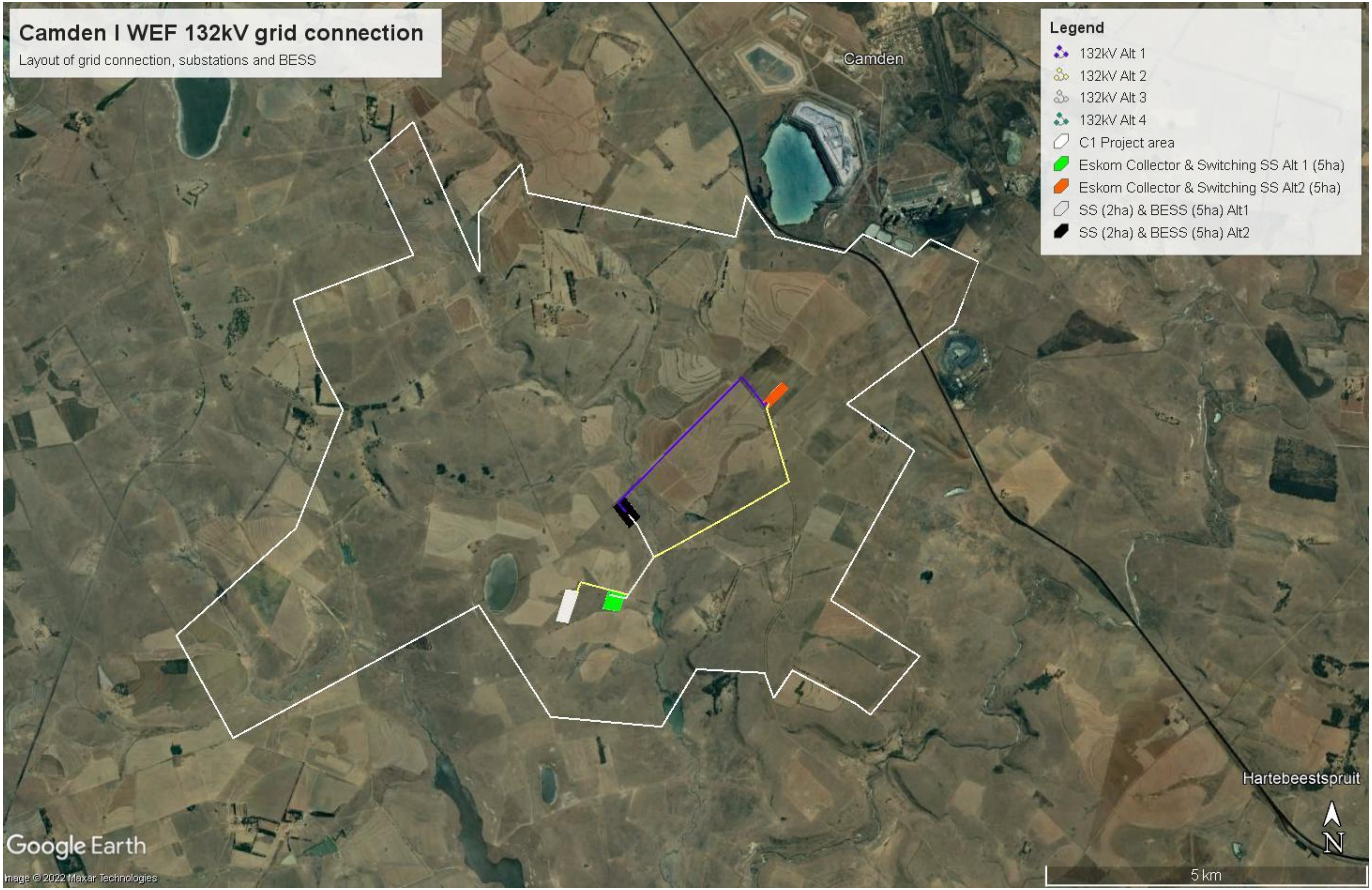


Figure 2: The lay-out of the proposed Camden I up to 132kV grid connection and Eskom collector & switching station.

2 TERMS OF REFERENCE & PROTOCOLS

2.1 Wind Energy Facility protocol

Protocol for the specialist assessment and minimum report content requirements for environmental impacts om avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).

2.2 Up to 132kV grid connection protocol

The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020).

The purpose of the specialist report is to determine the main issues and potential impacts of the proposed wind farm and grid connection, based by the on existing information and field assessments, according to the said protocols. In summary, the protocols require the following:

- Describe the affected environment from an avifaunal perspective.
- Discuss gaps in baseline data and other limitations and describe the expected impacts associated with the wind farm, BESS and the up to 132kV grid connection.
- Identify potential sensitive environments and receptors that may be impacted on by the proposed wind farm, BESS and 132kV grid connection and the types of impacts (i.e. direct, indirect and cumulative) that are most likely to occur.
- Determine the nature and extent of potential impacts during the construction, operational and decommissioning phases of the WEF, BESS and up to 132kV grid connection.
- Identify avifaunal sensitivities, including 'No-Go' areas, where applicable.
- Recommend mitigation measures to reduce the impact of the expected impacts.
- Provide an impact statement on whether the projects should be approved or not.

3 OUTLINE OF METHODOLOGY AND INFORMATION REVIEWED

The following methods were employed to conduct this study:

- Priority species for wind development were identified from the updated list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief *et al*. 2012).
- Powerline sensitive species were defined as species which could potentially be impacted by powerline collisions or electrocutions, based on their morphology. Larger birds, particularly raptors and vultures, are more vulnerable to electrocution as they are more likely to bridge the clearances between electrical components than smaller birds. Large terrestrial species and certain waterbirds with high wing loading are less manoeuvrable than smaller species and are therefore more likely to collide with overhead lines.
- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species, occur in the pentads where the proposed development is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5' × 5'). Each pentad is approximately 8 × 7.6 km. To get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 16 pentads some of which intersect and others that are near the development area, henceforth referred to as "the broader area" (see Figure 3Figure 4). The decision to include multiple pentads around the development area was to get a more representative picture of the bird abundance and variety in the region. The additional pentads and their data augment the bird distribution data. A total of 165 full protocol lists (i.e. bird listing surveys lasting a minimum of two hours each) and 227 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed to date for the 16 pentads where the development area is located.

The SABAP2 data was therefore regarded as a reliable reflection of the avifauna which occurs in the area, but the data was also supplemented by data collected during the site surveys and general knowledge of the area.

- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red List Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the latest (2021.3) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015; http://www.birdlife.org.za/conservation/important-bird-areas) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth © 2022) was used in order to view the broader area on a landscape level and to help identify bird habitat on the ground.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the development areas relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the development areas.
- The South African National Biodiversity Institute (SANBI) guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa (2020) were consulted to assist with the interpretation of the Terrestrial Animal Species protocol.
- The main source of information on the avifaunal diversity and abundance at the project area is an integrated pre-construction monitoring programme which was implemented at the project area, covering all seven proposed sub projects of the Camden Renewable Energy Complex (See Appendix 3).

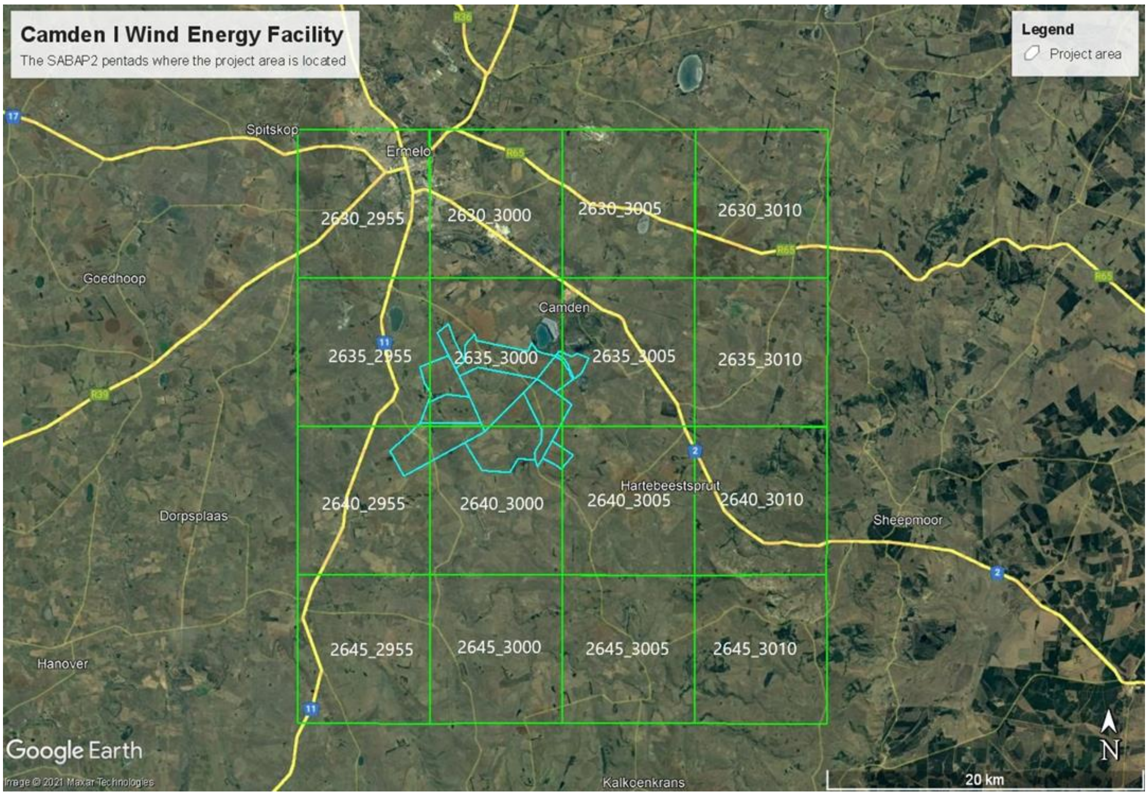


Figure 3: Area covered by the four SABAP2 pentad grid cells (green squares).

4 ASSUMPTIONS AND LIMITATIONS

This study made the basic assumption that the sources of information used are reliable and accurate. The following must be noted:

- The SABAP2 dataset is a comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, and the results of the pre-construction monitoring which was conducted over 12 months.
- Conclusions in this report are based on experience of these and similar species at wind farm developments in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.
- To date, only one peer-reviewed scientific paper has been published on the impacts wind farms have on birds in South Africa (Perold *et al*. 2020). The precautionary principle was therefore applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle. The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: "in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation."
- According to the specifications received from the proponent, the 33kV medium-voltage lines will be buried where practically feasible. It was therefore assumed that there could be 33kV overhead lines which could pose an electrocution risk to priority species.
- It is assumed that the up to 132kV overhead line will be built on poles/towers designed to 132kV specifications.

5 LEGISLATIVE CONTEXT

5.1 Agreements and conventions

Table 2 below lists agreements and conventions which South Africa is party to, and which are relevant to the conservation of avifauna[1].

Table 2: Agreements and conventions which South Africa is party to and which are relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global

[1] (BirdLife International (2021) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa. Checked: 2021-09-20).

Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

5.2 National legislation

5.2.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

(a) to an environment that is not harmful to their health or well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

- (i) prevent pollution and ecological degradation;
- (ii) promote conservation; and
- (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

5.2.2 The National Environmental Management Act 107 of 1998 (NEMA)

The National Environmental Management Act 107 of 1998 (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated. NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. In the case of wind energy developments, the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species where the output is 20MW or more (Government Gazette No 43110, 20 March 2020) is applicable to the wind farm development. The Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species was published on 30 October 2020. This protocol applies also for the assessment of impacts caused by power lines and BESS on avifauna.

5.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) and the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations)

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act 10 of 2004 read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

5.3 Provincial Legislation

The current legislation applicable to the conservation of fauna and flora in Mpumalanga is the Mpumalanga Nature Conservation Act 10 of 1998. It consolidated and amended the laws relating to nature conservation within the province and provides for matters connected therewith. All birds are classified as Protected Game (Section 4 (1) (b)), except those listed in Schedule 3, which are classified as Ordinary Game (Section 4 (1)(c)).

6 BASELINE ASSESSMENT

6.1 Important Bird Areas

The project area is not located in an Important Bird Area (IBA), but it is located between three IBAs. The closest IBA to the project area is the Amersfoort-Bethal-Carolina IBA SA018, which is located within 1.5km from the project site to the west. The Grasslands IBA SA020 is located 6-7km to the east of the site. The Chrissies Pans IBA SA019 is located 16-17km to the north-east of the site. Due to the close proximity of the site to the IBAs, it is possible that some highly mobile priority species which are also IBA trigger species, and which occur either permanently or sporadically in the IBAs, might be impacted by the project when they leave to forage or breed beyond the borders of the IBA. Species that were recorded in the broader areas and fall within this category are the following:

- Secretarybird
- Pied Avocet
- Denham's Bustard
- Blue Crane
- Grey Crowned Crane
- Wattled Crane
- White-backed Duck
- Yellow-billed Duck
- Martial Eagle
- Lanner Falcon
- Greater Flamingo

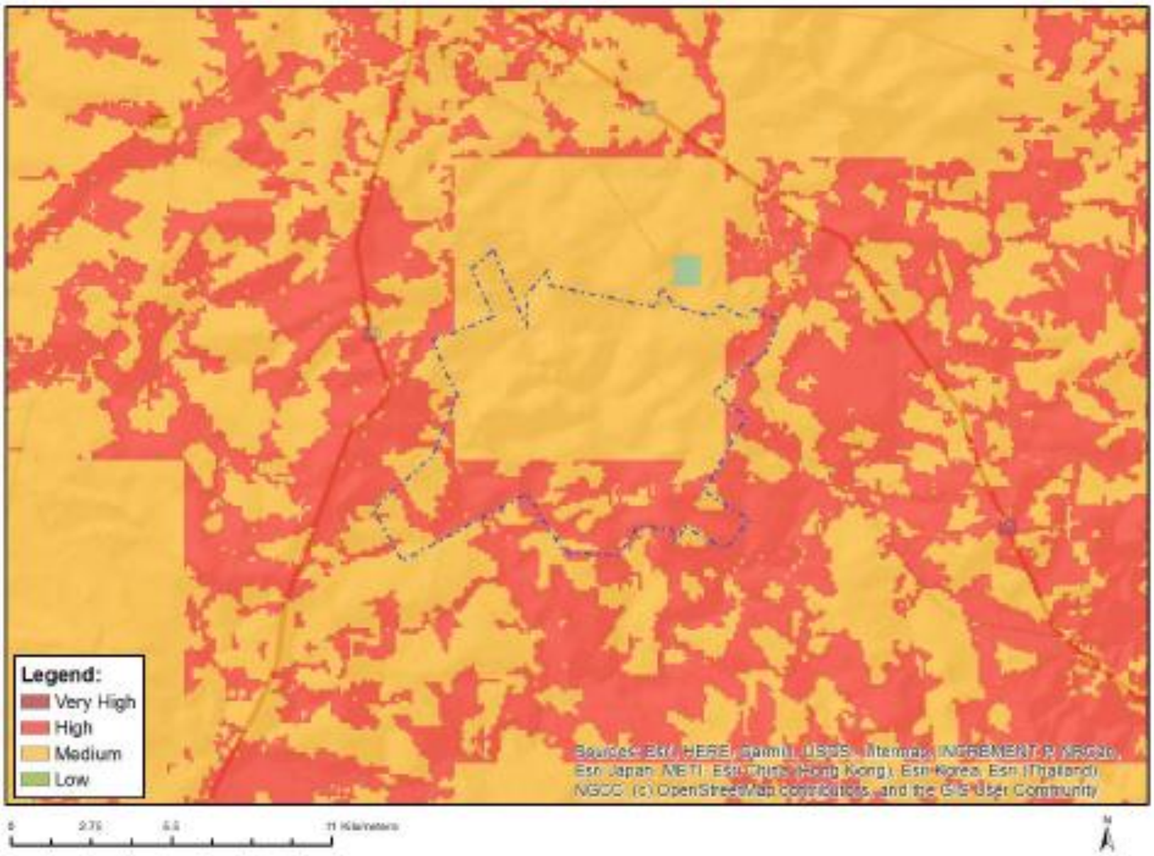
- Lesser Flamingo
- Black-necked Grebe
- Little Grebe
- African Marsh Harrier
- Black Harrier
- Southern Bald Ibis
- African Grass Owl
- Southern Pochard
- Cape Shoveler
- White-winged Tern

6.2 DFFE National Screening Tool[2]

In the case of the Animal Species theme, relevant to the proposed WEF, grid connection and BESS, the project area is classified as **Medium to High** sensitivity, based on the potential presence of several species of conservation concern (SCC) namely Grey Crowned Crane (Globally and Regionally Endangered), Martial Eagle (Globally and Regionally Endangered), Southern Bald Ibis (Globally and Regionally Vulnerable), White-bellied Korhaan (Regionally Vulnerable) and Secretarybird (Globally Endangered and Regionally Vulnerable) (Figure 5). This classification was confirmed during the site surveys, based on the presence of recorded SCC, namely Secretarybird (Globally Endangered, Regionally Vulnerable) White-bellied Bustard (Regionally Vulnerable), Blue Crane (Globally Vulnerable, Regionally Near-threatened), Grey Crowned Crane (Globally and Regionally Endangered), Martial Eagle (Globally and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), Greater Flamingo (Regionally Near-threatened), Lesser Flamingo (Globally and Regionally Near-threatened), Black Harrier (Regionally and Globally Endangered), Southern Bald Ibis (Regionally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), African Grass Owl (Regionally Vulnerable) and Cape Vulture (Globally Vulnerable and Regionally Endangered).

[2] The avifaunal wind theme in the screening tool is only applicable to projects in a Renewable Energy Development Zone (REDZ)

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Balearica regulorum
High	Aves-Polemaetus bellicosus
High	Aves-Geronticus calvus
High	Aves-Eupodotis senegalensis
Medium	Aves-Balearica regulorum
Medium	Aves-Sagittarius serpentarius

Figure 4: The National Web-Based Environmental Screening Tool map of the Camden I development area, indicating sensitivities for the Animal Species theme. This is applicable to the WEF, grid connection and BESS.

6.3 Protected Areas

According to the South African Protected Areas database (SAPAD), part of the project area overlaps with the Langcarel Private Nature Reserve. From an avifaunal perspective the state of the habitat and land use at the project area is more important than the legal status, which has been surveyed and assessed for this assessment. The results provided are therefore applicable regardless of the legal status of the land parcels considered.

6.4 Biomes and vegetation types

The project area is situated in the Grassland Biome, in the Mesic Highveld Grassland Bioregion (Muchina & Rutherford 2006). Vegetation on site consists predominantly Amersfoort Highveld Clay Grassland and Eastern Highveld Grassland, which is comprised of undulating grassland plains, with small, scattered patches of dolerite outcrops in areas, low hills, and pan depressions. The vegetation is comprised of a short, closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn (Mucina & Rutherford 2006).

Ermelo has a temperate climate. January is the warmest month with a maximum temperature of 24.4 C°. June and July are the coldest months, with a minimum temperature of 0.2 C°. The driest month is June with an average of 3 mm of precipitation. Most of the precipitation falls in December, averaging 151 mm. The average annual precipitation is around 756 mm (Climate – data.org 2021).

The topography in the project area is characterised by gentle undulating plains. The predominant land use for this area is livestock grazing with some crop farming, mostly maize, soya beans and pastures. The livestock in the project area is a combination of mostly sheep and cattle, with a few horses.

6.5 Bird habitat

Whilst much of the distribution and abundance of the bird species in the project area can be explained by the dominant biomes and vegetation types, it is also important to examine the modifications which have changed the natural landscape, and which may have an effect on the distribution of avifauna. These are sometimes evident at a much smaller spatial scale than the biome or vegetation types and are determined by a host of factors such as topography, land use and man-made infrastructure.

The following bird habitat classes were identified in the project area (see Appendix 2 for examples of the habitat classes):

6.5.1 Grassland

The majority of the habitat in the project area comprises grassland. The grassland varies from dense stands of relatively high grass to areas of heavily grazed short grass.

6.5.1.1 Wind priority species

The wind priority species which could potentially use the grassland in the project area on a regular basis are the following:

- Secretarybird
- White-bellied Bustard
- Common Buzzard
- Jackal Buzzard
- Buff-streaked Chat
- Blue Crane
- Grey Crowned Crane
- Black-chested Snake Eagle
- Long-crested Eagle

- Spotted Eagle-Owl
- Amur Falcon
- Lanner Falcon
- Grey-winged Francolin
- African Harrier-Hawk
- Southern Bald Ibis
- Black-winged Kite
- Blue Korhaan
- Black-winged Lapwing
- African Grass Owl
- Marsh Owl
- Black Sparrowhawk
- White Stork

The wind priority species which could occasionally use the grassland in the project area are the following:

- Black-bellied Bustard
- Denham's Bustard
- Brown Snake Eagle
- Martial Eagle
- Peregrine Falcon
- African Marsh Harrier
- Black Harrier
- Montagu's Harrier
- Northern Black Korhaan
- Cape Vulture

6.5.1.2 Powerline sensitive species

The powerline sensitive species which could potentially use the grassland in the project area on a regular basis are the following:

- Secretarybird
- White-bellied Bustard
- Lanner Falcon
- Southern Bald Ibis
- African Grass Owl
- Blue Crane
- Blue Korhaan
- Grey Crowned Crane
- Common Buzzard
- Jackal Buzzard
- Cape Crow
- Pied Crow
- Black-chested Snake Eagle
- Long-crested Eagle
- Spotted Eagle-Owl
- Western Cattle Egret
- Amur Falcon

- Helmeted Guineafowl
- African Harrier-Hawk
- Black-headed Heron
- Hadada Ibis
- Black-winged Kite
- Marsh Owl
- Western Barn Owl
- White Stork

The powerline sensitive species which could occasionally use the grassland in the project area are the following:

- Denham's Bustard
- Martial Eagle
- Black Harrier
- Cape Vulture
- Black-bellied Bustard
- Brown Snake Eagle
- Peregrine Falcon
- Montagu's Harrier
- Yellow-billed Kite
- Northern Black Korhaan

6.5.2 Drainage lines and wetlands

There are several wetlands in the project area, most of which are associated with drainage lines. Wetlands are characterised by static or slow flowing water and are extensively covered by tall emergent wetland vegetation.

6.5.2.1 Wind priority species

The priority species which could potentially use the wetlands in the project area on a regular basis are the following:

- Blue Crane
- Grey Crowned Crane
- African Grass Owl
- Marsh Owl

The priority species which could occasionally use the wetlands in the project area are the following:

- African Marsh Harrier
- Wattled Crane

6.5.2.2 Powerline sensitive species

The powerline sensitive species which could potentially use the wetlands in the project area on a regular basis are the following:

- African Grass Owl
- Blue Crane
- Grey Crowned Crane
- Hamerkop

- African Black Duck
- Great Egret
- Intermediate Egret
- Little Egret
- Glossy Ibis
- Hadada Ibis
- Marsh Owl

The powerline sensitive species which could occasionally use the wetlands in the project area are the following:

- African Marsh Harrier
- Wattled Crane

6.5.3 Agricultural lands

The project area contain a patchwork of agricultural fields. Some fields are lying fallow or are in the process of being re-vegetated by grass.

6.5.3.1 Wind priority species

The priority species which could potentially use the agricultural fields in the project area on a regular basis are the following:

- Blue Crane
- Grey Crowned Crane
- Common Buzzard
- Spotted Eagle-Owl
- Amur Falcon
- Lanner Falcon
- Southern Bald Ibis
- Black-winged Kite

The priority species which could occasionally use the agricultural lands in the project area are the following:

- Peregrine Falcon
- African Marsh Harrier
- Montagu's Harrier
- Wattled Crane
- Black Harrier
- Black-bellied Bustard
- Denham's Bustard
- Brown Snake Eagle
- Martial Eagle
- Northern Black Korhaan
- Cape Vulture

6.5.3.2 Powerline sensitive species

The powerline sensitive species which could potentially use the agricultural fields in the project area on a regular basis are the following:

- Amur Falcon
- Blue Crane
- Egyptian Goose
- Grey Crowned Crane
- Helmeted Guineafowl
- Lanner Falcon
- Southern Bald Ibis
- Spur-winged Goose

The powerline sensitive species which could occasionally use the agricultural lands in the project area are the following:

- Black-bellied Bustard
- Brown Snake Eagle
- Cape Vulture
- Denham's Bustard
- Martial Eagle
- Montagu's Harrier
- Northern Black Korhaan
- Peregrine Falcon
- Wattled Crane
- Yellow-billed Kite

6.5.4 Alien trees

The development area contains few trees. Most trees are alien species, particularly Eucalyptus, Australian Acacia (Wattle), and Salix (Willow) species. Trees are often planted as wind breaks next to agricultural lands and around homesteads. Some of the drainage lines also have trees growing in them.

6.5.4.1 Wind priority species

The priority species which could potentially use the alien trees in the project area on a regular basis are the following:

- Grey Crowned Crane
- Common Buzzard
- Spotted Eagle-Owl
- Amur Falcon
- Lanner Falcon
- Southern Bald Ibis
- Black-winged Kite
- Jackal Buzzard
- Black-chested Snake Eagle
- Long-crested Eagle
- African Harrier-Hawk
- Black Sparrowhawk
- African Fish Eagle

The priority species which could occasionally use the alien trees in the project area are the following:

- Peregrine Falcon
- Brown Snake Eagle
- Martial Eagle
- Cape Vulture

6.5.5 Dams

There are many ground dams at the project site, located in drainage lines.

6.5.5.1 Wind priority species

The priority species which could potentially use the dams in the project area on a regular basis are the following:

- African Fish Eagle

The priority species which could occasionally use the dams and pans in the project area are the following:

- Western Osprey

6.5.5.2 Powerline sensitive species

The powerline sensitive species which could potentially use the dams in the project area on a regular basis are the following:

- African Darter
- African Sacred Ibis
- African Swamphen
- Common Moorhen
- Egyptian Goose
- Great Egret
- Grey Heron
- Hamerkop
- Intermediate Egret
- Little Egret
- Little Grebe
- Purple Heron
- Red-billed Teal
- Red-knobbed Coot
- Reed Cormorant
- South African Shelduck
- Southern Pochard
- Spur-winged Goose
- White Stork
- White-breasted Cormorant

The priority species which could occasionally use the dams and pans in the project area are the following:

- Black Heron
- Black-crowned Night Heron
- Black-necked Grebe

- Blue-billed Teal
- Cape Teal
- Goliath Heron
- Mallard
- Squacco Heron
- Western Osprey

6.5.6 Pans

The project site contains one large pan, and another large pan is located approximately one kilometre south of the site. These pans are a potential drawcard for many species. Lesser and Greater Flamingos could use these pans for foraging and roosting. Large raptors and vultures could use the pans for bathing and drinking, and Blue Cranes could roost there on occasion.

6.5.6.1 Wind priority species

The wind priority species which could potentially use the pans in the project site on a regular basis are the following:

- Common Buzzard
- Jackal Buzzard
- Blue Crane
- Black-chested Snake Eagle
- Long-crested Eagle
- Lanner Falcon
- Greater Flamingo
- Lesser Flamingo
- African Harrier-Hawk

The priority species which could occasionally use the pans in the project site are the following:

- Brown Snake Eagle
- Martial Eagle
- Peregrine Falcon
- African Marsh Harrier
- Montagu's Harrier
- Black Harrier
- Cape Vulture
- Black-bellied Bustard
- Denham's Bustard
- Wattled Crane
- Northern Black Korhaan
- Western Osprey

6.5.6.2 Powerline sensitive species

The powerline sensitive species which could potentially use the pans in the project area on a regular basis are the following:

- Black-chested Snake Eagle
- Blue Crane

- Egyptian Goose
- Greater Flamingo
- Grey Crowned Crane
- Hamerkop
- Lanner Falcon
- Lesser Flamingo
- Red-knobbed Coot
- Secretarybird
- South African Shelduck

The powerline sensitive species which could occasionally use the pans in the project area are the following:

- Brown Snake Eagle
- Cape Teal
- Cape Vulture
- Mallard
- Martial Eagle
- Peregrine Falcon
- Yellow-billed Kite

6.5.7 High voltage lines

The project area is transected by several high voltage lines which originating at the nearby Camden power station and substation. High voltage lines are used by a variety of avifauna for perching, roosting and in some cases, breeding These include raptors, vultures, ibis and also cranes.

6.5.7.1 Wind priority species

The wind priority species which could potentially use the high voltage lines in the project area on a regular basis are the following:

- African Fish Eagle
- Amur Falcon
- Black-chested Snake Eagle
- Black-winged Kite
- Common Buzzard
- Grey Crowned Crane
- Lanner Falcon
- Long-crested Eagle
- Southern Bald Ibis

The wind priority species which could occasionally use the high voltage lines in the project area are the following:

- Brown Snake Eagle
- Cape Vulture
- Martial Eagle
- Peregrine Falcon

6.5.7.2 Powerline sensitive species

The powerline sensitive species which could potentially use the high voltage lines in the project area on a regular basis are the following:

- Amur Falcon
- Black-chested Snake Eagle
- Black-winged Kite
- Cape Crow
- Common Buzzard
- Jackal Buzzard
- Lanner Falcon
- Long-crested Eagle
- Pied Crow
- Rock Kestrel
- Southern Bald Ibis

The powerline sensitive species which could occasionally use the high voltage lines in the project area are the following:

- Brown Snake Eagle
- Cape Vulture
- Martial Eagle
- Peregrine Falcon
- Western Osprey

See Appendix 2 for photographic record of habitat features in the development area and immediate surroundings.

6.6 AVIFAUNA

6.6.1 South African Bird Atlas Project 2

The SABAP2 data indicates that a total of 234 bird species could potentially occur within the broader area – Appendix 1 provides a comprehensive list of all the species. Of these, 37 species are classified as wind priority species and 78 as powerline sensitive species. Of the 37 wind priority species, 16 are South African Red List species, and of the 78 powerline sensitive species, 15 are South African Red List species. Of the wind priority species, 25 are likely to occur regularly in the development area, and 55 powerline sensitive species are likely to occur regularly in the project area.

Table 3 and Table 4 list all the wind priority species and powerline sensitive species respectively that are likely to occur regularly and the possible impact on the respective species by the proposed wind farm (including the BESS) and 132kV grid connection. The following abbreviations and acronyms are used:

- NT = Near threatened
- VU = Vulnerable
- EN = Endangered

Table 3: Wind priority species potentially occurring at the project area.

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during monitoring	Likelihood of regular occurrence	Habitat							Impacts				
		Full protocol	Ad hoc protocol	Global status	Regional status	IBA trigger species			Grassland	Drainage lines & Wetlands	Alien trees	Pans	Agriculture	Dams	HV lines	Collision with turbines	Displacement - habitat transformation	Displacement - disturbance	Electrocution MV lines	Collision MV lines
African Fish Eagle	*Haliaeetus vocifer*	12.12	0.88	-	-		x	H			x			x	x	x			x	
African Grass Owl	*Tyto capensis*	2.42	0.00	-	VU	x	x	M	x	x						x	x	x	x	x
African Harrier-Hawk	*Polyboroides typus*	11.52	1.76	-	-		x	M	x		x	x				x			x	
African Marsh Harrier	*Circus ranivorus*	0.61	0.00	-	EN	x		L	x	x		x				x			x	
Amur Falcon	*Falco amurensis*	29.09	6.61	-	-		x	H	x		x		x		x	x				
Black Harrier	*Circus maurus*	0.00	0.88	EN	EN	x		L	x			x				x			x	
Black Sparrowhawk	*Accipiter melanoleucus*	12.12	0.88	-	-		x	M	x		x					x			x	
Black-bellied Bustard	*Lissotis melanogaster*	0.61	0.00	-	-			L	x							x	x	x		x
Black-chested Snake Eagle	*Circaetus pectoralis*	3.03	0.44	-	-		x	M	x		x	x			x	x			x	
Black-winged Kite	*Elanus caeruleus*	60.61	12.78	-	-		x	H	x		x		x		x	x			x	
Black-winged Lapwing	*Vanellus melanopterus*	14.55	0.00	-	-		x	H	x							x	x			
Blue Crane	*Grus paradisea*	11.52	0.44	VU	NT	x	x	H	x	x		x	x			x	x	x		x
Blue Korhaan	*Eupodotis caerulescens*	6.06	0.00	NT	LC	x	x	M	x							x	x	x		x
Brown Snake Eagle	*Circaetus cinereus*	1.82	0.00	-	-			L	x		x	x			x	x			x	
Buff-streaked Chat	*Campicoloides bifasciatus*	5.45	0.44	-	-	x		M	x								x	x		
Cape Vulture	*Gyps coprotheres*	0.00	0.00	EN	EN		x	L	x		x	x			x	x			x	x
Common Buzzard	*Buteo buteo*	27.88	9.25	-	-		x	H	x		x	x	x		x	x			x	
Denham's Bustard	*Neotis denhami*	1.82	0.00	NT	VU	x		L	x							x	x	x		x
Greater Flamingo	*Phoenicopterus roseus*	3.64	4.41	-	NT	x	x	M				x				x				x
Grey Crowned Crane	*Balearica regulorum*	5.45	0.00	EN	EN	x	x	M	x	x	x		x		x	x	x	x	x	x
Grey-winged Francolin	*Scleroptila afra*	27.27	2.20	-	-		x	H	x							x	x	x		
Jackal Buzzard	*Buteo rufofuscus*	19.39	2.20	-	-		x	H	x		x	x				x			x	
Lanner Falcon	*Falco biarmicus*	7.27	0.00	-	VU	x	x	M	x		x	x	x		x	x			x	
Lesser Flamingo	*Phoeniconaias minor*	3.64	1.32	NT	NT	x	x	M				x				x				x

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during monitoring	Likelihood of regular occurrence	Habitat							Impacts				
		Full protocol	Ad hoc protocol	Global status	Regional status	IBA trigger species			Grassland	Drainage lines & Wetlands	Alien trees	Pans	Agriculture	Dams	HV lines	Collision with turbines	Displacement - habitat transformation	Displacement - disturbance	Electrocution MV lines	Collision MV lines
Long-crested Eagle	*Lophaetus occipitalis*	6.67	9.25	-	-		x	M	x		x	x			x	x			x	
Marsh Owl	*Asio capensis*	5.45	0.44	-	-		x	H	x	x						x	x	x	x	x
Martial Eagle	*Polemaetus bellicosus*	2.42	0.00	EN	EN	x	x	L	x		x	x			x	x			x	
Montagu's Harrier	*Circus pygargus*	1.21	0.00	-	-			L	x	x		x				x			x	
Northern Black Korhaan	*Afrotis afraoides*	0.61	0.00	-	-			L	x							x	x	x		x
Peregrine Falcon	*Falco peregrinus*	1.21	0.00	-	-		x	L	x		x	x	x		x	x			x	
Secretarybird	*Sagittarius serpentarius*	13.33	0.00	EN	VU	x	x	H	x							x	x			x
Southern Bald Ibis	*Geronticus calvus*	23.03	3.08	VU	VU	x	x	H	x		x		x		x	x			x	x
Spotted Eagle-Owl	*Bubo africanus*	9.09	0.88	-	-		x	H	x		x		x			x		x	x	x
Wattled Crane	*Grus carunculata*	0.61	0.00	VU	CR	x		L		x						x				x
Western Osprey	*Pandion haliaetus*	0.61	0.00	-	-			L						x		x			x	
White Stork	*Ciconia ciconia*	7.27	1.32	-	-		x	M	x							x				x
White-bellied Bustard	*Eupodotis senegalensis*	7.88	0.00	-	VU	x	x	M	x							x	x	x		x

Table 4: Powerline sensitive species potentially occurring at the project area.

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during surveys	Likelihood of regular occurrence	Habitat							Impacts			
		SABAp2 full protocol reporting rate	SABAp2 Ad hoc protocol reporting rate	Global status	Regional status	IBA trigger species			Grassland	Drainage lines and wetlands	Dams	Pans	Alien trees	HV lines	Agriculture	Collisions: Powerline	Displacement: Disturbance	Displacement: Habitat transformation	Electrocutions: Substation and MV lines
African Black Duck	*Anas sparsa*	11	0	-	-		x	H		x						x			
African Darter	*Anhinga rufa*	16	2.2	-	-		x	H			x		x			x			
African Fish Eagle	*Haliaeetus vocifer*	12	0.9	-	-		x	H					x						x
African Grass Owl	*Tyto capensis*	2.4	0	-	VU		x	M	x	x						x	x	x	x
African Harrier-Hawk	*Polyboroides typus*	12	1.8	-	-		x	M	x				x						
African Marsh Harrier	*Circus ranivorus*	0.6	0	-	EN			L		x									
African Sacred Ibis	*Threskiornis aethiopicus*	48	6.2	-	-		x	H			x		x			x			
African Spoonbill	*Platalea alba*	16	2.2	-	-		x	H								x			
African Swamphen	*Porphyrio madagascariensis*	6.1	2.2	-	-		x	M			x								
Amur Falcon	*Falco amurensis*	29	6.6	-	-		x	H	x				x	x	x				x
Black Harrier	*Circus maurus*	0	0.9	EN	EN			L	x										
Black Heron	*Egretta ardesiaca*	0.6	0	-	-			L			x					x			
Black Sparrowhawk	*Accipiter melanoleucus*	12	0.9	-	-		x	H					x						x
Black-bellied Bustard	*Lissotis melanogaster*	0.6	0	-	-			L	x						x	x	x	x	
Black-chested Snake Eagle	*Circaetus pectoralis*	3	0.4	-	-		x	M	x			x	x	x					x
Black-crowned Night Heron	*Nycticorax nycticorax*	0.6	0	-	-			L			x					x			
Black-headed Heron	*Ardea melanocephala*	52	4	-	-		x	H	x							x			x
Black-necked Grebe	*Podiceps nigricollis*	0.6	0.4	-	-			L			x					x			
Black-winged Kite	*Elanus caeruleus*	61	13	-	-		x	H	x				x	x					x
Blue Crane	*Grus paradisea*	12	0.4	VU	NT		x	H	x	x		x			x	x	x	x	
Blue Korhaan	*Eupodotis caerulescens*	6.1	0	NT			x	H	x							x	x	x	
Blue-billed Teal	*Spatula hottentota*	1.2	0	-	-			L			x					x			
Brown Snake Eagle	*Circaetus cinereus*	1.8	0	-	-			L	x			x	x	x	x				x
Cape Crow	*Corvus capensis*	18	0.4	-	-		x	H	x				x	x					x
Cape Shoveler	*Spatula smithii*	19	0	-	-		x	H								x			
Cape Teal	*Anas capensis*	3	0	-	-		x	L			x	x				x			

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during surveys	Likelihood of regular occurrence	Habitat							Impacts			
		SABAp2 full protocol reporting rate	SABAp2 Ad hoc protocol reporting rate	Global status	Regional status	IBA trigger species			Grassland	Drainage lines and wetlands	Dams	Pans	Alien trees	HV lines	Agriculture	Collisions: Powerline	Displacement: Disturbance	Displacement: Habitat transformation	Electrocutions: Substation and MV lines
Cape Vulture	*Gyps coprotheres*	0	0	EN	EN		x	L	x			x	x	x	x	x			x
Common Buzzard	*Buteo buteo*	28	9.3	-	-		x	H	x				x	x					x
Common Moorhen	*Gallinula chloropus*	33	1.8	-	-		x	H			x								
Denham's Bustard	*Neotis denhami*	1.8	0	NT	VU			L	x						x	x	x	x	
Egyptian Goose	*Alopochen aegyptiaca*	78	6.2	-	-		x	H			x	x			x	x			
Fulvous Whistling Duck	*Dendrocygna bicolor*	0	0.4	-	-			L								x			
Glossy Ibis	*Plegadis falcinellus*	4.2	1.8	-	-			M		x						x			
Goliath Heron	*Ardea goliath*	2.4	0	-	-			L			x					x			
Great Egret	*Ardea alba*	7.9	1.3	-	-			M		x	x					x			
Greater Flamingo	*Phoenicopterus roseus*	3.6	4.4	-	NT		x	M				x				x			
Grey Crowned Crane	*Balearica regulorum*	5.5	0	EN	EN		x	M	x	x		x	x		x	x	x	x	
Grey Heron	*Ardea cinerea*	25	3.5	-	-		x	H			x					x			
Hadada Ibis	*Bostrychia hagedash*	90	14	-	-		x	H	x	x			x			x			x
Hamerkop	*Scopus umbretta*	12	0	-	-		x	H		x	x	x				x			
Helmeted Guineafowl	*Numida meleagris*	49	3.1	-	-		x	H	x				x		x		x	x	x
Intermediate Egret	*Ardea intermedia*	14	1.8	-	-		x	H		x	x					x			
Jackal Buzzard	*Buteo rufofuscus*	19	2.2	-	-		x	H	x				x	x					x
Lanner Falcon	*Falco biarmicus*	7.3	0	-	VU		x	M	x			x	x	x	x				x
Lesser Flamingo	*Phoeniconaias minor*	3.6	1.3	NT	NT		x	M				x				x			
Little Egret	*Egretta garzetta*	4.2	1.3	-	-			H		x	x					x			
Little Grebe	*Tachybaptus ruficollis*	39	3.1	-	-		x	H			x					x			
Long-crested Eagle	*Lophaetus occipitalis*	6.7	9.3	-	-		x	M	x				x	x					x
Mallard	*Anas platyrhynchos*	0.6	0.4	-	-			L			x	x				x			
Marsh Owl	*Asio capensis*	5.5	0.4	-	-		x	M	x	x						x	x	x	x
Martial Eagle	*Polemaetus bellicosus*	2.4	0	EN	EN		x	L	x			x	x	x	x				x
Montagu's Harrier	*Circus pygargus*	1.2	0	-	-			L	x						x				
Northern Black Korhaan	*Afrotis afraoides*	0.6	0	-	-			L	x						x	x	x	x	
Peregrine Falcon	*Falco peregrinus*	1.2	0	-	-		x	L	x			x	x	x	x				x
Pied Crow	*Corvus albus*	12	3.5	-	-		x	H	x				x	x					x
Purple Heron	*Ardea purpurea*	4.2	0	-	-			M			x					x			

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during surveys	Likelihood of regular occurrence	Habitat							Impacts			
		SABAp2 full protocol reporting rate	SABAp2 Ad hoc protocol reporting rate	Global status	Regional status	IBA trigger species			Grassland	Drainage lines and wetlands	Dams	Pans	Alien trees	HV lines	Agriculture	Collisions: Powerline	Displacement: Disturbance	Displacement: Habitat transformation	Electrocutions: Substation and MV lines
Red-billed Teal	*Anas erythrorhyncha*	17	1.3	-	-		x	H			x					x			
Red-knobbed Coot	*Fulica cristata*	58	4.8	-	-		x	H			x	x				x			
Reed Cormorant	*Microcarbo africanus*	64	4.8	-	-		x	H			x		x			x			
Rock Kestrel	*Falco rupicolus*	5.5	0.9	-	-		x	M					x	x					
Secretarybird	*Sagittarius serpentarius*	13	0	EN	VU		x	H	x			x	x			x	x	x	
South African Shelduck	*Tadorna cana*	30	3.5	-	-		x	H			x	x				x			
Southern Bald Ibis	*Geronticus calvus*	23	3.1	VU	VU		x	H	x				x	x	x	x			x
Southern Pochard	*Netta erythrophthalma*	9.1	0	-	-		x	M			x					x			
Spotted Eagle-Owl	*Bubo africanus*	9.1	0.9	-	-		x	M	x				x			x	x	x	x
Spur-winged Goose	*Plectropterus gambensis*	44	1.8	-	-		x	H			x				x	x			
Squacco Heron	*Ardeola ralloides*	1.2	0	-	-			L			x					x			
Wattled Crane	*Grus carunculata*	0.6	0	VU	CR			L		x					x	x			
Western Barn Owl	*Tyto alba*	3	0.4	-	-			M	x				x			x			x
Western Cattle Egret	*Bubulcus ibis*	45	12	-	-		x	H	x				x			x			
Western Osprey	*Pandion haliaetus*	0.6	0	-	-			L			x		x	x					x
White Stork	*Ciconia ciconia*	7.3	1.3	-	-		x	M	x		x					x			
White-backed Duck	*Thalassornis leuconotus*	6.7	0	-	-		x	M								x			
White-bellied Bustard	*Eupodotis senegalensis*	7.9	0	-	VU		x	M	x							x	x	x	
White-breasted Cormorant	*Phalacrocorax lucidus*	12	0.9	-	-		x	H			x		x			x			
White-faced Whistling Duck	*Dendrocygna viduata*	0.6	0	-	-			L								x			
Yellow-billed Duck	*Anas undulata*	62	4.4	-	-		x	H								x			
Yellow-billed Kite	*Milvus aegyptius*	2.4	0	-	-		x	L	x			x	x		x				x

6.6.2 Pre-construction monitoring

Table 55, and Figure 5 6 and 7 below present the results of the integrated pre-construction monitoring conducted at the Camden I project area and control area. Monitoring was conducted by means of drive transect counts, walk transect counts, vantage point watches, and focal point counts (see Appendix 3 for more detail on the methodology) as per the requirements of the latest avifaunal guideline at the time of writing. Monitoring was implemented in the following time slots:

1. 26 July - 07 August 2020
2. 16 - 30 September 2020
3. 02 - 08 October 2020
4. 20 - 21 March , 12 - 15 April and 3 - 13 May 2021

6.6.2.1 Transects

The results of the transect counts are tabled in Table 5 below:

Table 5: The results of the transect counts

Turbine site	Number of records
Species composition	
All Species	129
Wind Priority Species (11%)	14
Non-Priority Species	115
Total count	
Drive transects	2282
Walk transects	3946
Total	6228
Control site	Number of records
Species composition	
All Species	118
Wind Priority Species (10%)	12
Non-Priority Species	106
Total count	
Drive transects	2776
Walk transects	1993
Total	4769

An Index of Kilometric Abundance (IKA = birds/km) was calculated for each wind priority species recorded during transects over all four seasons (see Figures 6 and 7 below).

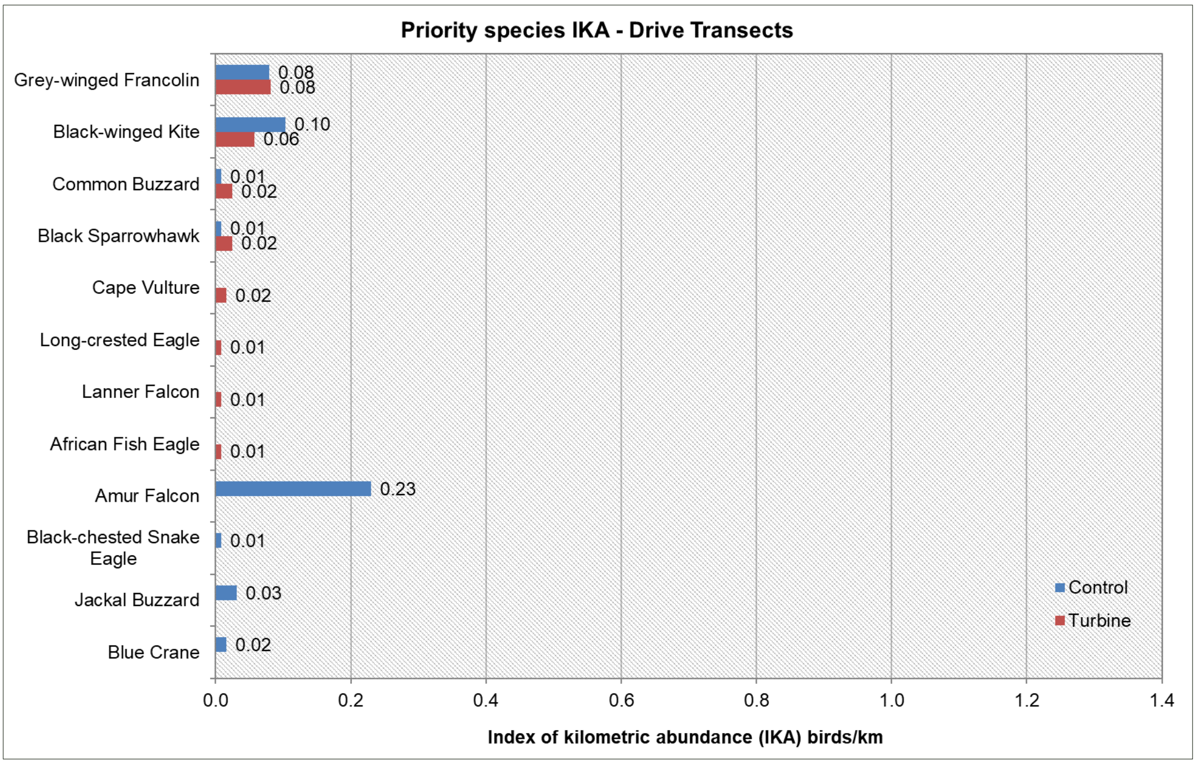


Figure 5: Index of kilometric abundance of wind priority species recorded at the project area and control site through drive transect surveys over all four seasons.

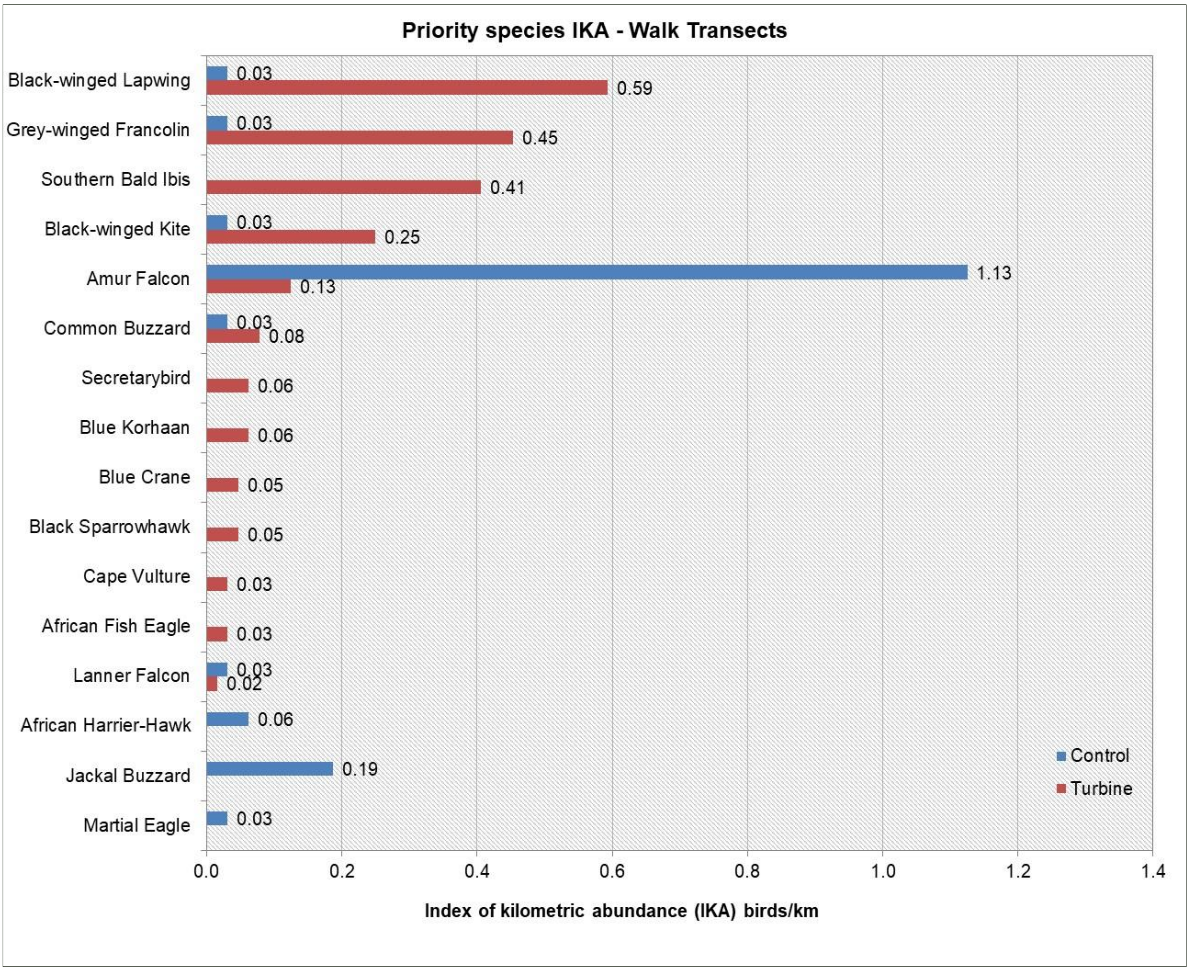


Figure 6: Index of kilometric abundance of wind priority species recorded at the WEF through walk transect surveys over all four seasons.

Figure 7**8** below shows the spatial distribution of the wind priority species recorded during transect counts and incidental sightings over all four seasons.

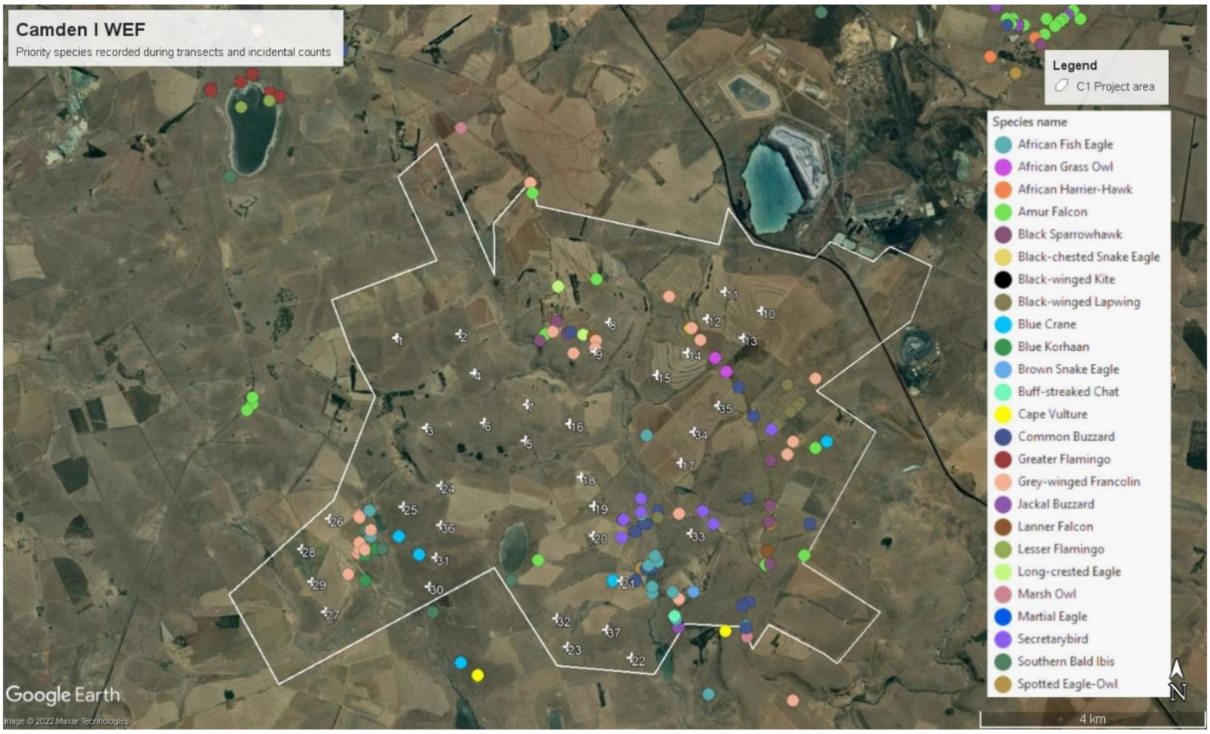


Figure 7: The location of wind priority species recorded at the proposed WEF through transect counts and incidental sightings.

6.6.2.2 Focal points

A total of three potential focal points (FPs) of bird activity were identified and monitored. The focal points are as follows:

- FP1: A farm dam in a drainage line in the project area
- FP2: A large salt pan in the project area
- FP3: A large pan situated approximately 3.6km north-west of the project area on the farm Rietspruit 437 IS.

A total of 1 462 birds were counted at the focal points over four seasons during three counts. The results of focal point counts are displayed in Table 6. SCC are indicated in red

Table 6: Species recorded during focal points counts in the 12 months pre-construction monitoring period. Wind priority species are indicated with a (w). Powerline sensitive species are indicated with a (p).

Focal point	Species
FP1: A farm dam in a drainage line in the project area	African Darter (p) African Fish Eagle (w, p) African Rail African Sacred Ibis (p) African Swamphen Black Crake Blacksmith Lapwing

	Brown-throated Martin Cape Wagtail Cape Weaver Common Buzzard (w, p) Common Moorhen Common Waxbill Egyptian Goose (p) Hamerkop (p) Lesser Swamp Warbler Levaillant's Cisticola Little Grebe (p) Little Rush Warbler Malachite Kingfisher Pied Kingfisher Red-billed Teal (p) Red-knobbed Coot (p) Reed Cormorant (p) South African Shelduck (p) Southern Masked Weaver Southern Red Bishop Spur-winged Goose (p) Western Cattle Egret (p) White-breasted Cormorant (p) Yellow-billed Duck(p)
FP2: A large salt pan in the project area	African Spoonbill (p) Blacksmith Lapwing Black-winged Stilt Cape Shoveler (p) Cape Wagtail Common Greenshank (p) Crowned Lapwing Egyptian Goose (p) Grey Heron (p) Kittlitz's Plover Little Grebe (p) Pied Avocet Red-billed Teal (p) Red-knobbed Coot (p) South African Shelduck(p) Yellow-billed Duck (p)
FP3: A large pan situated approximately 3.6km north-west of the project area on the farm Rietspruit 437 IS.	Blacksmith Lapwing Black-winged Stilt Cape Shoveler (p) Cape Teal (p) Egyptian Goose (p) Greater Flamingo (w, p) Kittlitz's Plover Lesser Flamingo (w, p)

	Pied Avocet South African Shelduck (p) Southern Bald Ibis (w. p) Three-banded Plover

See Appendix 2 for the location of the focal points.

6.6.2.3 Incidental counts

Table 77 provides an overview of the incidental sightings of priority species during four surveys in the project area and immediate surroundings.

Table 7: Incidental sightings of wind priority species made during 12 months pre-construction monitoring. SCC are indicated in red.

Bird name	Status	Survey 1	Survey 2	Survey 3	Survey 4	Grand total
Black-winged Kite		7	13	4	6	**30**
Common Buzzard			2	20	3	**25**
Southern Bald Ibis	Regionally Vulnerable	11	2	7		**20**
Amur Falcon				12		**12**
Grey-winged Francolin		2	2	5	3	**12**
Secretarybird	Globally Endangered, Regionally Vulnerable	1	4	6	1	**12**
African Fish Eagle		5	1	1	3	**10**
Jackal Buzzard		1	3	4	2	**10**
Blue Crane	Globally Vulnerable, Regionally near-threatened	4	3	1		**8**
Long-crested Eagle		1		3	3	**7**
Spotted Eagle-Owl		1	2	4		**7**
Black Sparrowhawk			3	3		**6**
Grey Crowned Crane	Globally and Regionally Endangered	3	3			**6**
White-bellied Bustard	Regionally Vulnerable	2	4			**6**
Black-winged Lapwing		1	1	1	2	**5**
African Harrier-Hawk		1		2		**3**
Black-chested Snake Eagle				3		**3**
Greater Flamingo	Regionally near-threatened	2		1		**3**
Lesser Flamingo	Globally and Regionally near-threatened	2		1		**3**
Marsh Owl		1		2		**3**
White Stork				3		**3**
African Grass Owl	Regionally Vulnerable		1	1		**2**
Black-rumped Buttonquail			1			**1**
Blue Korhaan	Regionally near-threatened		1			**1**
Lanner Falcon	Regionally Vulnerable			1		**1**
Martial Eagle	Globally and Regionally Endangered			1		**1**
Peregrine Falcon				1		**1**
Buff-streaked Chat					1	**1**
Brown Snake Eagle					1	**1**
Cape Vulture	Globally Vulnerable, Regionally Endangered				1	**1**

See Appendix 1 for a list of all species recorded during the pre-construction monitoring.

6.6.2.4 Vantage point observations

A total of 192 hours of vantage point watches were completed at four vantage points in order to record flight patterns of priority species in the project area. In the four sampling periods, the duration of priority species flights amounted to 7 hours, 27 minutes and 16 seconds. A total of 306 individual flights were recorded. The passage rate for priority species was 1.1 birds/hour. This amounts to approximately 14.5 birds per day.[3] See Figure 8**9** below for the duration of flights for each priority species.[4]

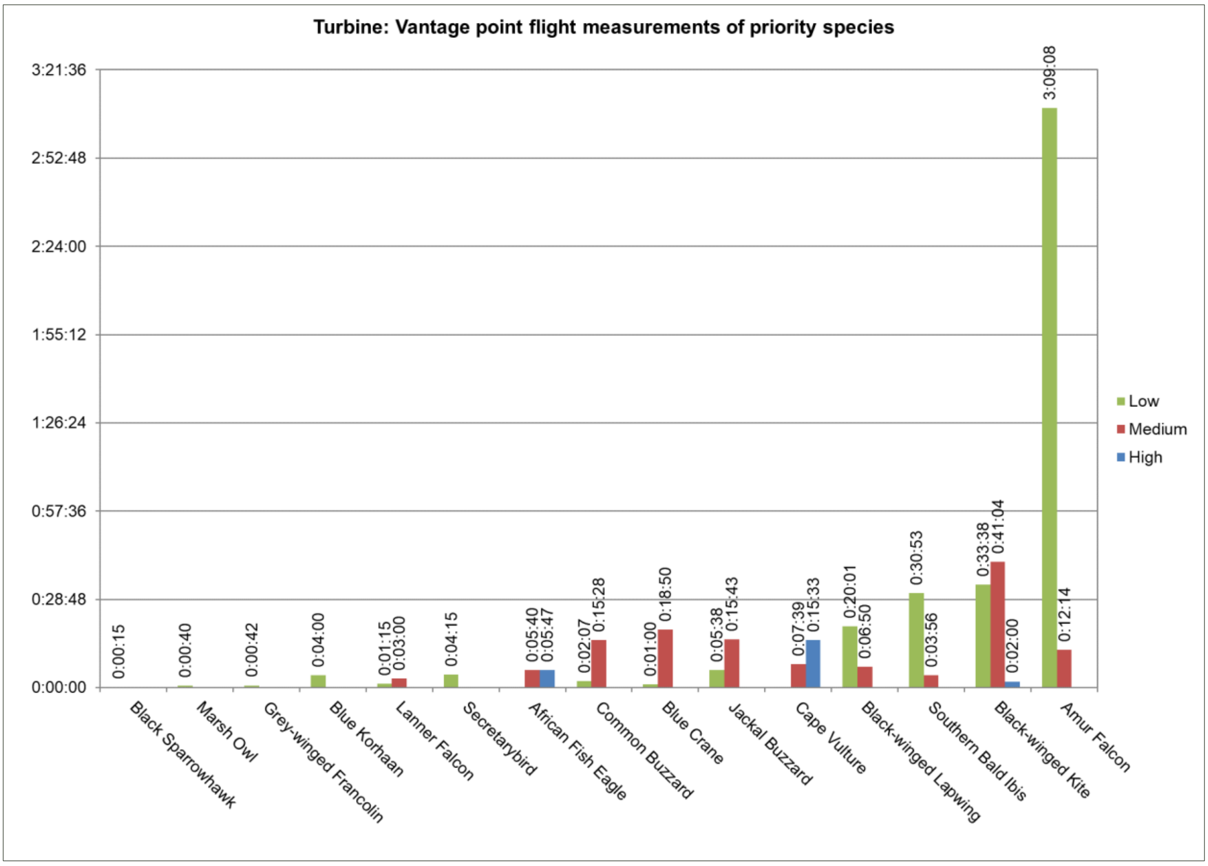


Figure 8: Flight times and altitude recorded for priority species

6.6.2.5 *Site specific collision risk rating*

A site-specific collision risk rating for each priority species recorded during VP watches was calculated to give an indication of the likelihood of an individual of the specific species to collide with the turbines at these sites. This was calculated taking into account the following factors:

- The duration of rotor altitude flights;

[3] Assuming 13 hours daylight averaged over all four seasons.

[4] Flight duration was calculated by multiplying the flight time with the number of individuals in the flight e.g., if the flight time was 30 seconds and it contained two individuals, the flight duration was 30 seconds x 2 = 60 seconds.

- The susceptibility to collisions, based on morphology (size) and behaviour (soaring, predatory, ranging behaviour, flocking behaviour, night flying, aerial display and habitat preference) using the ratings for priority species in the Avian Wind Farm Sensitivity Map of South Africa (Retief *et al*., 2012); and
- The number of turbines.

This was done in order to gain a rough indication of which species are likely to be most at risk of collision. The formula used is as follows[5]:

Duration of rotor altitude flights x collision ratings in the Avian Wind Farm Sensitivity Map x number of turbines ÷100.

The results are presented in Table 87 and Figure 910 below.

Table 8: Site specific collision risk rating

Species	Duration of rotor altitude flights (hr)	Avian Wind Farm Sensitivity Map collision susceptibility rating	Site specific collision risk rating
Blue Korhaan	0.00	70	0.00
Marsh Owl	0.00	65	0.00
Grey-winged Francolin	0.00	55	0.00
Black Sparrowhawk	0.00	55	0.00
Secretarybird	0.00	95	0.00
Lanner Falcon	0.00	85	0.08
Southern Bald Ibis	0.00	90	0.12
Black-winged Lapwing	0.00	57	0.13
African Fish Eagle	0.00	115	0.21
Amur Falcon	0.01	75	0.30
Cape Vulture	0.01	120	0.30
Common Buzzard	0.01	75	0.38
Jackal Buzzard	0.01	95	0.49
Blue Crane	0.01	85	0.52
Black-winged Kite	0.03	57	0.76
Average	0.01	79.6	0.22

[5] It is important to note that the formula does not incorporate avoidance behaviour. This may differ between species and may have a significant impact on the size of the risk associated with a specific species. It is generally assumed that 95-98% of bird flights will successfully avoid the turbines (SNH, 2010).

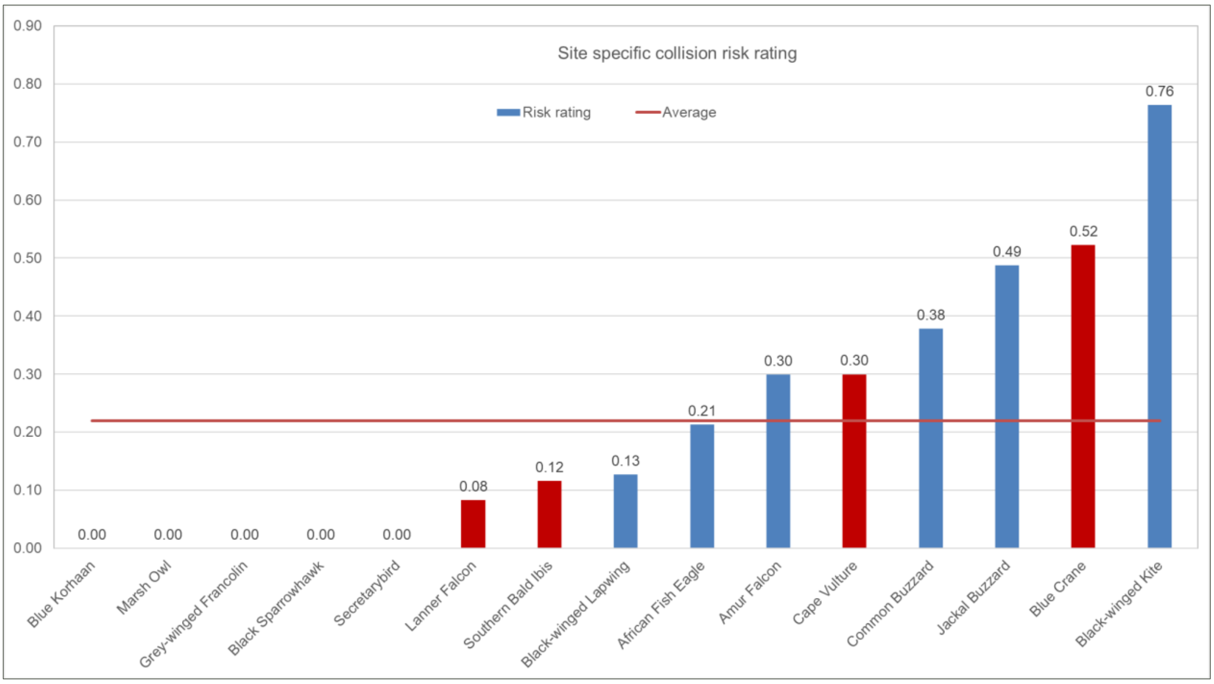


Figure 9: Site specific collision risk rating for priority species. The red line indicates the average collision risk rating for priority species at the development site, based on recorded flight behaviour in four surveys. Species of conservation concern are indicated with red bars.

6.6.2.6 Spatial distribution of flights over the turbine area

Flight maps were prepared for the SCC, indicating the spatial distribution of flights observed from the various vantage points. This was done by overlaying a 100m x 100m grid over the survey area. Each grid cell was then given a weighting score (i.e., Very High; High; Medium; Low) taking into account the flight intensity i.e., the duration and distance of individual flight lines through a grid cell and the number of individual birds associated with each flight crossing the grid cell, in order to give an indication where the observed flight activity was most concentrated (see Appendix 4).

7 IMPACT ASSESSMENT

7.1 Wind Energy Facility

The effects of a wind farm on birds are highly variable and depend on a wide range of factors, including the specification of the development, the topography of the surrounding land, the habitats affected and the number and species of birds present. With so many variables involved, the impacts of each wind farm must be assessed individually. The principal areas of concern with regard to effects on birds are listed below. Each of these potential effects can interact with each other, either increasing the overall impact on birds or, in some cases, reducing a particular impact (for example where habitat loss or displacement causes a reduction in birds using an area which might then reduce the risk of collision):

- Mortality of priority avifauna due to collisions with the wind turbines
- Displacement of priority avifauna due to disturbance during construction and operation of the wind farm
- Displacement of priority avifauna due to habitat change and loss at the wind farm
- Mortality of priority avifauna due to electrocution on the medium voltage overhead lines

- Mortality of priority avifauna due to collisions with the medium voltage overhead lines

It should be noted that the assessment is made on the *status quo* as it is currently on site. The possible change in land use in the broader development site is not taken into account because the extent and nature of future developments (not only wind energy development) are unknown at this stage. It is possible that there could be changes in the foreseeable future in the form of mining.

7.1.1 Collision mortality on wind turbines[6]

Wind energy generation has experienced rapid worldwide development over recent decades as its environmental impacts are considered to be relatively lower than those caused by traditional energy sources, with reduced environmental pollution and water consumption (Saidur *et al.*, 2011). However, bird fatalities due to collisions with wind turbines have been consistently identified as a main ecological drawback to wind energy (Drewitt and Langston, 2006).

Collisions with wind turbines appear to kill fewer birds than collisions with other man-made infrastructure, such as power lines, buildings or even traffic (Calvert *et al.* 2013; Erickson *et al.* 2005). Nevertheless, estimates of bird deaths from collisions with wind turbines worldwide range from 0 to almost 40 deaths per turbine per year (Sovacool, 2009). The number of birds killed varies greatly between sites, with some sites posing a higher collision risk than others, and with some species being more vulnerable (e.g. Hull *et al.* 2013; May *et al.* 2012a). These numbers may not reflect the true magnitude of the problem, as some studies do not account for detectability biases such as those caused by scavenging, searching efficiency and search radius (Bernardino *et al.* 2013; Erickson *et al.* 2005; Huso and Dalthorp 2014). Additionally, even for low fatality rates, collisions with wind turbines may have a disproportionate effect on some species. For long-lived species with low productivity and slow maturation rates (e.g. raptors), even low mortality rates can have a significant impact at the population level (e.g. Carrete *et al.* 2009; De Lucas *et al.* 2012a; Drewitt and Langston, 2006). The situation is even more critical for species of conservation concern, which sometimes are most at risk (e.g. Osborn *et al.* 1998).

High bird fatality rates at several wind farms have raised concerns among the industry and scientific community. High profile examples include the Altamont Pass Wind Resource Area (APWRA) in California because of high fatality of Golden eagles (*Aquila chrysaetos*), Tarifa in Southern Spain for Griffon vultures (*Gyps fulvus*), Smøla in Norway for White-tailed eagles (*Haliaatus albicilla*), and the port of Zeebrugge in Belgium for gulls (*Larus* sp.) and terns (*Sterna* sp.) (Barrios and Rodríguez, 2004; Drewitt and Langston, 2006; Everaert and Stienen, 2008; May *et al.* 2012a; Thelander *et al.* 2003). Due to their specific features and location, and characteristics of their bird communities, these wind farms have been responsible for a large number of fatalities that culminated in the deployment of additional measures to minimize or compensate for bird collisions. However, currently, no simple formula can be applied to all sites; in fact, mitigation measures must inevitably be defined according to the characteristics of each wind farm and the diversity of species occurring there (Hull *et al.* 2013; May *et al.* 2012b). An understanding of the factors that explain bird collision risk and how they interact with one another is therefore crucial to proposing and implementing valid mitigation measures.

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[6] This section is based largely on a (2014) review paper by Ana Teresa Marques, Helena Batalha, Sandra Rodrigues, Hugo Costa, Maria João Ramos Pereira,Carlos Fonseca, Miguel Mascarenhas, Joana Bernardino. *Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies*. Biological Conservation 179 (2014) 40– 52.

7.1.1.1 Species-specific factors

- Morphological features

Certain morphological traits of birds, especially those related to size, are known to influence collision risk with structures such as power lines and wind turbines. Janss (2000) identified weight, wing length, tail length and total bird length as being collision risk determinant. Wing loading (ratio of body weight to wing area) and aspect ratio (ratio of wing span squared to wing area) are particularly relevant, as they influence flight type and thus collision risk (Bevanger, 1994; De Lucas *et al.* 2008; Herrera-Alsina *et al.* 2013; Janss, 2000). Birds with high wing loading, such as the Griffon Vulture (*Gyps fulvus*), seem to collide more frequently with wind turbines at the same sites than birds with lower wing loadings, such as Common Buzzards (*Buteo buteo*) and Short-toed Eagles (*Circaetus gallicus*), and this pattern is not related with their local abundance (Barrios and Rodríguez, 2004; De Lucas *et al.* 2008). High wing-loading is associated with low flight manoeuvrability (De Lucas *et al.* 2008), which determines whether a bird can escape an encountered object fast enough to avoid collision.

Information on the wing loading of the priority species potentially occurring regularly at the proposed Camden 1 Wind Energy Facility was not available at the time of writing. However, based on general observations, and research on related species, it can be confidently assumed that priority species that could potentially be vulnerable to wind turbine collisions due to morphological features (high wing loading) are bustards, cranes, flamingos and vultures, making them less manoeuvrable (Keskin et al. 2019).

- Sensorial perception

Birds are assumed to have excellent visual acuity, but this assumption is contradicted by the large numbers of birds killed by collisions with man-made structures (Drewitt and Langston, 2008; Erickson *et al.* 2005). A common explanation is that birds collide more often with these structures in conditions of low visibility, but recent studies have shown that this is not always the case (Krijgsveld *et al.* 2009). The visual acuity of birds seems to be slightly superior to that of other vertebrates (Martin, 2011; McIsaac, 2001). Unlike humans, who have a broad horizontal binocular field of 120°, some birds have two high acuity areas that overlap in a very narrow horizontal binocular field (Martin, 2011). Relatively small frontal binocular fields have been described for several species that are particularly vulnerable to power line collisions, such as vultures (Gyps sp.) cranes and bustards (Martin and Katzir, 1999; Martin et.al, 2010; Martin, 2012, 2011; O'Rourke *et al.* 2010). Furthermore, for some species, their high resolution vision areas are often found in the lateral fields of view, rather than frontally (e.g. Martin et.al, 2010; Martin, 2012, 2011; O'Rourke *et al.* 2010). Finally, some birds tend to look downwards when in flight, searching for conspecifics or food, which puts the direction of flight completely inside the blind zone of some species (Martin et.al, 2010; Martin, 2011).

Some of the regularly occurring priority species at the proposed Camden 1 Wind Energy Facility have high resolution vision areas found in the lateral fields of view, rather than frontally, e.g., the vultures, bustards and cranes. The exceptions to this are the priority raptors which all have wider binocular fields, although as pointed out by Martin (2011, 2012), this does not necessarily result in these species being able to avoid obstacles better.

- Phenology

Recent studies have shown that, within a wind farm, raptor collision risk and fatalities are higher for resident than for migrating birds of the same species. An explanation for this may be that resident birds generally use the wind farm area several times while a migrant bird crosses it just once (Krijgsveld *et al.* 2009). However, other factors like bird behaviour are certainly relevant. Katzner *et al.* (2012) showed that Golden Eagles performing local movements fly at lower altitudes, putting them at a greater risk of collision than migratory eagles. Resident eagles flew more frequently over cliffs and steep slopes, using low altitude slope updrafts, while migratory eagles flew more frequently over flat areas and gentle slopes where thermals are generated, enabling the birds to use them to gain lift and fly at higher altitudes.

South Africa is at the end of the migration path for summer migrants; therefore, the phenomenon of migratory flyways where birds are concentrated in large numbers for a limited period of time, e.g. the African Rift Valley or Mediterranean Red Sea flyways, is not a feature of the national landscape. The migratory priority species which could occur at the proposed Camden 1 Wind Energy Facility with some regularity, e.g., White Stork, Amur Falcon and Common Buzzard will behave much the same as the resident birds once they arrive in the area. The same is valid for local migrants such as the Denham's Bustard, Lesser Flamingo and Greater Flamingo. It is expected that, for the period when they are present, these species will be exposed to the same risks as resident species.

- Bird behaviour

Flight type seems to play an important role in collision risk, especially when associated with hunting and foraging strategies. Kiting flight (hanging in the wind with almost motionless wings), which is used in strong winds and occurs in rotor swept zones, has been highlighted as a factor explaining the high collision rate of Red-tailed Hawks *Buteo jamaicensis* at APWRA (Hoover and Morrison, 2005), and could also be a factor in contributing to the high collision rate for Jackal Buzzards in South Africa (Ralston-Paton & Camagu 2019). The hovering behaviour exhibited by Common Kestrels *Falco tinnunculus* when hunting may also explain the fatality levels of this species at wind farms in the Strait of Gibraltar (Barrios and Rodríguez, 2004). This may also explain the high mortality rate of Rock Kestrels *Falco rupicolus* at wind farms in South Africa (Ralston-Paton & Camagu 2019). Kiting and hovering are associated with strong winds, which often produce unpredictable gusts that may suddenly change a bird's position (Hoover and Morrison, 2005). Additionally, while birds are hunting and focused on prey, they might lose track of wind turbine positions (Krijgsveld *et al.* 2009; Smallwood *et al.* 2009). In the case of raptors, aggressive interactions may play an important role in turbine fatalities, in that birds involved in these interactions are momentarily distracted, putting them at risk. At least one eye-witness account of a Martial Eagle getting killed by a turbine in South Africa in this fashion is on record (Simmons & Martins 2016).

Social behaviour may also result in a greater collision risk with wind turbines due to a decreased awareness of the surroundings. Several authors have reported that flocking behaviour increases collision risk with power lines as opposed to solitary flights (e.g. Janss, 2000). However, caution must be exercised when comparing the particularities of wind farms with power lines, as some species appear to be vulnerable to collisions with power lines but not with wind turbines, e.g. indications are that bustards, which are highly vulnerable to power line collisions, are not prone to wind turbine collisions – a Spanish database of over 7000 recorded turbine collisions contains no Great Bustards *Otis tarda* (A. Camiña 2012a). Similarly, in South Africa, very few bustard collisions with wind turbines have been reported to date, all Ludwig's Bustards (Ralston-Paton & Camagu 2019). No Denham's Bustards *Neotis denhami* turbine fatalities have been reported to date, despite the species occurring at several wind farm sites.

The priority species which could occur with some regularity at the proposed Camden 1 Wind Energy Facility can be classified as either terrestrial species, soaring species or occasional long-distance fliers. Terrestrial species spend most of the time foraging on the ground. They do not fly often and when they do, they generally fly for short distances at low to medium altitude. At the application site bustards and korhaans are included in this category. Occasional long-distance fliers generally behave as terrestrial species but can and do undertake long distance flights on occasion. Species in this category are White Stork, Denham's Bustard, Blue Crane, Grey Crowned Crane, Southern Bald Ibis, Secretarybird and Greater and Lesser Flamingo. Soaring species spend a significant time on the wing in a variety of flight modes including soaring, kiting, hovering, and gliding at medium to high altitudes. At the project site, these include all the raptors and vultures.

- Avoidance behaviours

Two types of avoidance have been described (Furness *et al.*, 2013): 'macro-avoidance' whereby birds alter their flight path to keep clear of the entire wind farm (e.g. Desholm and Kahlert, 2005; Plonczkier and Simms, 2012; Villegas-Patraca *et al.* 2014), and 'micro-avoidance' whereby birds enter the wind farm but take evasive actions to avoid individual wind turbines (Band *et al.* 2007). This may differ between species and may have a significant impact on the size of the risk associated with a specific species. It is generally assumed that 95-98% of birds will successfully avoid the turbines (SNH 2010).

It is anticipated that most birds at the proposed Camden 1 Wind Energy Facility will avoid the wind turbines, as is generally the case at all wind farms (SNH 2010). Exceptions already mentioned are raptors that engage in hunting which might serve to distract them and place them at risk of collision, birds engaged in display behaviour or inter- and intraspecific aggressive interaction. Complete macro-avoidance of the wind farm is unlikely for any of the priority species likely to occur at the proposed WEF.

- Bird abundance

Some authors suggest that fatality rates are related to bird abundance, density or utilization rates (Carrete *et al.* 2012; Kitano and Shiraki, 2013; Smallwood and Karas, 2009), whereas others point out that, as birds use their territories in a non-random way, fatality rates do not depend on bird abundance alone (e.g. Ferrer *et al.* 2012; Hull *et al.* 2013). Instead, fatality rates depend on other factors such as differential use of specific areas within a wind farm (De Lucas *et al.* 2008). For example, at Smøla, White-tailed Eagle flight activity is correlated with collision fatalities (Dahl *et al.* 2013). In the APWRA, Golden Eagles, Red-tailed Hawks and American Kestrels (*Falco spaverius*) have higher collision fatality rates than Turkey Vultures (*Cathartes aura*) and Common Raven (*Corvus corax*), even though the latter are more abundant in the area (Smallwood *et al.* 2009), indicating that fatalities are more influenced by each species' flight behaviour and turbine perception. Also, in southern Spain, bird fatality was higher in the winter, even though bird abundance was higher during the pre-breeding season (De Lucas *et al.* 2008).

The abundance of priority species at the proposed Camden 1 Wind Energy Facility will fluctuate depending on the season of the year. Greater numbers are expected during the rainy season, when foraging conditions are better and certain migratory species are present.

7.1.1.2 Site-specific factors

- Landscape features

Susceptibility to collision can also heavily depend on landscape features at a wind farm site, particularly for soaring birds that predominantly rely on wind updrafts to fly. Some landforms such as ridges, steep slopes and valleys may be more frequently used by some birds, for example for hunting or during migration (Barrios and Rodríguez, 2004; Drewitt and Langston, 2008; Katzner *et al.* 2012; Thelander *et al.* 2003). In APWRA, Red-tailed Hawk fatalities occur more frequently than expected by chance at wind turbines located on ridge tops and swales, whereas Golden Eagle fatalities are higher at wind turbines located on slopes (Thelander *et al.* 2003). Other birds may follow other landscape features, such as peninsulas and shorelines, during dispersal and migration periods. Kitano and Shiraki (2013) found that the collision rate of White-tailed Eagles along a coastal cliff was extremely high, suggesting an effect of these landscape features on fatality rates.

The project site does not contain many landscape features as it is situated on a slightly undulating plain. The most significant landscape features from a collision risk perspective are the large pans. Pans attract many birds, including Red List species such as Greater Flamingo, Lesser Flamingo, Martial Eagle, Cape Vulture and Secretarybird.

- Flight paths

For territorial raptors like Golden Eagles (and Verreaux's Eagles – see Ralston-Patton 2017)), foraging areas are preferably located near to the nest, when compared to the rest of their home range. For example, in Scotland 98% of Golden Eagle movements were registered at ranges less than 6 km from the nest, and the core areas were located within a 2 - 3 km radius (McGrady *et al.* 2002). These results, combined with the terrain features selected by Golden Eagles to forage such as areas close to ridges, can be used to predict the areas used by the species to forage (McLeod *et al.* 2002), and therefore provide a sensitivity map and guidance to the development of new wind farms (Bright *et al.* 2006).

The pans are likely to act as a focal point for flight activity as birds converge on the pan, e.g. Blue Crane to roost and flamingos to forage. Several raptor species and Cape Vultures may also use the pans intermittently for bathing and drinking.

- Food availability

Factors that increase the use of a certain area or that attract birds, like food availability; also play a role in collision risk. For example, the high density of raptors at the APWRA and the high collision fatality due to collision with turbines is thought to result, at least in part, from high prey availability in certain areas (Hoover and Morrison, 2005; Smallwood *et al.* 2001). This may be particularly relevant for birds that are less aware of obstructions such as wind turbines while foraging (Krijgsveld *et al.* 2009;

Smallwood *et al.* 2009). It is speculated that the mortality of three Verreaux's Eagles in 2015 at a wind farm site in South Africa may have been linked to the availability of food (Smallie 2015).

The agricultural activity is an attractant for Southern Bald Ibis.

7.1.1.3 Summary of turbine collision risk

The proposed Camden 1 Wind Energy Facility will pose a collision risk to several priority species which could occur regularly at the site. Species exposed to this risk are large terrestrial species and occasional long distance fliers i.e., bustards, cranes, flamingos, storks, Southern Bald Ibis and Secretarybird, although bustards and cranes generally seem to be not as vulnerable to turbine collisions as was originally anticipated (Ralston-Paton & Camagu 2019). Soaring priority species, i.e., species such as Cape Vulture and a variety of raptors, including several species of eagles, are highly vulnerable to the risk of collisions. The following priority species could be at risk of collisions with the turbines: Common Buzzard, Jackal Buzzard, Blue Crane, Brown Snake Eagle, Black-chested Snake Eagle, Long-crested Eagle, Martial Eagle, Peregrine Falcon, Lanner Falcon, Greater Flamingo, Lesser Flamingo, Montagu's Harrier, African Marsh Harrier, Black Harrier, African Harrier-Hawk, Cape Vulture, Secretarybird, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Wattled Crane, Grey Crowned Crane, African Fish Eagle, Spotted Eagle-Owl, Amur Falcon, Grey-winged Francolin, Southern Bald Ibis, Black-winged Kite, Northern Black Korhaan, Blue Korhaan, Black-winged Lapwing, Western Osprey, Marsh Owl, African Grass Owl, Black Sparrowhawk and White Stork.

7.1.2 Displacement due to disturbance

The displacement of birds from areas within and surrounding wind farms due to visual intrusion and disturbance in effect can amount to habitat loss. Displacement may occur during both the construction and operation phases of wind farms and may be caused by the presence of the turbines themselves through visual, noise and vibration impacts, or as a result of vehicle and personnel movements related to site maintenance. The scale and degree of disturbance will vary according to site- and species-specific factors and must be assessed on a site-by-site basis (Drewitt & Langston 2006).

Unfortunately, few studies of displacement due to disturbance are conclusive, often because of the lack of before- and-after and control-impact (BACI) assessments. Indications are that Great Bustard *Otis tarda* could be displaced by wind farms up to one kilometre from the facility (Langgemach 2008). An Austrian study found displacement for Great Bustards up to 600m (Wurm & Kollar as quoted by Raab *et al.* 2009). However, there is also evidence to the contrary; information on Great Bustard received from Spain points to the possibility of continued use of leks at operational wind farms (Camiña 2012b). The same situation seems to prevail at wind farms in the Eastern Cape where Denham's Bustard are still using wind farm sites as leks.[7] Research on small grassland species in North America indicates that permanent displacement is uncommon and very species specific (e.g. see Stevens et.al 2013, Hale et.al 2014). There also seems to be little evidence for a persistent decline in passerine populations at wind farm sites in the UNITED KINGDOM (despite some evidence of turbine avoidance), with some species, including Skylark, showing increased populations after wind farm construction (see Pierce-Higgins et. al 2012). Populations of Thekla Lark *Galerida theklae* were found to be unaffected by wind farm developments in Southern Spain (see Farfan *et al*. 2009).

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[7] Personal communication by Wessel Rossouw, bird monitor based in Jeffreys Bay, from personal observations in the Kouga municipal area.

The consequences of displacement for breeding productivity and survival are crucial to whether or not there is likely to be a significant impact on population size. However, studies of the impact of wind farms on breeding birds are also largely inconclusive or suggest lower disturbance distances, though this apparent lack of effect may be due to the high site fidelity and long life-span of the breeding species studied. This might mean that the true impacts of disturbance on breeding birds will only be evident in the longer term, when new recruits replace existing breeding birds. Few studies have considered the possibility of displacement for short-lived passerines (such as larks), although Leddy *et al.* (1999) found increased densities of breeding grassland passerines with increased distance from wind turbines, and higher densities in the reference area than within 80m of the turbines. A review of minimum avoidance distances of 11 breeding passerines were found to be generally <100m from a wind turbine ranging from 14 – 93m (Hötker *et al.* 2006). A comparative study of nine wind farms in Scotland (Pearce-Higgens *et al.* 2009) found unequivocal evidence of displacement: Seven of the 12 species studied exhibited significantly lower frequencies of occurrence close to the turbines, after accounting for habitat variation, with equivocal evidence of turbine avoidance in a further two. No species were more likely to occur close to the turbines. Levels of turbine avoidance suggest breeding bird densities may be reduced within a 500m buffer of the turbines by 15– 53%, with Common Buzzard *Buteo buteo*, Hen Harrier *Circus cyaneus*, Golden Plover *Pluvialis apricaria*, Snipe *Gallinago gallinago*, Curlew *Numenius arquata* and Wheatear *Oenanthe oenanthe* most affected. In a follow-up study, monitoring data from wind farms located on unenclosed upland habitats in the United Kingdom were collated to test whether breeding densities of upland birds were reduced as a result of wind farm construction or during wind farm operation. Red Grouse *Lagopus lagopus scoticus*, Snipe *Gallinago gallinago* and Curlew *Numenius arquata* breeding densities all declined on wind farms during construction. Red Grouse breeding densities recovered after construction, but Snipe and Curlew densities did not. Post-construction Curlew breeding densities on wind farms were also significantly lower than reference sites. Conversely, breeding densities of Skylark *Alauda arvensis* and Stonechat *Saxicola torquata* increased on wind farms during construction. Overall, there was little evidence for consistent post-construction population declines in any species, suggesting that wind farm construction can have greater impacts upon birds than wind farm operation (Pierce-Higgens *et al.* 2012).

It is inevitable that a measure of displacement will take place for all priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species in the remaining high-quality grassland, wetlands and wetland fringes the most, as this could temporarily disrupt their reproductive cycle. Some species might be able to recolonise the area after the completion of the construction phase, but for some species, this might only be partially the case, resulting in lower densities than before once the WEF is operational, due to the disturbance factor of the operational turbines, and the habitat fragmentation. In summary, the following species could be impacted by disturbance during the construction phase: Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Grey Crowned Crane, Spotted Eagle-Owl, Grey-winged Francolin, Northern Black Korhaan, Blue Korhaan, Marsh Owl and African Grass Owl.

7.1.3 Displacement due to habitat loss

The scale of permanent habitat loss resulting from the construction of a wind farm and associated infrastructure depends on the size of the project but, in general, it is likely to be small per turbine base. Typically, actual habitat loss amounts to 2–5% of the total development site (Fox *et al.* 2006 as cited by Drewitt & Langston 2006), though effects could be more widespread where developments interfere with hydrological patterns or flows on wetland or peatland sites (unpublished data). Some changes could also be beneficial. For example, habitat changes following the development of the Altamont

Pass wind farm in California led to increased mammal prey availability for some species of raptor (for example through greater availability of burrows for Pocket Gophers *Thomomys bottae* around turbine bases), though this may also have increased collision risk (Thelander *et al.* 2003 as cited by Drewitt & Langston 2006).

However, the results of habitat transformation may be more subtle, whereas the actual footprint of the wind farm may be small in absolute terms, the effects of the habitat fragmentation brought about by the associated infrastructure (e.g. power lines and roads) may be more significant. Sometimes Great Bustard can be seen close to or under power lines, but a study done in Spain (Lane *et al.* 2001 as cited by Raab *et al.* 2009) indicates that the total observation of Great Bustard flocks was significantly higher further from power lines than at control points. Shaw (2013) found that Ludwig's Bustard generally avoid the immediate proximity of roads within a 500m buffer. Bidwell (2004) found that Blue Cranes select nesting sites away from roads. This means that power lines and roads also cause loss and fragmentation of the habitat used by the population in addition to the potential direct mortality. The physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab *et al.* 2010). It has been shown that fragmentation of natural grassland in Mpumalanga (in that case by afforestation) has had a detrimental impact on the densities and diversity of grassland species (Allan *et al.* 1997).

The construction of additional roads is likely to result in further habitat fragmentation, although the site already has a large number of access roads, most of which will be upgraded and utilised for the wind farm development. This, together with the disturbance factor of the operating turbines, could have an effect on the density of several species, particularly larger terrestrial species which would utilise the remaining high quality grassland, wetlands and wetland fringes as breeding habitat. Given the conceptual turbine layout and associated road infra-structure, it is not expected that any priority species will be permanently displaced from the development site, but densities may be reduced. In summary, the following ground living species are likely to be most affected by habitat transformation: Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Northern Black Korhaan, Blue Korhaan, Marsh Owl, African Grass Owl, Black-winged Lapwing and Secretarybird.

7.1.4 Electrocution on the medium voltage network

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2000). The electrocution risk is largely determined by the design of the electrical hardware.

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the electricity could potentially pose an electrocution risk to several power line sensitive species that could on occasion perch on these poles. In summary, the following priority species are potentially vulnerable to electrocution in this manner: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl

Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite

7.1.5 Collisions with the medium voltage network

Collisions are one of the biggest threat posed by overhead lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes, and various species of waterbirds, and to a lesser extent, vultures. 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 transmission lines (Van Rooyen 2004, Anderson 2001).

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to power line collisions in South Africa (see Figure 11).

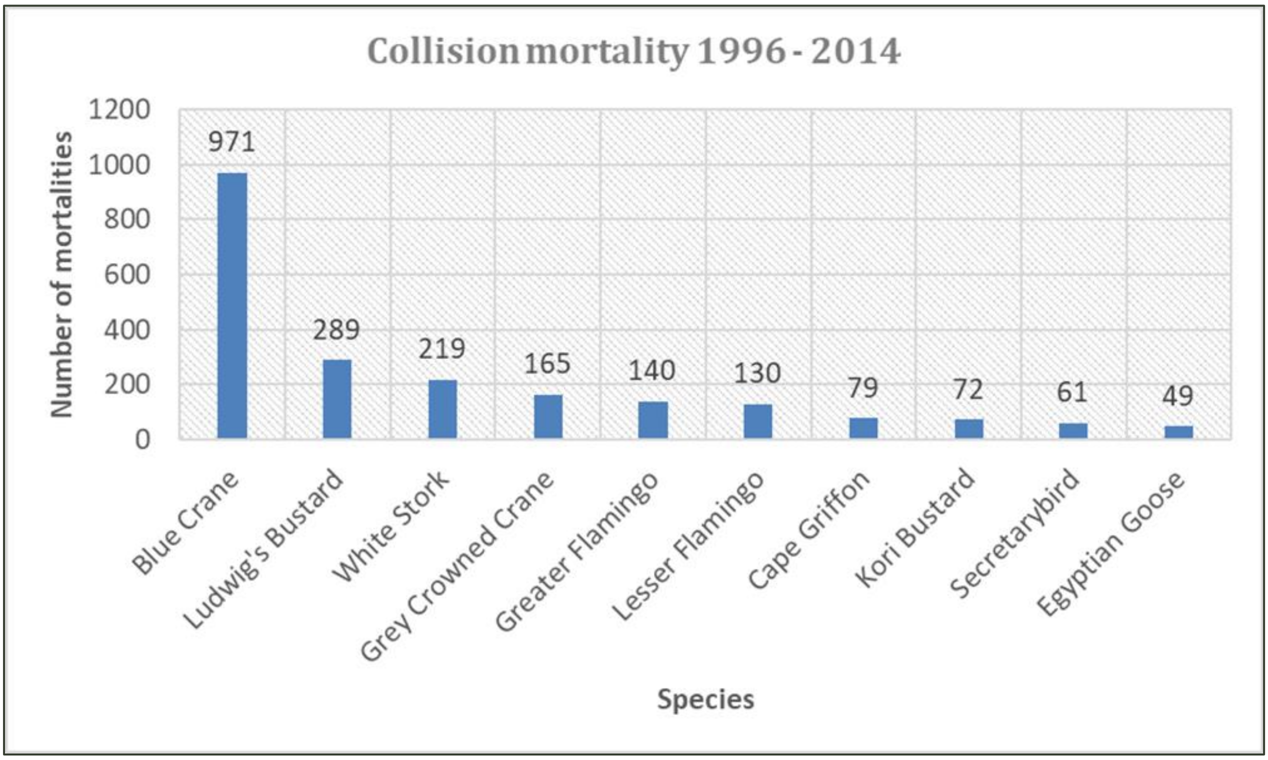

Figure 10: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

Power line collisions are generally accepted as a key threat to bustards (Raab *et al*. 2009; Raab *et al*. 2010; Jenkins & Smallie 2009; Barrientos *et al*. 2012, Shaw 2013). In one study, carcass surveys were performed under high voltage transmission lines in the Karoo for two years, and low voltage distribution lines for one year (Shaw 2013). Ludwig's Bustard was the most common collision victim (69% of carcasses), with bustards generally comprising 87% of mortalities recovered. Total annual mortality was estimated at 41% of the Ludwig's Bustard population, with Kori Bustards *Ardeotis kori* also dying in large numbers (at least 14% of the South African population killed in the Karoo alone). Karoo Korhaan was also recorded, but to a much lesser extent than Ludwig's Bustard. The reasons for the relatively low collision risk of this species probably include their smaller size (and hence greater agility in flight) as well as their more sedentary lifestyles, as local birds are familiar with their territory and are less likely to collide with power lines (Shaw 2013).

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (EWT) and Eskom tested the effectiveness of two types of line markers in reducing power line collision mortalities of large birds on three 400kV transmission lines near Hydra substation in the Karoo. Marking was highly effective for Blue Cranes, with a 92% reduction in mortality, and large birds in general with a 56% reduction in mortality, but not for bustards, including the endangered Ludwig's Bustard. The two different marking devices were approximately equally effective, namely spirals and bird flappers, they found no evidence supporting the preferential use of one type of marker over the other (Shaw et al. 2017).

Distribution lines i.e. 11kV to 88kV are often overlooked in collision studies, but given their far greater extent they can represent a serious source of mortality (Shaw et al. 2010a, 2010b).

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. These spans could pose a collision risk to virtually all powerline sensitive avifauna, depending on where those spans are located. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, Yellow-billed Duck.

7.2 Battery Energy Storage Facility (BESS)

The impact that is associated with the construction of the BESS is the potential displacement of priority avifauna due to disturbance associated with the construction of the facility and habitat transformation in the footprint of the facility.

7.2.1 Displacement due to habitat destruction and disturbance

During the construction of the BESS, habitat destruction/transformation will inevitably take place. The construction activities will constitute the following:

- Site clearance and preparation.
- Construction of the infrastructure related to the BESS.
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site.
- Removal of vegetation for the proposed infrastructure line, stockpiling of topsoil and cleared vegetation.
- Excavations for infrastructure.

These activities will impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the 5 ha proposed facility is likely to be relatively insignificant due to the relatively small size of the footprint (only 0.07% of the total project area, and 2.5% of the buildable area).

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through **disturbance**; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be challenging to implement.

The priority species which are potentially most vulnerable to the impact of displacement due to disturbance and habitat transformation linked to the BESS are terrestrial species and owls. Priority species that could be affected are the following: African Grass Owl, Black-bellied Bustard, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Secretarybird and White-bellied Bustard

7.3 Up to 132kV overhead line (OHL)

The following potential impacts on powerline sensitive avifauna are associated with the construction and operation of the up to 132kV grid connection:

- Mortality due to electrocution on the proposed OHL infrastructure
- Mortality due to electrocution on the electrical infrastructure within the proposed on-site substation.
- Mortality due to collisions with the proposed OHL.
- Displacement due to disturbance associated with the construction of the proposed OHL and on-site substation.
- Displacement due to habitat transformation associated with the construction of the proposed OHL and on-site substation.

7.3.1 Mortality of powerline sensitive avifauna due to electrocutions

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the voltage size of the proposed powerline and the pole/tower design. Should the proposed OHL be constructed using a 132kV tower specification, the electrocution impact for the majority of priority species will be negligible. The only priority species capable of bridging the clearance distances of an OHL constructed using this specification is the Cape Vulture, due to their size and gregarious nature.

Ordinarily, the construction of a single circuit powerline using the approved vulture friendly pole/tower design D-DT-7649 accordance with the Distribution Technical Bulletin titled *Refurbishment of 66/88kV line kite type frames with D-DT-7649 type top configuration* - *Reference Number 240-170000467* will eliminate the electrocution risk. The configuration of the insulators and the clearance distances between the live and earthed components on this structure can comfortably accommodate a perching vulture. However if the OHL will be built on lattice structures, it is imperative that there is a minimum clearance of 1.8m between the jumper cables and/or insulators and the horizontal earthed component on the lattice structure (pers.comm. Lourens Leeuwner - Eskom-EWT Strategic Partnership Manager). Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended (if suitable insulation material is readily available), alternatively all jumper cables must be suspended below the crossarms.

Electrocutions within the proposed on-site substation are possible, however the likelihood of this impact on the more sensitive SCC is remote, as these species are unlikely to regularly utilise the infrastructure within the onsite substation station for perching or roosting. Species that are more vulnerable to this impact are medium-sized raptors, corvids, owls and certain species of waterbirds.

It is assumed that the OHL will be built on 132kV pole/tower designs therefore the powerline sensitive species which is potentially vulnerable to electrocution on the actual towers/poles is Cape Vulture. As far as the substation is concerned, the following species are potentially at risk of electrocution: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite.

7.3.2 Mortality of powerline sensitive avifauna due to collisions

See also the discussion under 7.1.5.

In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with transmission lines:

"The collision risk posed by powerlines is complex and problems are often localised. While any bird flying near a powerline is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to powerlines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the lower-resolution, and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin

2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).

Topography and weather conditions affect how birds use the landscape. Powerlines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with powerlines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 2012).

The technical aspects of powerline design and siting also play a big part in collision risk. Grouping similar powerlines on a common servitude, or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins et al. 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on powerlines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown et al. 1987, Faanes 1987, Alonso et al. 1994a, Bevanger 1994)."

Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and powerline configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as powerlines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is key to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with powerlines i.e. Kori Bustard *Ardeotis kori*, Blue Crane and White Stork. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35°, respectively, are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and powerlines. These findings have applicability to species outside of these families especially raptors (A*ccipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes, and are also known to be vulnerable to powerline collisions.

Despite doubts about the efficacy of line marking to reduce the collision risk for bustards (Jenkins *et al.* 2010; Martin *et al.* 2010), there are numerous studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduce mortality rates (e.g. Bernardino *et al.* 2018; Sporer *et al.* 2013, Barrientos *et al.* 2011; Jenkins *et al.* 2010; Alonso & Alonso 1999; Koops & De Jong 1982), including to some extent for bustards (Barrientos *et al.* 2012; Hoogstad 2015 pers.comm). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. Barrientos *et al.* (2011) reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease of 55–94% in bird mortalities. Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5m, whereas using the same devices at 10m intervals only reduces the mortality by 57%. Barrientos *et al.* (2012) found that larger BFDs were more effective in reducing Great Bustard collisions than smaller ones. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

The up to 132kV OHL could pose a collision risk to virtually all powerline sensitive avifauna, depending on where those spans are located. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, Yellow-billed Duck.

7.3.3 Displacement due to habitat transformation

During the construction of powerlines, service roads (jeep tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed OHL grid connection through the transformation of habitat. The construction activities will constitute the following:

- Site clearance and preparation;
- Excavations for infrastructure;
- Construction of the substation and grid connection infrastructure; and
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site.

Relevant to this development, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the on-site substation is unavoidable. In the case of the OHL, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed OHL. The loss of habitat in the substation footprint (2 ha) will be a relatively insignificant percentage of the habitat that regularly supports powerline sensitive species and the resultant impact is likely to be fairly minimal.

Powerline sensitive species which are potentially vulnerable to displacement due to habitat transformation are mostly ground nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and, White-bellied Bustard

7.3.4 Displacement due to disturbance

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although this is often impractical to implement due to tight construction schedules.

Powerline sensitive species which are potentially vulnerable to displacement due to disturbance are mostly ground nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and White-bellied Bustard

8 IMPACT RATINGS

The impacts on avifauna of the proposed Camden 1 WEF, BESS and 132V OHL are rated according to the criteria set out below.

8.1 Determination of Significance of Impacts

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation. The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects are reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[8], indirect[9], secondary[10] as well as cumulative[11] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[12] presented in Table 8.

Table 9: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

[8] Impacts that arise directly from activities that form an integral part of the Project.

[9] Impacts that arise indirectly from activities not explicitly forming part of the Project.

[10] Secondary or induced impacts caused by a change in the Project environment.

[11] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

[12] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

8.2 Impact Assessments

8.2.1 Impact assessment tables

The impacts are summarised in table form are in Appendix 4.

8.3 Cumulative impacts

“Cumulative Impact”, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section addresses whether the construction of the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or whole-scale changes to the environment
- Unacceptable increase in impact

11.3.1 Wind Energy Facility

According to the official database of DFFE and other documents in the public domain, there are currently one additional planned renewable energy facility within a 30km radius around the proposed development, namely the Camden II Wind Energy Facility (up to 210MW)(see Figure 15).

The proposed Camden I WEF will consist of up to 37 turbines in total. According to information that that is available, the number of additional wind turbines that are planned within a 30km radius in broadly similar habitat around the proposed WEF is another (up to) 45 i.e. for the proposed Camden II WEF. If both the Camden I and Camden II projects are approved, a total of up to 82 turbines may be developed, of which the Camden I will contribute approximately 45%. As such, the WEFs’ contribution to the total number of turbines, and by implication to the cumulative impact of all the planned turbines, is **High,** but could be reduced to **Moderate** with appropriate mitigation**.**

The total area of similar habitat (excluding opencast mining and urban areas) available to birds in the 30km radius around the project area (including the project area) is approximately 4 258 km². This translates into approximately 1 turbine/52km² which is a low density. The turbine density, if all the turbines are constructed, and by implication the cumulative impact on avifauna of the currently planned wind energy projects within this area, is therefore considered to be **Low**, and the impact could be reduced if the recommended mitigation at the two Camden wind projects is diligently implemented.

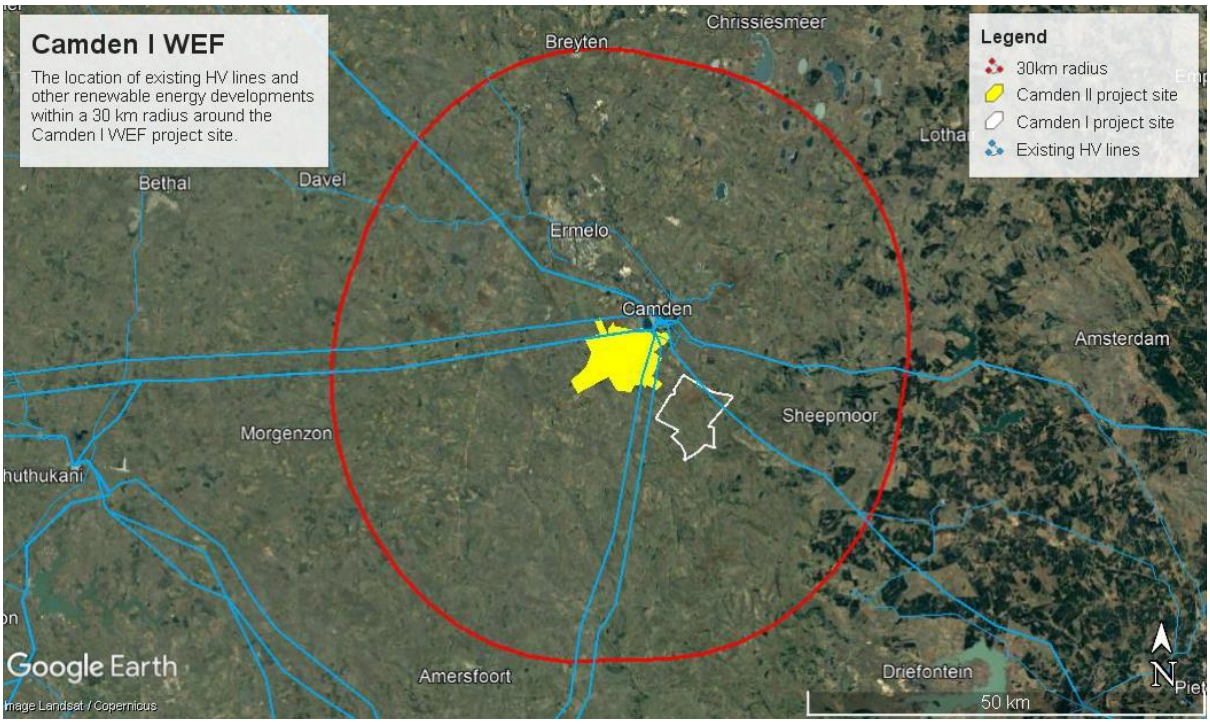

Figure 11: Proposed renewable energy projects and existing HV lines within 30km of the proposed Camden I WEF (Source: DFFE database 2022 & WSP Environmental).

11.3.2 Up to 132kV OHL

According to the official database of DFFE and other documents in the public domain, there is currently one additional planned renewable energy facility within a 30km radius around the proposed development, namely the Camden II Wind Energy Facility (see Figure 12) which will have a grid connection of maximum 12.2km in length. In addition, there will be a 400kV connection to the Camden Power Station Substation of maximum 8.9km. The maximum length of the Camden I OHL will be 5.3km.

The combined length of the grid connections for the Camden I and II renewable energy projects listed above, and the 400kV OHL to Camden Power Station Substation, is approximately 26.4km. The proposed Camden I grid connection will be a maximum of 5.3km long. The existing high voltage lines in the 30km radius around the proposed Camden I WEF run into hundreds of kilometres (see Figure 12). The Camden I grid OHL contribution to the total length of high voltage lines within a 30km radius, and by implication to the cumulative impact of all the planned and existing high voltage lines, is thus **Low** in comparison. However, the density of planned and existing high voltage lines within a 30km radius, and by implication the cumulative impact on avifauna, is considered to be **Moderate**.

11.3.3 Battery Energy Storage System

The BESS will transform an area of approximately 5 ha. Given the available habitat of 4 258km² within a 30km radius around the project site, the cumulative impact of displacement and habitat transformation caused by the BESS is **Low** due to the small footprint.

9 MITIGATION MEASURES

The impact significance without mitigation measures is assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the proposed Project. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in Figure 13.

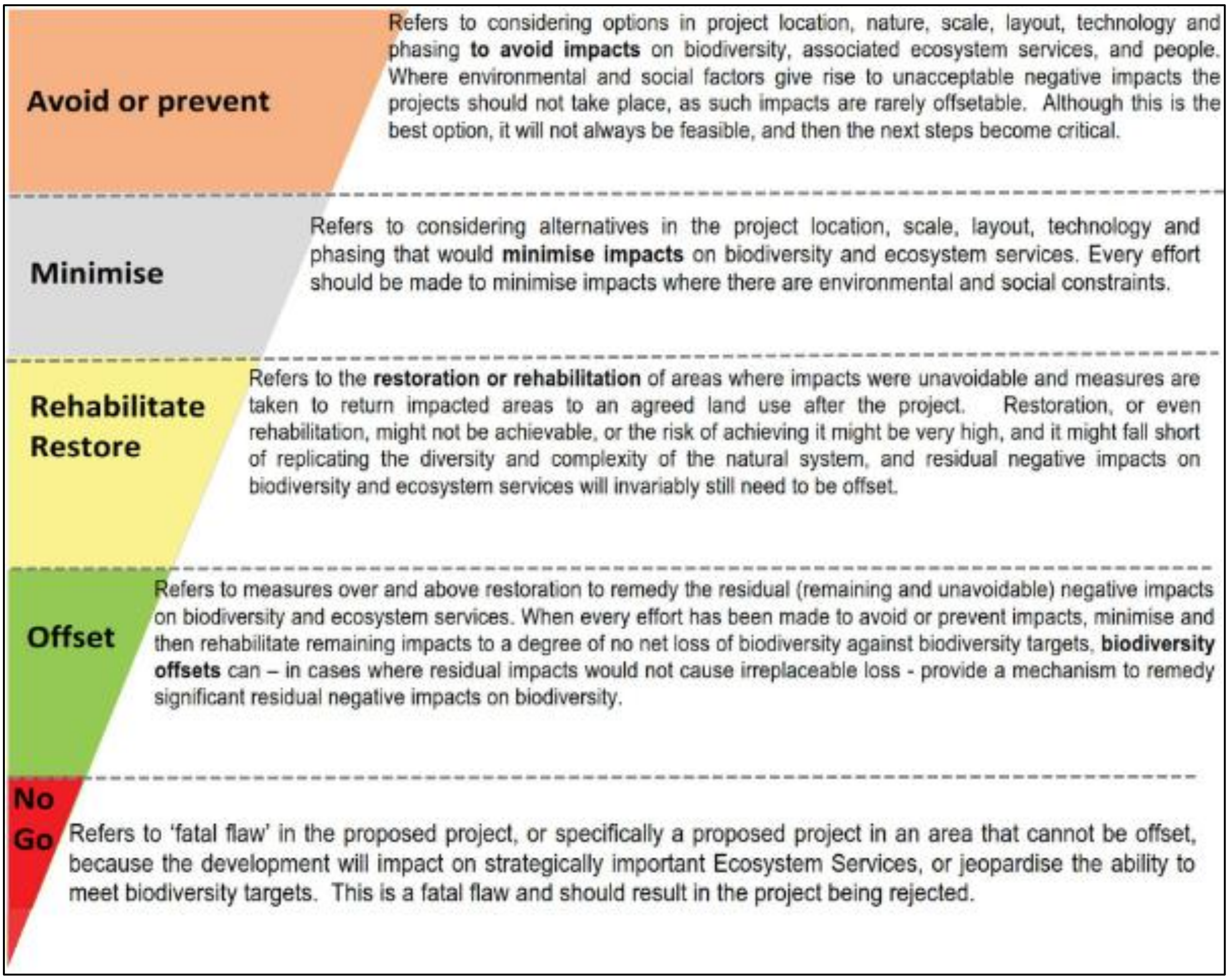

Figure 12: **Mitigation Sequence/Hierarchy**

9.1 Wind Energy Facility

The mitigation measures that are proposed for the wind energy facility are listed below.

9.1.1 Design Phase

- The medium voltage cable should be buried as far as possible. Overhead lines should only be considered if technical constraints to trenching are present.
- A bird-friendly pole design must be employed for all medium voltage overhead lines. The avifaunal specialist must approve the final design prior to construction commencing.
- Bird flight diverters should be installed on all overhead medium voltage power lines according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines).
- A 100m **all infrastructure exclusion zone** must be implemented around drainage lines and associated wetlands (except essential road and gridline crossings). Wetlands are important breeding, roosting and foraging habitat for a variety of SCC, most notably for African Grass Owl (SA status Vulnerable), Grey Crowned Crane (SA status Endangered) and African Marsh

Harrier (SA status Endangered). Where unavoidable, road and grid line crossings across these features should be restricted to the immediate footprint of the infrastructure only.

- A 1km **turbine exclusion zone** must be implemented around large pans (other infrastructure allowed). The most significant landscape features from a collision risk perspective are the large pans. Pans attract many birds, including SCC such as Greater Flamingo (SA status Near-threatened), Lesser Flamingo (SA status near-threatened), Martial Eagle (SA Status Endangered), Cape Vulture (SA Status Endangered) and Secretarybird (SA status Vulnerable).
- Development in the remaining **high sensitivity grassland must be limited as far as possible (limited infrastructure zone)**. Where possible, infrastructure must be located near margins, with shortest routes taken from the existing roads. The grassland is vital breeding, roosting and foraging habitat for a variety of SCC. These include Blue Crane (SA status near-threatened), Blue Korhaan (Global status near -threatened), White-bellied Bustard (SA Status Vulnerable), Denham's Bustard (SA Status Vulnerable).

9.1.2 Construction phase

- Conduct a pre-construction inspection to identify SCC that may be breeding within the project footprint to ensure that the impacts on breeding species (if any) are adequately managed.
- Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum
- Measures to control noise and dust should be applied according to current best practice in the industry.

9.1.3 Operational phase

- The mitigation measures proposed by the vegetation specialist must be strictly enforced, including rehabilitation of disturbed areas.
- It is recommended that shutdown on demand (SDoD) is implemented at all turbines for a trial period of two years to monitor the frequency and duration of shutdown events. Based on the result of the trail period, the need for the continuation of the SDoD, or the implementation of other proven mitigation measures if available at the time, must be evaluated by the avifaunal specialist. The need for SDoD arises from the following circumstances:
    - The site is located between three IBAs. Due to the close proximity of the site to the IBAs, it is possible that some highly mobile priority species which are also IBA trigger species, and which occur either permanently or sporadically in the IBAs, might be at risk of collisions they leave to forage or breed beyond the borders of the IBA at the project site.
    - Cape Vultures have been recorded at the site. The species could occur sporadically, and they are highly vulnerable to turbine collisions.
    - The habitat at the site is used by a variety of Red List priority species. This includes not only natural grassland, but also agriculture e.g., Southern Bald Ibis forage extensively in agricultural fields.

- Live-bird monitoring and carcass searches to be implemented in the operational phase, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al.,* 2015) to compare the abundance of avifauna during the pre-construction monitoring with the abundance post-construction. Operational monitoring and carcass searches to be implemented for a minimum of two years, and then again in Year 5 and every fifth year after that.
- If estimated annual collision rates indicate unacceptable mortality levels of priority species, i.e., if it exceeds the pre-determined threshold determined by the avifaunal specialist additional measures will have to be implemented which could include shut down on demand or other proven measures.

9.1.4 De-commissioning phase

- Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.
- The mitigation measures proposed by the vegetation specialist must be strictly enforced, including rehabilitation of disturbed areas.

Figure 14 indicates the avifauna sensitivity zones identified in the course of the study, relevant to the wind energy facility.

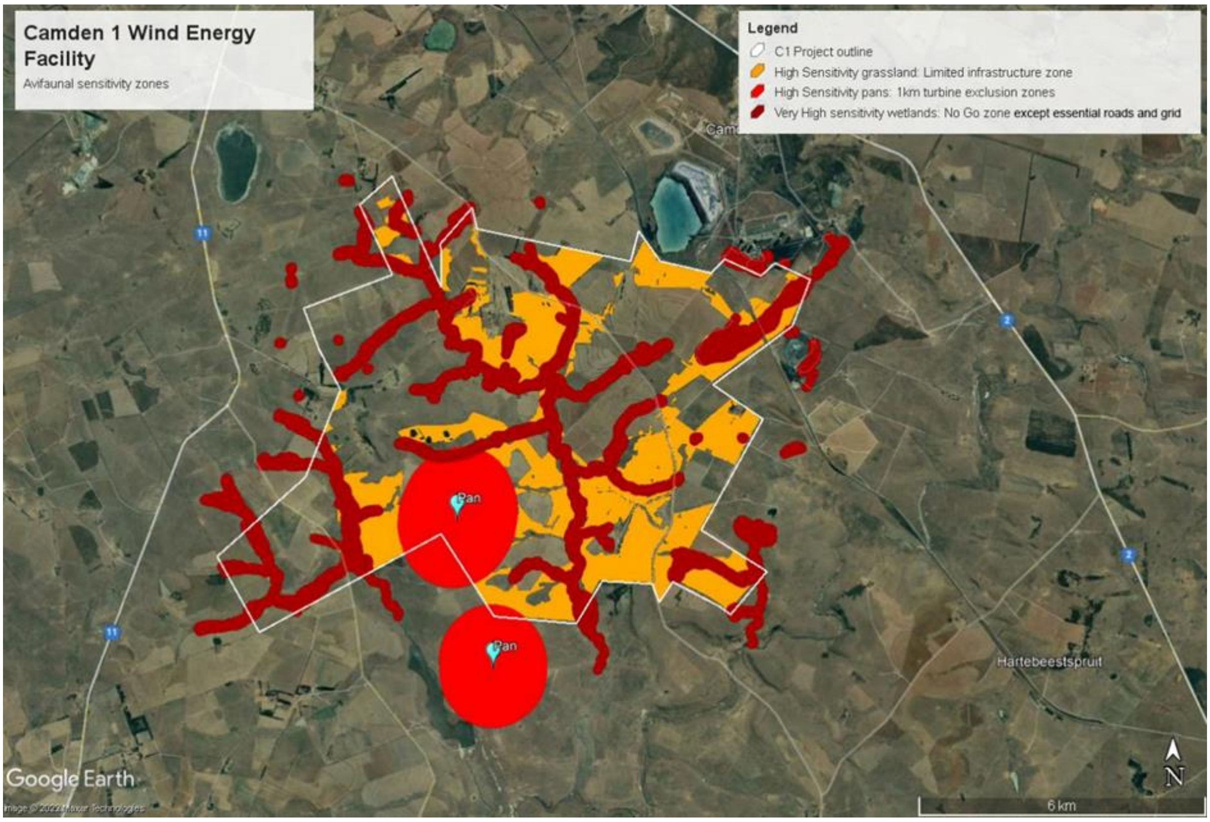

Figure 13: Avifaunal sensitivity zones

9.2 Battery Energy Storage Facility (BESS)

The mitigation measures that are proposed for the BESS are listed below.

9.2.1 Design Phase

None.

9.2.2 Construction phase

- Conduct a pre-construction inspection to identify SCC that may be breeding within the project footprint to ensure that the impacts on breeding species (if any) are adequately managed.
- Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum
- Measures to control noise and dust should be applied according to current best practice in the industry.

9.2.3 Operational phase

- None.

9.2.4 De-commissioning phase

- Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.
- The mitigation measures proposed by the vegetation specialist must be strictly enforced, including rehabilitation of disturbed areas.

9.3 Up to 132kV OHL

The mitigation measures that are proposed for the up to 132kV OHL are listed below.

9.3.1 Planning & Design phase

- If a steel monopole pole design is used, the approved vulture friendly pole/tower design D-DT-7649 in accordance with the Eskom Distribution Technical Bulletin titled *Refurbishment of 66/88kV line kite type frames with D-DT-7649 type top configuration - Reference Number 240-170000467* relating to bird friendly structures, must be used.
- If lattice type structures are used, it is imperative that a minimum vertical clearance of 1.8m is maintained between the jumper cables and/or insulator live ends, and the horizontal earthed components. Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended (if suitable insulation material is readily available), alternatively all jumper cables must be suspended below the crossarms.

9.3.2 Construction phase

- Conduct an inspection (avifaunal walk-through) to identify SCC that may be breeding within the infrastructure footprints. If a nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding birds during the construction period. This could include measures such as delaying some of the activities until after the breeding season, or other measures deemed suitable and practical at the time.
- Bird Flight Diverters must be fitted to the entire OHL according to the applicable Eskom Engineering Instruction (*Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines*). These devices must be installed as soon as the conductors and earthwires are strung.
- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- Vegetation clearance should be limited to what is absolutely necessary.
- The mitigation measures proposed by the vegetation specialist must be strictly enforced.

9.3.3 Operational phase

- No management actions are required for the operational phase

9.3.4 De-commissioning phase

- Conduct an avifaunal inspection of the OHL prior to its decommissioning to identify nests on the poles/towers.
- Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

10 PREFERRED ALTERNATIVE

10.1 Wind energy facility

Only one proposed wind turbine lay-out was provided for assessment. This layout has been refined to consider the specialist sensitivities as far as possible however, and adheres to the no-go zones requested in this report.

10.2 Battery Energy Storage System

Alternative 1 and Alternative 2 two are both located in the same habitat type, namely high sensitivity grassland. Both alternatives will therefore have the same potential displacement impact on priority avifauna, therefore no preferred alternative can be selected. However, both options are acceptable, due to the low impact of the small footprint.

10.3 Up to 132kV OHL

Alternative 4 is the preferred alternative due to it being the shortest of all the alternatives. Alternative 2 is the least preferred alternative due to it being the longest and it runs mostly through high sensitivity grassland, and it crosses three drainage lines. However, all the alternatives can be mitigated to acceptable levels and therefore are considered suitable from an avifaunal perspective.

11 CONDITIONS FOR INCLUSION IN THE EMPr

Please see Appendix 6 for the monitoring requirements to be included in the EMPr for the WEF project.

12 ‘NO-GO’ ALTERNATIVE

The ‘no-go’ alternative is the option of not constructing the Camden 1 WEF, BESS and up to 132kV OHL, where the *status quo* of the current status and/or activities on the project areas would prevail. This alternative would result in no additional impact on the receiving environment.

Should the ‘no-go’ alternative be considered, there would be no impact on the existing environmental baseline and no benefits to the local economy and affected communities. The alternative also bears the opportunity cost of missed socio-economic benefits to the local community that would otherwise realise from establishing the farms which form part of the project areas. The option of not developing also entails that the bid to provide renewable/clean energy to the national grid and contribute to meeting the country’s energy demands will be forfeited.

However, from a strictly avifaunal perspective, the ‘no-go’ alternative will result in the current *status quo* being maintained. The ‘no-go’ option would eliminate any additional impact on the ecological integrity of the proposed WEF development site, as far as avifauna is concerned, bearing in mind that there have already been extensive impacts in the project area in the form of agriculture.

13 SUMMARY AND CONCLUSION

13.1 Wind Energy Facility

The proposed Camden 1 WEF will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the construction phase.
- Collision mortality caused by the wind turbines in the operational phase.
- Electrocution on the medium voltage overhead lines in the operational phase.
- Collisions with the medium voltage overhead lines in the operational phase.
- Displacement due to disturbance linked to dismantling activities in the decommissioning phase.

13.1.1 Displacement of priority species due to disturbance linked to construction activities in the construction phase

It is inevitable that a measure of displacement will take place at the WEF for all priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species in the remaining high-quality grassland, wetlands and wetland fringes the most, as this could temporarily disrupt their reproductive cycle. Some species might be able to recolonise the area after the completion of the construction phase, but for some species, this might only be partially the case, resulting in lower densities than before once the WEFs are operational, due to the disturbance factor of the operational turbines, and the habitat fragmentation. In summary, the following species could be impacted by disturbance during the construction phase African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Spotted Eagle-Owl and
White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and will be reduced but remain at a **moderate** level post-mitigation.

13.1.2 Displacement of priority species due to habitat transformation in the construction phase

The network of existing roads at the WEF has likely resulted in significant habitat fragmentation. This, together with the disturbance factor of the operating turbines, could have an effect on the density of several species, particularly larger terrestrial species and owls which would utilise the remaining high-quality grassland, wetlands and wetland fringes as breeding habitat. Given the conceptual turbine layout and associated road infra-structure, it is not expected that any priority species will be permanently displaced from the development site, but densities may be reduced. In summary, the following species are likely to be most affected by habitat transformation: African Grass Owl, Black-bellied Bustard, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Secretarybird and White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and will be reduced but remain at a **moderate** level post-mitigation.

13.1.3 Collision mortality of priority species caused by the wind turbines in the operational phase

The proposed Camden 1 Wind Energy Facility will pose a collision risk to several priority species which could occur regularly at the site. Species exposed to this risk are large terrestrial species and occasional long distance fliers i.e., bustards, cranes, flamingos, storks, Southern Bald Ibis and Secretarybird, although bustards and cranes generally seem to be not as vulnerable to turbine collisions as was originally anticipated (Ralston-Paton & Camagu 2019). Soaring priority species, i.e., species such as Cape Vulture and a variety of raptors, including several species of eagles, are highly vulnerable to the risk of collisions. The following priority species could be at risk of collisions with the turbines: Common Buzzard, Jackal Buzzard, Blue Crane, Brown Snake Eagle, Black-chested Snake Eagle, Long-crested Eagle, Martial Eagle, Peregrine Falcon, Lanner Falcon, Greater Flamingo, Lesser Flamingo, Montagu's Harrier, African Marsh Harrier, Black Harrier, African Harrier-Hawk, Cape Vulture, Secretarybird, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Wattled Crane, Grey Crowned Crane, African Fish Eagle, Spotted Eagle-Owl, Amur Falcon, Grey-winged Francolin, Southern Bald Ibis, Black-winged Kite, Northern Black Korhaan, Blue Korhaan, Black-winged Lapwing, Western Osprey, Marsh Owl, African Grass Owl, Black Sparrowhawk and White Stork. The impact is rated as **moderate** pre-mitigation but should be reduced to a **low** level post-mitigation.

13.1.4 Electrocution of priority species on the medium voltage overhead lines (if any) in the operational phase

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the electrical infrastructure could potentially pose an electrocution risk to several power line sensitive species that could on occasion perch on these poles. In summary, the following priority species are potentially vulnerable to electrocution in this manner: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite. The impact is rated as **moderate** pre-mitigation but should be reduced to a **low** level post-mitigation.

13.1.5 Collisions of priority species with the medium voltage overhead lines (if any) in the operational phase

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. These spans could pose a collision risk to virtually all powerline sensitive avifauna, depending on where those spans are located. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, Yellow-billed Duck. The impact is rated as **moderate** pre-mitigation but should be reduced to a **low** level post-mitigation.

13.1.6 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase

The impact is likely to be similar in nature and extent to the construction phase of the proposed WEF. The impact is rated as **medium** pre-mitigation and it will decrease to **low** post-mitigation.

13.2 Battery Energy Storage Facility (BESS)

The impact that is associated with the construction of the BESS is the potential displacement of priority avifauna due to disturbance associated with the construction and dismantling of the facility and habitat transformation in the footprint of the facility.

13.2.1 Displacement due to disturbance associated with the construction of the facility

Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be challenging to implement. The priority species which are potentially most vulnerable to the impact of displacement due to disturbance linked to the BESS are terrestrial species and owls. Priority species that could be most affected are the following: African Grass Owl, Black-bellied Bustard, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Secretarybird and White-bellied Bustard. The impact is rated as **low** pre- and post-mitigation.

13.2.2 Displacement due to habitat transformation associated with the construction of the facility

These construction activities will impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the 5 ha proposed facility is likely to be relatively insignificant due to the relatively small size of the footprint (only 0.07% of the total project area, and 2.5% of the buildable area). The impact is rated as **low** pre-mitigation and it will decrease to **very low** post-mitigation.

13.2.3 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase

The impact is likely to be similar in nature and extent to the construction phase of the proposed BESS. The impact is rated as **low** pre-mitigation and it will decrease to **very low** post-mitigation.

13.3 The up to 132kV OHL

The following potential impacts on powerline sensitive avifauna are associated with the construction and operation of the up to 132kV grid connection related to the Wind Energy Facility:

- Displacement due to disturbance associated with the construction of the proposed OHL and on-site substation.
- Displacement due to habitat transformation associated with the construction of the proposed OHL and on-site substation.
- Mortality due to electrocution on the proposed OHL infrastructure
- Mortality due to electrocution on the electrical infrastructure within the proposed on-site substation.
- Mortality due to collisions with the proposed OHL.
- Displacement due to disturbance associated with the dismantling of the proposed OHL and on-site substation.

13.3.1 Displacement due to disturbance associated with the construction of the proposed OHL and on-site substation.

Construction activities could impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although this is often impractical to implement due to tight construction schedules. Powerline sensitive species which are potentially most vulnerable to displacement due to disturbance are mostly ground nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

13.3.2 Displacement due to habitat transformation associated with the construction of the proposed OHL and on-site substation.

During the construction of powerlines, service roads (jeep tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed OHL grid connection through the transformation of habitat. Relevant to this development, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the on-site substation is unavoidable. In the case of the OHL, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed OHL. The loss of habitat in the substation footprint (2 ha) will be a relatively insignificant percentage of the habitat that regularly supports powerline sensitive species, and the resultant impact is likely to be fairly minimal. Powerline sensitive species which are potentially most vulnerable to displacement due to habitat transformation are mostly ground nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and, White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

13.3.3 Mortality of powerline sensitive avifauna due to electrocutions on the OHL

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the voltage size of the proposed powerline and the pole/tower design. Should the proposed OHL be constructed using a 132kV tower specification, the electrocution impact for the majority of priority species will be negligible. The only priority species capable of bridging the clearance distances of an OHL constructed using this specification is the Cape Vulture, due to their size and gregarious nature. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

13.3.4 Mortality of powerline sensitive avifauna due to electrocutions in the onsite substation

Electrocutions within the proposed on-site substation are possible, however the likelihood of this impact on the more sensitive SCC is remote, as these species are unlikely to regularly utilise the infrastructure within the onsite substation station for perching or roosting. Powerline sensitive species that are more vulnerable to electrocutions are medium-sized raptors, corvids, owls and certain species of waterbirds.. As far as the substation is concerned, the following species are potentially at risk of electrocution: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite. The impact is rated as **low** pre- and post-mitigation.

13.3.5 Mortality of powerline sensitive avifauna due to collisions with the OHL

The up to 132kV OHL could pose a collision risk to virtually all powerline sensitive avifauna, depending on where the spans are located. Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions, powerline configuration and visual capacity. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, Yellow-billed Duck. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

13.3.6 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase

The impact is likely to be similar in nature and extent to the construction phase of the proposed OHL and onsite substation. The impact is rated as **medium** pre-mitigation and it will decrease to **low** post-mitigation.

13.4 Cumulative impacts

16.4.1 Wind Energy Facility

The proposed Camden I WEF will consist of up to 37 turbines in total. According to information that that is available, the number of additional wind turbines that are planned within a 30km radius in broadly similar habitat around the proposed WEF is another (up to) 45 i.e. for the proposed Camden II WEF. If both the Camden I and Camden II projects are approved, a total of up to 82 turbines may be developed, of which the Camden I will contribute approximately 45%. As such, the WEFs' contribution to the total number of turbines, and by implication to the cumulative impact of all the planned turbines, is **High,** but could be reduced to **Moderate** with appropriate mitigation**.** The total area of similar habitat (excluding opencast mining and urban areas) available to birds in the 30km radius around the project area (including the project area) is approximately 4 258 km². This translates into approximately 1 turbine/52km² which is a low density. The turbine density, if all the turbines are constructed, and by implication the cumulative impact on avifauna of the currently planned wind energy projects within this area, is therefore considered to be **Low**, and the impact could be reduced if the recommended mitigation at the two Camden wind projects is diligently implemented.

16.4.2 Up to 132kV OHL

The combined length of the grid connections for the Camden I and II renewable energy projects listed above, and the 400kV OHL to Camden Power Station Substation, is approximately 26.4km. The proposed Camden I grid connection will be a maximum of 5.3km long. The existing high voltage lines in the 30km radius around the proposed Camden I WEF run into hundreds of kilometres (see Figure 12). The Camden I grid OHL contribution to the total length of high voltage lines within a 30km radius, and by implication to the cumulative impact of all the planned and existing high voltage lines, is thus **Low** in comparison. However, the density of planned and existing high voltage lines within a 30km radius, and by implication the cumulative impact on avifauna, is considered to be **Moderate**.

16.4.3 Battery Energy Storage Facility

The BESS will transform an area of approximately 5 ha. Given the available habitat of 4 258km² within a 30km radius around the project site, the cumulative impact of displacement and habitat transformation caused by the BESS is **Low** due to the small footprint.

14 CONCLUSION AND IMPACT STATEMENT

14.1 Wind Energy Facility

The proposed wind energy facility will have a moderate impact on priority avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation, although some instances moderate residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed WEF development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

14.2 Battery Energy Storage Facility (BESS)

The proposed BESS will have a low impact on priority avifauna which, could be reduced to a very low level in most instances through appropriate mitigation, although some instances low residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed BESS development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

14.3 The up to 132kV OHL

The proposed up to 132kV OHL will have a mostly moderate impact on priority avifauna which, in all instances, could be reduced to a low impact through appropriate mitigation. No fatal flaws were discovered during the onsite investigations. The proposed development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

15 POST CONSTRUCTION PROGRAMME

The new procedures and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of NEMA came into force in March 2020. According to these regulations, a detailed post-construction monitoring programme for the WEF must be included as part of the bird specialist study. See Appendix 7 for a proposed programme for the WEF.

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APPENDIX 1: SPECIES LISTS

Species list for the broader area Species name	Taxonomic name	SABAP2 full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
African Black Duck	*Anas sparsa*	10.9	0.0	-	-
African Black Swift	*Apus barbatus*	3.0	0.4	-	-
African Darter	*Anhinga rufa*	16.4	2.2	-	-
African Fish Eagle	*Haliaeetus vocifer*	12.1	0.9	-	-
African Grass Owl	*Tyto capensis*	2.4	0.0	-	VU
African Harrier-Hawk	*Polyboroides typus*	11.5	1.8	-	-
African Hoopoe	*Upupa africana*	12.7	0.9	-	-
African Jacana	*Actophilornis africanus*	1.8	1.3	-	-
African Marsh Harrier	*Circus ranivorus*	0.6	0.0	-	EN
African Palm Swift	*Cypsiurus parvus*	1.2	1.3	-	-
African Paradise Flycatcher	*Terpsiphone viridis*	4.8	0.0	-	-
African Pipit	*Anthus cinnamomeus*	74.5	8.4	-	-
African Rail	*Rallus caerulescens*	5.5	0.0	-	-
African Reed Warbler	*Acrocephalus baeticatus*	3.0	0.4	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	47.9	6.2	-	-
African Snipe	*Gallinago nigripennis*	20.0	0.9	-	-
African Spoonbill	*Platalea alba*	16.4	2.2	-	-
African Stonechat	*Saxicola torquatus*	87.9	10.6	-	-
African Swamphen	*Porphyrio madagascariensis*	6.1	2.2	-	-
African Wattled Lapwing	*Vanellus senegallus*	23.0	0.4	-	-
African Yellow Warbler	*Iduna natalensis*	3.0	0.0	-	-
Amethyst Sunbird	*Chalcomitra amethystina*	11.5	0.4	-	-
Amur Falcon	*Falco amurensis*	29.1	6.6	-	-
Ant-eating Chat	*Myrmecocichla formicivora*	89.7	12.3	-	-
Banded Martin	*Riparia cincta*	42.4	3.1	-	-
Barn Swallow	*Hirundo rustica*	41.8	7.9	-	-
Bar-throated Apalis	*Apalis thoracica*	5.5	0.0	-	-
Black Crake	*Zapornia flavirostra*	9.1	0.0	-	-
Black Harrier	*Circus maurus*	0.0	0.9	EN	EN
Black Heron	*Egretta ardesiaca*	0.6	0.0	-	-
Black Sparrowhawk	*Accipiter melanoleucus*	12.1	0.9	-	-
Black-bellied Bustard	*Lissotis melanogaster*	0.6	0.0	-	-
Black-chested Prinia	*Prinia flavicans*	16.4	0.0	-	-
Black-chested Snake Eagle	*Circaetus pectoralis*	3.0	0.4	-	-
Black-collared Barbet	*Lybius torquatus*	28.5	0.9	-	-
Black-crowned Night Heron	*Nycticorax nycticorax*	0.6	0.0	-	-
Black-headed Heron	*Ardea melanocephala*	52.1	4.0	-	-
Black-headed Oriole	*Oriolus larvatus*	13.9	1.8	-	-
Black-necked Grebe	*Podiceps nigricollis*	0.6	0.4	-	-
Blacksmith Lapwing	*Vanellus armatus*	67.9	7.0	-	-
Black-throated Canary	*Crithagra atrogularis*	67.9	2.2	-	-
Black-winged Kite	*Elanus caeruleus*	60.6	12.8	-	-
Black-winged Lapwing	*Vanellus melanopterus*	14.5	0.0	-	-
Black-winged Stilt	*Himantopus himantopus*	9.1	0.0	-	-
Blue Crane	*Grus paradisea*	11.5	0.4	VU	NT
Blue Korhaan	*Eupodotis caerulescens*	6.1	0.0	NT	

Species list for the broader area	**Taxonomic name**	**SABAP2 full protocol reporting rate**	**SABAP2 Ad hoc protocol reporting rate**	**Global status**	**Regional status**
Species name					
Blue-billed Teal	*Spatula hottentota*	1.2	0.0	-	-
Bokmakierie	*Telophorus zeylonus*	64.8	4.4	-	-
Brown Snake Eagle	*Circaetus cinereus*	1.8	0.0	-	-
Brown-throated Martin	*Riparia paludicola*	46.7	4.0	-	-
Buff-streaked Chat	*Campicoloides bifasciatus*	5.5	0.4	-	-
Cape Batis	*Batis capensis*	0.6	0.0	-	-
Cape Bunting	*Emberiza capensis*	13.9	0.4	-	-
Cape Canary	*Serinus canicollis*	75.2	7.0	-	-
Cape Crow	*Corvus capensis*	17.6	0.4	-	-
Cape Grassbird	*Sphenoeacus afer*	24.8	0.9	-	-
Cape Longclaw	*Macronyx capensis*	86.7	10.1	-	-
Cape Robin-Chat	*Cossypha caffra*	60.0	3.5	-	-
Cape Shoveler	*Spatula smithii*	18.8	0.0	-	-
Cape Sparrow	*Passer melanurus*	81.8	6.6	-	-
Cape Starling	*Lamprotornis nitens*	6.1	0.0	-	-
Cape Teal	*Anas capensis*	3.0	0.0	-	-
Cape Turtle Dove	*Streptopelia capicola*	92.1	23.8	-	-
Cape Vulture	*Gyps coprotheres*	0.0	0.0	EN	EN
Cape Wagtail	*Motacilla capensis*	78.2	3.5	-	-
Cape Weaver	*Ploceus capensis*	33.9	2.2	-	-
Cape White-eye	*Zosterops virens*	35.2	1.3	-	-
Capped Wheatear	*Oenanthe pileata*	10.3	0.0	-	-
Cardinal Woodpecker	*Dendropicos fuscescens*	9.1	1.3	-	-
Chorister Robin-Chat Robin-Chat	*Cossypha dichroa*	1.2	0.0	-	-
Cinnamon-breasted Bunting	*Emberiza tahapisi*	1.8	0.0	-	-
Cloud Cisticola	*Cisticola textrix*	7.9	0.9	-	-
Common Buttonquail	*Turnix sylvaticus*	0.6	0.0	-	-
Common Buzzard	*Buteo buteo*	27.9	9.3	-	-
Common Greenshank	*Tringa nebularia*	5.5	0.0	-	-
Common House Martin	*Delichon urbicum*	6.1	0.0	-	-
Common Moorhen	*Gallinula chloropus*	32.7	1.8	-	-
Common Myna	*Acridotheres tristis*	21.2	10.1	-	-
Common Ostrich	*Struthio camelus*	21.8	1.3	-	-
Common Quail	*Coturnix coturnix*	29.1	0.4	-	-
Common Sandpiper	*Actitis hypoleucos*	1.2	0.0	-	-
Common Waxbill	*Estrilda astrild*	52.7	3.5	-	-
Crested Barbet	*Trachyphonus vaillantii*	3.0	0.0	-	-
Crowned Lapwing	*Vanellus coronatus*	61.2	3.1	-	-
Cuckoo Finch	*Anomalospiza imberbis*	1.2	0.0	-	-
Dark-capped Bulbul	*Pycnonotus tricolor*	50.3	4.0	-	-
Denham's Bustard	*Neotis denhami*	1.8	0.0	NT	VU
Diederik Cuckoo	*Chrysococcyx caprius*	24.2	0.9	-	-
Domestic Duck	*Anas platyrhynchos domestica*	0.6	0.0	-	-
Drakensberg Prinia	*Prinia hypoxantha*	18.8	0.0	-	-
Eastern Clapper Lark	*Mirafra fasciolata*	6.7	0.0	-	-
Eastern Long-billed Lark	*Certhilauda semitorquata*	4.8	0.0	-	-
Egyptian Goose	*Alopochen aegyptiaca*	78.2	6.2	-	-

Species list for the broader area	Taxonomic name	SABAP2 full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Species name					
European Bee-eater	*Merops apiaster*	0.6	0.0	-	-
Familiar Chat	*Oenanthe familiaris*	0.6	0.0	-	-
Fan-tailed Widowbird	*Euplectes axillaris*	39.4	3.1	-	-
Fiscal Flycatcher	*Melaenornis silens*	17.0	0.9	-	-
Fork-tailed Drongo	*Dicrurus adsimilis*	10.3	0.4	-	-
Fulvous Whistling Duck	*Dendrocygna bicolor*	0.0	0.4	-	-
Giant Kingfisher	*Megaceryle maxima*	4.8	0.0	-	-
Glossy Ibis	*Plegadis falcinellus*	4.2	1.8	-	-
Golden-breasted Bunting	*Emberiza flaviventris*	5.5	0.4	-	-
Goliath Heron	*Ardea goliath*	2.4	0.0	-	-
Great Egret	*Ardea alba*	7.9	1.3	-	-
Greater Flamingo	*Phoenicopterus roseus*	3.6	4.4	-	NT
Greater Striped Swallow	*Cecropis cucullata*	55.8	7.9	-	-
Green Wood Hoopoe	*Phoeniculus purpureus*	7.9	0.4	-	-
Grey Crowned Crane	*Balearica regulorum*	5.5	0.0	EN	EN
Grey Heron	*Ardea cinerea*	24.8	3.5	-	-
Grey-headed Gull	*Chroicocephalus cirrocephalus*	3.6	0.4	-	-
Grey-winged Francolin	*Scleroptila afra*	27.3	2.2	-	-
Groundscraper Thrush	*Turdus litsitsirupa*	0.6	0.0	-	-
Hadada Ibis	*Bostrychia hagedash*	89.7	13.7	-	-
Hamerkop	*Scopus umbretta*	11.5	0.0	-	-
Helmeted Guineafowl	*Numida meleagris*	49.1	3.1	-	-
Horus Swift	*Apus horus*	1.2	0.0	-	-
House Sparrow	*Passer domesticus*	20.0	9.3	-	-
Intermediate Egret	*Ardea intermedia*	13.9	1.8	-	-
Jackal Buzzard	*Buteo rufofuscus*	19.4	2.2	-	-
Karoo Thrush	*Turdus smithi*	5.5	0.0	-	-
Kittlitz's Plover	*Charadrius pecuarius*	7.3	0.4	-	-
Kurrichane Thrush	*Turdus libonyana*	8.5	0.4	-	-
Lanner Falcon	*Falco biarmicus*	7.3	0.0	-	VU
Laughing Dove	*Spilopelia senegalensis*	45.5	7.5	-	-
Lazy Cisticola	*Cisticola aberrans*	4.8	0.0	-	-
Lesser Flamingo	*Phoeniconaias minor*	3.6	1.3	NT	NT
Lesser Grey Shrike	*Lanius minor*	0.6	0.0	-	-
Lesser Honeyguide	*Indicator minor*	0.6	0.0	-	-
Lesser Moorhen	*Paragallinula angulata*	0.6	0.4	-	-
Lesser Striped Swallow	*Cecropis abyssinica*	0.6	1.3	-	-
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	12.7	0.4	-	-
Levaillant's Cisticola	*Cisticola tinniens*	73.9	5.7	-	-
Little Egret	*Egretta garzetta*	4.2	1.3	-	-
Little Grebe	*Tachybaptus ruficollis*	38.8	3.1	-	-
Little Rush Warbler	*Bradypterus baboecala*	6.7	0.9	-	-
Little Stint	*Calidris minuta*	1.8	0.0	-	-
Little Swift	*Apus affinis*	16.4	4.8	-	-
Long-crested Eagle	*Lophaetus occipitalis*	6.7	9.3	-	-
Long-tailed Widowbird	*Euplectes progne*	84.8	15.4	-	-
Malachite Kingfisher	*Corythornis cristatus*	7.3	0.0	-	-
Malachite Sunbird	*Nectarinia famosa*	11.5	0.4	-	-

Species list for the broader area Species name	Taxonomic name	SABAP2 full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Mallard	*Anas platyrhynchos*	0.6	0.4	-	-
Marsh Owl	*Asio capensis*	5.5	0.4	-	-
Martial Eagle	*Polemaetus bellicosus*	2.4	0.0	EN	EN
Montagu's Harrier	*Circus pygargus*	1.2	0.0	-	-
Mountain Wheatear	*Myrmecocichla monticola*	4.8	0.9	-	-
Namaqua Dove	*Oena capensis*	1.8	0.0	-	-
Neddicky	*Cisticola fulvicapilla*	7.9	0.0	-	-
Nicholson's Pipit	*Anthus nicholsoni*	1.8	0.4	-	-
Northern Black Korhaan	*Afrotis afraoides*	0.6	0.0	-	-
Olive Thrush	*Turdus olivaceus*	6.1	0.4	-	-
Olive Woodpecker	*Dendropicos griseocephalus*	3.0	0.0	-	-
Orange-breasted Waxbill	*Amandava subflava*	9.7	0.0	-	-
Pale-crowned Cisticola	*Cisticola cinnamomeus*	21.2	0.0	-	-
Peregrine Falcon	*Falco peregrinus*	1.2	0.0	-	-
Pied Avocet	*Recurvirostra avosetta*	4.8	0.0	-	-
Pied Crow	*Corvus albus*	11.5	3.5	-	-
Pied Kingfisher	*Ceryle rudis*	12.7	0.4	-	-
Pied Starling	*Lamprotornis bicolor*	55.2	11.5	-	-
Pin-tailed Whydah	*Vidua macroura*	44.8	2.6	-	-
Plain-backed Pipit	*Anthus leucophrys*	1.2	0.0	-	-
Purple Heron	*Ardea purpurea*	4.2	0.0	-	-
Quailfinch	*Ortygospiza atricollis*	47.9	1.8	-	-
Red-backed Shrike	*Lanius collurio*	0.6	0.0	-	-
Red-billed Quelea	*Quelea quelea*	38.8	1.8	-	-
Red-billed Teal	*Anas erythrorhyncha*	17.0	1.3	-	-
Red-capped Lark	*Calandrella cinerea*	56.4	2.2	-	-
Red-chested Cuckoo	*Cuculus solitarius*	4.8	0.4	-	-
Red-chested Flufftail	*Sarothrura rufa*	0.6	0.0	-	-
Red-collared Widowbird	*Euplectes ardens*	12.1	1.3	-	-
Red-eyed Dove	*Streptopelia semitorquata*	64.2	12.3	-	-
Red-faced Mousebird	*Urocolius indicus*	4.2	0.4	-	-
Red-headed Finch	*Amadina erythrocephala*	1.8	0.0	-	-
Red-knobbed Coot	*Fulica cristata*	58.2	4.8	-	-
Red-throated Wryneck	*Jynx ruficollis*	29.7	2.2	-	-
Red-winged Francolin	*Scleroptila levaillantii*	24.8	1.3	-	-
Red-winged Starling	*Onychognathus morio*	8.5	3.1	-	-
Reed Cormorant	*Microcarbo africanus*	63.6	4.8	-	-
Rock Dove	*Columba livia*	6.1	4.4	-	-
Rock Kestrel	*Falco rupicolus*	5.5	0.9	-	-
Rock Martin	*Ptyonoprogne fuligula*	13.9	1.8	-	-
Ruff	*Calidris pugnax*	1.8	0.4	-	-
Rufous-naped Lark	*Mirafra africana*	1.2	0.9	-	-
Sand Martin	*Riparia riparia*	1.2	0.4	-	-
Secretarybird	*Sagittarius serpentarius*	13.3	0.0	EN	VU
Sedge Warbler	*Acrocephalus schoenobaenus*	0.6	0.0	-	-
Sentinel Rock Thrush	*Monticola explorator*	2.4	0.0	NT	
South African Cliff Swallow	*Petrochelidon spilodera*	38.2	3.5	-	-
South African Shelduck	*Tadorna cana*	30.3	3.5	-	-

Species list for the broader area Species name	Taxonomic name	SABAP2 full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Southern Bald Ibis	*Geronticus calvus*	23.0	3.1	VU	VU
Southern Boubou	*Laniarius ferrugineus*	15.2	0.9	-	-
Southern Fiscal	*Lanius collaris*	92.1	15.4	-	-
Southern Grey-headed Sparrow	*Passer diffusus*	57.6	4.4	-	-
Southern Masked Weaver	*Ploceus velatus*	90.9	9.7	-	-
Southern Pochard	*Netta erythrophthalma*	9.1	0.0	-	-
Southern Red Bishop	*Euplectes orix*	84.2	12.3	-	-
Speckled Mousebird	*Colius striatus*	25.5	0.9	-	-
Speckled Pigeon	*Columba guinea*	67.3	13.2	-	-
Spike-heeled Lark	*Chersomanes albofasciata*	48.5	1.3	-	-
Spotted Eagle-Owl	*Bubo africanus*	9.1	0.9	-	-
Spotted Flycatcher	*Muscicapa striata*	4.2	0.4	-	-
Spotted Thick-knee	*Burhinus capensis*	9.1	0.0	-	-
Spur-winged Goose	*Plectropterus gambensis*	44.2	1.8	-	-
Squacco Heron	*Ardeola ralloides*	1.2	0.0	-	-
Streaky-headed Seedeater	*Crithagra gularis*	9.1	0.4	-	-
Swainson's Spurfowl	*Pternistis swainsonii*	61.2	2.6	-	-
Tawny-flanked Prinia	*Prinia subflava*	0.6	0.4	-	-
Temminck's Courser	*Cursorius temminckii*	1.8	0.0	-	-
Three-banded Plover	*Charadrius tricollaris*	35.2	0.9	-	-
Village Weaver	*Ploceus cucullatus*	4.2	0.0	-	-
Wailing Cisticola	*Cisticola lais*	9.1	0.0	-	-
Wattled Crane	*Grus carunculata*	0.6	0.0	VU	CR
Wattled Starling	*Creatophora cinerea*	0.6	0.0	-	-
Western Barn Owl	*Tyto alba*	3.0	0.4	-	-
Western Cattle Egret	*Bubulcus ibis*	44.8	12.3	-	-
Western Osprey	*Pandion haliaetus*	0.6	0.0	-	-
Whiskered Tern	*Chlidonias hybrida*	12.1	5.3	-	-
White Stork	*Ciconia ciconia*	7.3	1.3	-	-
White-backed Duck	*Thalassornis leuconotus*	6.7	0.0	-	-
White-bellied Bustard	*Eupodotis senegalensis*	7.9	0.0	-	VU
White-breasted Cormorant	*Phalacrocorax lucidus*	11.5	0.9	-	-
White-faced Whistling Duck	*Dendrocygna viduata*	0.6	0.0	-	-
White-rumped Swift	*Apus caffer*	30.3	4.0	-	-
White-throated Swallow	*Hirundo albigularis*	37.6	1.8	-	-
White-winged Tern	*Chlidonias leucopterus*	3.6	0.9	-	-
Willow Warbler	*Phylloscopus trochilus*	4.2	0.0	-	-
Wing-snapping Cisticola	*Cisticola ayresii*	45.5	6.2	-	-
Wood Sandpiper	*Tringa glareola*	6.1	0.0	-	-
Yellow Canary	*Crithagra flaviventris*	15.8	0.4	-	-
Yellow-billed Duck	*Anas undulata*	61.8	4.4	-	-
Yellow-billed Kite	*Milvus aegyptius*	2.4	0.0	-	-
Yellow-crowned Bishop	*Euplectes afer*	34.5	4.0	-	-
Yellow-fronted Canary	*Crithagra mozambica*	9.1	0.9	-	-
Zitting Cisticola	*Cisticola juncidis*	41.2	2.6	-	-

Species list for pre-construction surveys **Priority species**	**Taxonomic name**	**WEF Transects**	**Control transects**	**Focal points**	**Incidental counts**	**WEF vantage points**	**Control vantage points**
African Fish Eagle	*Haliaeetus vocifer*	*		*	*	*	
African Grass Owl	*Tyto capensis*				*		
African Harrier-Hawk	*Polyboroides typus*		*		*		*
Amur Falcon	*Falco amurensis*	*	*		*	*	*
Black Sparrowhawk	*Accipiter melanoleucus*	*	*		*	*	
Black-chested Snake Eagle	*Circaetus pectoralis*		*		*		*
Black-rumped Buttonquail	*Turnix nanus*				*		
Black-winged Kite	*Elanus caeruleus*	*	*		*	*	
Black-winged Lapwing	*Vanellus melanopterus*	*	*		*	*	*
Blue Crane	*Grus paradisea*	*	*		*	*	*
Blue Korhaan	*Eupodotis caerulescens*	*			*	*	
Brown Snake Eagle	*Circaetus cinereus*				*		
Buff-streaked Chat	*Campicoloides bifasciatus*				*		
Cape Vulture	*Gyps coprotheres*	*			*	*	*
Common Buzzard	*Buteo buteo*	*	*	*	*	*	*
Greater Flamingo	*Phoenicopterus roseus*			*	*		
Grey Crowned Crane	*Balearica regulorum*				*		
Grey-winged Francolin	*Scleroptila afra*	*	*		*	*	
Jackal Buzzard	*Buteo rufofuscus*		*		*	*	*
Lanner Falcon	*Falco biarmicus*	*	*		*	*	
Lesser Flamingo	*Phoeniconaias minor*			*	*		
Long-crested Eagle	*Lophaetus occipitalis*	*			*		
Marsh Owl	*Asio capensis*				*	*	
Martial Eagle	*Polemaetus bellicosus*		*		*		
Peregrine Falcon	*Falco peregrinus*				*		
Secretarybird	*Sagittarius serpentarius*	*			*	*	
Southern Bald Ibis	*Geronticus calvus*	*		*	*	*	
Spotted Eagle-Owl	*Bubo africanus*				*		
White Stork	*Ciconia ciconia*				*		
White-bellied Bustard	*Eupodotis senegalensis*				*		
30		**14**	**12**	**5**	**30**	**15**	**8**

Non-Priority Species	Taxonomic name	WEF Transects	Control transects	Focal points	Incidental counts
African Black Duck	*Anas sparsa*	*			
African Darter	*Anhinga rufa*	*	*	*	
African Hoopoe	*Upupa africana*		*		
African Pipit	*Anthus cinnamomeus*	*	*		
African Quail-Finch	*Ortygospiza atricollis*	*	*		
African Rail	*Rallus caerulescens*			*	
African Reed Warbler	*Acrocephalus baeticatus*	*			
African Sacred Ibis	*Threskiornis aethiopicus*	*	*	*	
African Snipe	*Gallinago nigripennis*	*	*		
African Spoonbill	*Platalea alba*	*	*	*	
African Stonechat	*Saxicola torquatus*	*	*		
African Swamphen	*Porphyrio madagascariensis*			*	
African Wattled Lapwing	*Vanellus senegallus*	*	*		
Ant-eating Chat	*Myrmecocichla formicivora*	*	*		
Banded Martin	*Riparia cincta*	*	*		
Barn Swallow	*Hirundo rustica*	*	*		
Black Crake	*Amaurornis flavirostra*			*	
Black-chested Prinia	*Prinia flavicans*	*	*		
Black-collared Barbet	*Lybius torquatus*	*			
Black-headed Heron	*Ardea melanocephala*	*	*		
Black-headed Oriole	*Oriolus larvatus*		*		
Blacksmith Lapwing	*Vanellus armatus*	*	*	*	
Black-throated Canary	*Crithagra atrogularis*	*	*		
Black-winged Stilt	*Himantopus himantopus*		*	*	
Bokmakierie	*Telophorus zeylonus*	*	*		
Brown-throated Martin	*Riparia paludicola*	*	*	*	
Cape Bunting	*Emberiza capensis*		*		
Cape Canary	*Serinus canicollis*	*	*		
Cape Crow	*Corvus capensis*	*			
Cape Glossy Starling	*Lamprotornis nitens*	*			
Cape Grassbird	*Sphenoeacus afer*		*		
Cape Longclaw	*Macronyx capensis*	*	*		
Cape Robin-Chat	*Cossypha caffra*	*	*		
Cape Shoveler	*Lamprotornis nitens*	*	*	*	
Cape Sparrow	*Passer melanurus*	*	*		
Cape Teal	*Anas capensis*			*	
Cape Turtle Dove	*Streptopelia capicola*	*	*		
Cape Wagtail	*Motacilla capensis*	*	*	*	
Cape Weaver	*Ploceus capensis*	*	*	*	
Cape White-eye	*Zosterops virens*	*	*		
Capped Wheatear	*Oenanthe pileata*	*			

Non-Priority Species	Taxonomic name	WEF Transects	Control transects	Focal points	Incidental counts
Cardinal Woodpecker	*Dendropicos fuscescens*		*		
Chinspot Batis	*Batis molitor*		*		
Cloud Cisticola	*Cisticola textrix*	*	*		
Common Greenshank	*Tringa nebularia*		*	*	
Common Moorhen	*Gallinula chloropus*	*		*	
Common Myna	*Acridotheres tristis*	*	*		
Common Ostrich	*Struthio camelus*	*	*		
Common Quail	*Coturnix coturnix*	*	*		
Common Waxbill	*Estrilda astrild*	*	*	*	
Crowned Lapwing	*Vanellus coronatus*	*	*	*	
Dark-capped Bulbul	*Pycnonotus tricolor*	*	*		
Diederik Cuckoo	*Chrysococcyx caprius*	*	*		
Drakensberg Prinia	*Prinia hypoxantha*	*	*		
Eastern Clapper Lark	*Mirafra fasciolata*	*	*		
Eastern Long-billed Lark	*Certhilauda semitorquata*	*			
Egyptian Goose	*Alopochen aegyptiaca*	*	*	*	
Fan-tailed Widowbird	*Euplectes axillaris*	*	*		
Fiscal Flycatcher	*Melaenornis silens*	*	*		
Fork-tailed Drongo	*Dicrurus adsimilis*		*		
Giant Kingfisher	*Bostrychia hagedash*		*		
Greater Striped Swallow	*Cecropis cucullata*	*	*		
Grey Heron	*Ardea cinerea*	*	*	*	
Hadeda	*Bostrychia hagedash*	*	*		
Hamerkop	*Scopus umbretta*	*	*	*	
Helmeted Guineafowl	*Numida meleagris*	*	*		
Horus Swift	*Apus horus*		*		
House Sparrow	*Passer domesticus*	*			
Intermediate Egret	*Ardea intermedia*		*		
Kittlitz's Plover	*Charadrius pecuarius*	*	*	*	
Kurrichane Thrush	*Turdus libonyana*		*		
Laughing Dove	*Spilopelia senegalensis*	*	*		
Lazy Cisticola	*Cisticola aberrans*	*			
Lesser Moorhen	*Paragallinula angulata*		*		
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	*		*	
Levaillant's Cisticola	*Cisticola tinniens*	*	*	*	
Little Grebe	*Tachybaptus ruficollis*	*	*	*	
Little Rush Warbler	*Bradypterus baboecala*			*	
Little Swift	*Apus affinis*	*	*		
Long-tailed Widowbird	*Euplectes progne*	*	*		
Malachite Kingfisher	*Corythornis cristatus*	*		*	
Mountain Wheatear	*Myrmecocichla monticola*	*			

Non-Priority Species	Taxonomic name	WEF Transects	Control transects	Focal points	Incidental counts
Namaqua Dove	*Oena capensis*		*		
Olive Woodpecker	*Dendropicos griseocephalus*	*			
Orange-breasted Waxbill	*Ortygospiza atricollis*	*			
Pale-crowned Cisticola	*Cisticola cinnamomeus*	*	*		
Pied Avocet	*Recurvirostra avosetta*			*	
Pied Crow	*Corvus albus*	*			
Pied Kingfisher	*Ceryle rudis*	*		*	
Pied Starling	*Lamprotornis bicolor*	*	*		
Pin-tailed Whydah	*Vidua macroura*	*	*		
Red-billed Quelea	*Quelea quelea*	*	*		
Red-billed Teal	*Anas erythrorhyncha*		*	*	
Red-capped Lark	*Calandrella cinerea*	*	*		
Red-chested Cuckoo	*Cuculus solitarius*	*			
Red-chested Flufftail	*Sarothrura rufa*	*			
Red-collared Widowbird	*Euplectes ardens*	*	*		
Red-eyed Dove	*Streptopelia capicola*	*	*		
Red-faced Mousebird	*Urocolius indicus*	*	*		
Red-knobbed Coot	*Fulica cristata*	*	*	*	
Red-throated Wryneck	*Jynx ruficollis*	*	*		
Red-winged Francolin	*Scleroptila levaillantii*	*	*		
Reed Cormorant	*Microcarbo africanus*	*	*	*	
Ring-necked Dove	*#N/A*		*		
Rock kestrel	*Falco rupicolus*				*
Rock Martin	*Ptyonoprogne fuligula*	*	*		
Sentinel Rock Thrush	*Monticola explorator*	*			
South African Cliff Swallow	*Petrochelidon spilodera*	*	*		
South African Shelduck	*Tadorna cana*	*	*	*	
Southern Boubou	*Laniarius ferrugineus*		*		
Southern Fiscal	*Lanius collaris*	*	*		
Southern Grey-headed Sparrow	*Passer diffusus*	*	*		
Southern Masked Weaver	*Ploceus velatus*	*	*	*	
Southern Pochard	*Netta erythrophthalma*	*			
Southern Red Bishop	*Euplectes orix*	*	*	*	
Speckled Mousebird	*Colius striatus*	*	*		
Speckled Pigeon	*Columba guinea*	*	*		
Spike-heeled Lark	*Chersomanes albofasciata*	*	*		
Spotted Flycatcher	*Muscicapa striata*	*			
Spotted Thick-knee	*Burhinus capensis*		*		
Spur-winged Goose	*Plectropterus gambensis*	*	*	*	
Streaky-headed Seedeater	*Crithagra gularis*	*			
Swainson's Spurfowl	*Pternistis swainsonii*	*	*		

Non-Priority Species	Taxonomic name	WEF Transects	Control transects	Focal points	Incidental counts
Temminck's Courser	*Cursorius temminckii*	*			
Three-banded Plover	*Charadrius tricollaris*	*	*	*	
Wailing Cisticola	*Cisticola lais*	*	*		
Wattled Starling	*Creatophora cinerea*	*			
Western Cattle Egret	*Bubulcus ibis*	*	*	*	
Whiskered Tern	*Chlidonias hybrida*	*			
White-backed Duck	*Thalassornis leuconotus*	*			
White-breasted Cormorant	*Phalacrocorax lucidus*	*	*	*	
White-rumped Swift	*Apus caffer*	*	*		
White-throated Swallow	*Hirundo albigularis*	*	*		
White-winged Tern	*Chlidonias leucopterus*	*	*		
Willow Warbler	*Phylloscopus trochilus*		*		
Wing-snapping Cisticola	*Cisticola ayresii*	*	*		
Yellow Canary	*Crithagra flaviventris*	*	*		
Yellow-billed Duck	*Anas undulata*	*	*	*	
Yellow-billed Kite	*Milvus aegyptius*	*			
Yellow-crowned Bishop	*Euplectes afer*	*	*		
Yellow-fronted Canary	*Crithagra mozambica*	*			
Zitting Cisticola	*Cisticola juncidis*	*	*		
142	Subtotal	115	106	39	1
	Grand total	**129**	118	44	31

APPENDIX 2: HABITAT FEATURES AT THE PROJECT AREA

Figure 1: High sensitivity natural grassland

Figure 2: A large pan

Figure 3: An example of an earth dam

Figure 4: Agriculture


Figure 5: Drainage line and associated wetland


Figure 6: Alien trees

APPENDIX 3: PRE-CONSTRUCTION MONITORING

1. Objectives

The objective of the pre-construction monitoring at the proposed Camden I Wind Energy Facility (WEF) was to gather baseline data over a period of four seasons on the variety and abundance of avifauna at the project area.

2. Methods

One set of guidelines were applicable to these wind facilities:

- Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa.* Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa. Hereafter referred to as the wind guidelines.

The wind guidelines are applicable to all wind energy facilities which require environmental authorisation. The wind guidelines require a minimum of four site visits a year over a period of four seasons.

Wind priority species were identified using the latest (November 2014) BirdLife SA (BLSA) list of priority species for wind farms.

Monitoring surveys were conducted during the following periods:

- 26 - 31 July 2020 (winter)
- 2 - 7 August 2020 (winter)
- 16 - 19, 30 September 2020 (spring)
- 2 - 3, 7 - 8 October 2020 (spring)
- 4 – 5 November 2020 (spring)
- 10 – 13, 20 - 27 February 2021 (summer)
- 21 – 22 March 2021 (summer)
- 12 – 15 April 2021 (autumn)
- 3 – 6, 12 – 13 May 2021 (autumn)

Monitoring was conducted in the following manner:

- One drive transect was identified totalling 10.2km on the development site and one drive transect in the control site with a total length of 10.5km.
- One monitor travelling slowly (± 10km/h) in a vehicle recorded all birds on both sides of the transect. The observer stopped at regular intervals (every 500m) to scan the environment with binoculars. Drive transects were counted three times per sampling session.
- In addition, 4 walk transects of 1km each were identified at the development site, and two at the control site, and counted 4 times per sampling season. All birds were recorded during walk transects.
- The following variables were recorded:
    - Species
    - Number of birds

- Date
- Start time and end time
- Estimated distance from transect
- Wind direction
- Wind strength (estimated Beaufort scale)
- Weather (sunny; cloudy; partly cloudy; rain; mist)
- Temperature (cold; mild; warm; hot)
- Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground) and
- Co-ordinates (priority species only)

The aim with drive transects is primarily to record large priority species (i.e. raptors and large terrestrial species), while walk transects are primarily aimed at recording small passerines. The objective of the transect monitoring is to gather baseline data on the use of the site by birds in order to measure potential displacement by the wind and solar farm activities.

- Four vantage points (VPs) were identified from which the majority of the buildable area can be observed, to record the flight altitude and patterns of priority species. One VP was also identified on the control site. The following variables were recorded for each flight:
  - Species
  - Number of birds
  - Date
  - Start time and end time
  - Wind direction
  - Wind strength (estimated Beaufort scale 1-7)
  - Weather (sunny; cloudy; partly cloudy; rain; mist)
  - Temperature (cold; mild; warm; hot)
  - Flight altitude (high i.e. >220m; medium i.e. 30m – 220m; low i.e. <30m)
  - Flight mode (soar; flap; glide; kite; hover) and
  - Flight time (in 15 second-intervals).

The objective of vantage point counts is to measure the potential collision risk with the turbines.

A total of three potential focal points (FPs) of bird activity were identified and monitored. The focal points are as follows:

- FP1: A farm dam in a drainage line in the application site
- FP2: A large salt pan in the application site
- FP3: A large pan situated approximately 3.6km north-west of the application site on the farm Rietspruit 437 IS.

Figure 1: Area where monitoring was performed, with position of vantage points, focal points, drive transects and walk transects. The area to the north-east of the project area is the control area.

APPENDIX 4: FLIGHT MAPS


Camden 1 WEF
Flight activity of Blue Korhaan
Legend
C1 Project outline
Low
Medium
High
Very high
Google Earth
Image © 2022 Maxar Technologies
N
4 km


Camden 1 WEF
Flight activity of Cape Vulture
Legend
C1 Project outline
Low
Medium
High
Very high
Google Earth
Image © 2022 Maxar Technologies
4 km
N


Camden 1 WEF
Flight activity of Lanner Falcon
Legend
C1 Project outline
Low
Medium
High
Very high
Google Earth
Image © 2022 Maxar Technologies
4 km
N


Camden 1 WEF
Flight activity of Secretarybird
Legend
C1 Project outline
Low
Medium
High
Very high
Google Earth
Image © 2022 Maxar Technologies
4 km
N


Camden 1 WEF
Flight activity of Southern Bald Ibis
Legend
C1 Project outline
Low
Medium
High
Very high
Google Earth
Image © 2022 Maxar Technologies
N
4 km

APPENDIX 5: IMPACT TABLES

Project Name: Camden I WEF

Impact Assessment

CONSTRUCTION

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with the construction of the wind turbines and associated infrastructure.	Construction	Negative	Moderate	4	2	4	2	5	**60**	**N3**	3	2	3	2	4	**40**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with the construction of the wind turbines and associated infrastructure.	Construction	Negative	Moderate	3	2	4	4	4	**52**	**N3**	3	2	3	4	3	**36**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						

Project Name: Camden I WEF

Impact Assessment

OPERATIONAL

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Mortality: Collision	Mortality of priority species due to collisions with the wind turbines	Operational	Negative	Moderate	4	3	4	4	4	**60**	**N3**	3	3	3	4	2	**26**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 2:	Mortality: Collision	Mortality of priority species due to collisions with the medium voltage overhead power lines	Operational	Negative	Moderate	4	3	4	4	3	**45**	**N3**	3	3	3	4	2	**26**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 3:	Mortality: Electrocution	Electrocution of priority species on the medium voltage infrastructure	Operational	Negative	High	4	3	4	4	4	**60**	**N3**	1	3	2	4	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

Project Name: Camden I WEF

Impact Assessment

DECOMISSIONING

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with the dismantling of the wind turbines and associated infrastructure.	Construction	Negative	Moderate	4	2	3	2	4	**44**	**N3**	3	2	2	2	3	**27**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

Project Name: Camden I WEF

Impact Assessment

CUMULATIVE

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with the construction of the wind turbines and associated infrastructure.	Construction	Negative	Moderate	4	3	3	3	4	**52**	**N3**	3	3	3	2	3	**33**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with the construction of the wind turbines and associated infrastructure.	Construction	Negative	Moderate	3	3	4	4	4	**56**	**N3**	3	3	3	4	3	**39**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						
Impact 3:	Mortality: Collision	Mortality of priority species due to collisions with the wind turbines	Operational	Negative	Moderate	5	3	4	4	4	**64**	**N4**	4	3	3	4	3	**42**	**N3**
					Significance	**N4 - High**							**N3 - Moderate**						
Impact 4:	Mortality: Collision	Mortality of priority species due to collisions with the medium voltage overhead power lines	Operational	Negative	Moderate	4	3	4	4	4	**60**	**N3**	3	3	3	4	4	**52**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						
Impact 5:	Mortality: Electrocution	Electrocution of priority species on the medium voltage infrastructure	Operational	Negative	High	5	3	4	4	4	**64**	**N4**	2	3	2	4	3	**33**	**N3**
					Significance	**N4 - High**							**N3 - Moderate**						

Project Name: Camden BESS

Impact Assessment

CONSTRUCTION

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with the construction of the BESS	Construction	Negative	Moderate	2	1	1	2	3	**18**	**N2**	2	1	1	2	2	**12**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with the construction of the BESS	Construction	Negative	Moderate	2	1	5	4	2	**24**	**N2**	2	1	5	4	2	**24**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						

DECOMISSIONING

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with the dismantling of the BESS	Construction	Negative	Moderate	2	1	1	2	3	**18**	**N2**	2	1	1	2	2	**12**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						

Project Name: Camden BESS

Impact Assessment

CUMULATIVE

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with the construction of the BESS	Construction	Negative	Moderate	2	1	1	2	4	**24**	**N2**	2	1	1	2	3	**18**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with the construction of the BESS	Construction	Negative	Moderate	3	1	5	4	2	**26**	**N2**	3	1	5	4	2	**26**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						

Project Name: Camden I Up to 132kV OHL

Impact Assessment

CONSTRUCTION

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with construction of the on-site substation and up to 132kV overhead power line	Construction	Negative	Moderate	4	2	3	2	4	**44**	**N3**	3	2	3	2	3	**30**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with construction of the on-site substation and up to 132kV overhead power line	Construction	Negative	Moderate	2	2	3	2	4	**36**	**N3**	2	2	3	2	3	**27**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

Project Name: Camden I Up to 132kV OHL

Impact Assessment

OPERATION

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	**E+**	**R+**	**D)x**	**P=**	**S**		**(M+**	**E+**	**R+**	**D)x**	**P=**	**S**	
Impact 1:	Mortality: Collision	Mortality of priority species due to collisions with the up to 132kV overhead power line	Operational	Negative	Moderate	5	3	3	4	4	**60**	**N3**	3	3	3	4	2	**26**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 2:	Mortality: Electrocution	Electrocution of priority species on the on-site substation infrastructure	Operational	Negative	High	5	3	3	4	2	**30**	**N2**	1	2	3	4	2	**20**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						
Impact 3:	Mortality: Electrocution	Electrocution of priority species on the up to 132kV OHL	Operational	Negative	High	5	3	3	4	3	**45**	**N3**	1	2	3	4	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

Project Name: Camden I Up to 132kV OHL

Impact Assessment

DECOMISSIONING

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with decommissioning of the on-site substation and up to 132kV overhead power line	Decommissioning	Negative	Moderate	4	2	3	2	4	**44**	**N3**	3	2	3	2	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

Project Name: Camden I Up to 132kV OHL

Impact Assessment

CUMULATIVE

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Mortality: Collision	Powerline collision mortality of priority avifauna due to the construction of the overhead power line.	Cumulative	Negative	Moderate	2	2	2	4	3	**30**	**N2**	2	3	3	4	2	**24**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						
Impact 2:	Displacement	Displacement of priority avifauna due to disturbance and habitat transformation	Cumulative	Negative	Moderate	3	2	3	2	3	**30**	**N2**	3	2	3	2	2	**20**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						
Impact 3:	Mortality: Electrocution	Mortality (electrocution) of priority avifauna due to the construction of the on-site substation	Cumulative	Negative	High	3	3	3	4	2	**26**	**N2**	1	2	3	4	2	**20**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						

APPENDIX 6: ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

Environmental Management Programme (EMPr): WEF

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation / Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Mortality due to collisions with the turbines					
Mortality of priority avifauna due to collisions with the wind turbines	Prevent mortality of priority avifauna	The results of the pre-construction monitoring must guide the lay-out of the turbines, especially as far as proposed no-turbine zones are concerned. No turbines must be constructed in the buffer zones which were identified based on the results of the pre-construction monitoring, with a specific view to limiting the risk of collisions to a variety of birds, including several Red Data species.	1. A 100m turbine exclusion zone must be implemented around wetlands, dams and pans. Other infrastructure must be limited as far as possible to prevent displacement of African Grass Owl. 2.	Once-off during the planning phase.	Project Developer
Avifauna: Mortality due to electrocution					
Electrocution of raptors on the internal medium voltage poles	Prevent electrocutions	1. Use underground cabling as much as is practically possible. 2. Where the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively for complicated pole structures e.g. insulation of live components to prevent electrocutions on terminal structures and pole transformers.	1. Design the facility with underground cabling as far as possible. 2. Consult with Avifaunal Specialist during the design phase of the overhead lines.	Once-off during the planning phase.	Project Developer

EMPr for the Construction Phase (Including pre- and post-construction activities)

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of priority avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific Construction EMPr (CEMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and must apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving. 2. Maximum use of existing roads. 3. Measures to control noise and dust according to latest best practice. 4. Restricted access to the rest of the property. 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation and rehabilitation of the footprint.	**1.** Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. Monthly 2. Monthly 3. Monthly 4. Monthly 5. Monthly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO
Avifauna: Displacement due to habitat transformation					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the wind turbines and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the biodiversity specialist study.	1. All biodiversity recommendations regarding rehabilitation must be followed 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance. 3. Vehicle and pedestrian access to the site to be controlled and restricted to the facility footprint as much as possible to prevent unnecessary destruction of	1. All biodiversity recommendations regarding rehabilitation must be followed	1. Frequency as stated by the biodiversity specialist	1. Developer 2. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		vegetation.			

EMPr for the Operational Phase

Impact	Mitigation/ Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Mortality due to collisions with the wind turbines					
Bird collisions with the wind turbines	Prevention of collision mortality on the wind turbines.	1. Formal live-bird monitoring and carcass searches to be implemented at the start of the operational phase, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al*., 2015), to assess collision rates. The exact time when operational monitoring is to commence, will depend on the construction schedule, and must commence when the first turbines start operating. The Best Practice Guidelines require that, as an absolute minimum, operational monitoring is to be undertaken for the first two years of operation, and then repeated again in year 5, and again every five years thereafter for the operational lifetime of the facility.	1. Appoint Avifaunal Specialist to compile operational monitoring plan, including live bird monitoring and carcass searches. 2. Implement operational monitoring plan. 3. If estimated annual collision rates indicate unacceptable mortality levels of priority species, i.e., if it exceeds the pre-determined threshold determined by the avifaunal specialist implement shut down on demand or other proven measures. 4. Compile quarterly and annual progress reports detailing the results of the operational monitoring and progress with any recommended mitigation measures.	1. Once-off 2. Years 1,2, 5 and every five years after that for the duration of the operational lifetime of the facility. 3. Years 1 and 2, and then after evaluation, annually as long as it is deemed necessary in the opinion of the avifaunal specialist in consultation with the WEF managemen t.	1. Operations Manager 2. Operations Manager 3. Operations Manager 4. Operations Manager
Avifauna: Mortality due to collisions and electrocutions on the medium voltage network					
Bird electrocutions on the overhead sections of the internal 33kV cables	Prevention of electrocution mortality on the overhead sections of the 33kV internal cable network.	1. Conduct regular inspections of the overhead sections of the internal reticulation network to look for carcasses.	1. Carcass searchers under the supervision of the Avifaunal Specialist. 2. Design and implement mitigation measures if mortality thresholds are exceeded. 3. Compile quarterly and annual progress reports detailing the results of the	1. At least once every two months.	1. Operations Manager

Impact	Mitigation/ Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			operational monitoring and progress, with any recommended mitigation measures.		

EMPr for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to disturbance associated with the dismantling activities					
The noise and movement associated with the de-commissioning activities at the WEF footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the EMPr.	A site-specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and must apply good environmental practice during construction. The EMPr must specifically include the following: 1. No off-road driving. 2. Maximum use of existing roads. 3. Measures to control noise and dust according to latest best practice. 4. Restricted access to the rest of the property. 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	**1.** Implementation of the EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the footprint area is demarcated and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. On a daily basis 2. Monthly 3. Monthly 4. Monthly 5. Monthly	1. O&M Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Mortality of avifauna, specifically Cape Vulture, due to electrocutions on the overhead powerline poles/towers	Reduction of avian electrocution mortality	If a steel monopole pole design is used, the approved vulture friendly pole/tower design D-DT-7649 in accordance with the Eskom Distribution Technical Bulletin titled Refurbishment of 66/88kV line kite type frames with D-DT-7649 type top configuration - Reference Number 240-170000467 relating to bird friendly structures, must be used. If lattice type structures are used, it is imperative that a minimum vertical clearance of 1.8m is maintained between the jumper cables and/or insulator live ends, and the horizontal earthed components. Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended (if suitable insulation material is readily available), alternatively all jumper cables must be suspended below the crossarms.	1. Construct the powerline using a minimum vertical clearance of 1.8m between the jumper cables and/or insulators and the horizontal earthed component on the lattice structure. 2. If possible, insulate jumper cables that may be present on strain and terminal poles/towers. Alternatively suspend all jumper cables below the crossarms	Once-off	Contractor and ECO

Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	Conduct a pre-construction inspection (avifaunal walk-through) of the final powerline alignment to identify priority species that may be breeding within the final footprint. If a SSC nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding birds during the construction period. A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the biodiversity specialist report pertaining to the limitation of the footprint.	1. Walk-through by avifaunal specialist 2. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 3. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 4. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 5. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 6. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. Once-off 2. Monthly 3. Monthly 4. Monthly 5. Monthly	1. Avifaunal Specialist 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO 6. Contractor and ECO
Avifauna: Mortality due to collision with the overhead powerline					
Mortality of avifauna due to collisions with the overhead powerline.	Reduction of avian collision mortality	Bird Flight Diverters must be fitted to the entire OHL according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). These devices must be installed as soon as the conductors and	1. Fit Eskom approved Bird Flight Diverters on the entire length of line	1. Once-off	1. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		earthwires are strung.			

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to disturbance					
The noise and movement associated with the decommissioning activities will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Decommissioning EMPr.	Conduct an avifaunal inspection of the OHL prior to its decommissioning to identify nests on the poles/towers. A site-specific Decommissioning EMPr (DEMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the DEMPr and should apply good environmental practice during decommissioning. The DEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	1. Implementation of the DEMPr. Oversee activities to ensure that the DEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that decommissioning personnel are made aware of the impacts relating to off-road driving. 3. Access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the decommissioning area is demarcated clearly and that personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. Once-off 2. Monthly 3. Monthly 4. Monthly 5. Monthly 6. Monthly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Appendix 7: Post-construction monitoring plan

1 INTRODUCTION

The avifaunal post-construction monitoring at the proposed Camden I WEF must be conducted in accordance with the latest version (2015) of the *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa* (Jenkins *et al*., 2015)[13].

2 AIM OF POST-CONSTRUCTION MONITORING

The avifaunal post construction monitoring aims to assess the impact of each proposed WEF by comparing pre- and post- construction monitoring data and to measure the extent of bird fatalities caused by each WEF. Post-construction monitoring is therefore necessary to:

- Confirm as far as possible what the actual impacts of each WEF are on avifauna; and
- Determine what mitigation is required if need be (adaptive management).

The proposed post-construction monitoring can be divided into three categories:

- Habitat classification;
- Quantifying bird numbers and movements (replicating baseline pre-construction monitoring); and
- Quantifying bird mortalities.

Post-construction monitoring will aim to answer the following questions:

- How has the habitat available to birds in and around each WEF changed?
- How has the number of birds and species composition changed?
- How have the movements of priority species changed?
- How has each WEF affected priority species’ breeding success?
- How many birds collide with the turbines of each WEF? And are there any patterns to this?
- What mitigation is necessary to reduce the impacts on avifauna?

3 TIMING

Post-construction monitoring should commence as soon as possible after the first turbines become operational to ensure that the immediate effects of each facility on resident and passing birds are recorded, before they have time to adjust or habituate to the developments. However, it should be

[13] Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa.

borne in mind that it is also important to obtain an understanding of the impacts of the facilities as they would be over the lifespan of the facilities. Over time the habitat within each WEF may change, birds may become habituated to, or learn to avoid the facilities. It is therefore necessary to monitor over a longer period than just an initial one year.

4 DURATION

Monitoring should take place in Year 1 and 2 of the operational phase of each proposed WEF, and then repeated in Year 5 and every five years after that. After the first year of monitoring, the programme should be reviewed in order to incorporate significant findings that may have emerged. This may entail the revision of the number of turbines to be searched, and the size of the search plots, depending on the outcome of the first year of monitoring. If significant impacts are observed, i.e., exceeding predetermined thresholds, and mitigation is required, the matter should be taken up with the operator to discuss potential mitigation. In such instances the scope of monitoring could be reduced to focus only on the impacts of concern.

5 HABITAT CLASSIFICATION

Any observed changes in bird numbers and movements at each WEF may be linked to changes in the available habitat. The avian habitats available must be mapped once a year for the first two years, then in year 5 and thereafter in 5-yearly intervals as part of the monitoring programme.

6 BIRD NUMBERS AND MOVEMENTS

In order to determine if there are any impacts relating to displacement and/or disturbance, all methods used to estimate bird numbers and movements during baseline monitoring must be applied as far as is practically possible in the same way to post-construction work in order to ensure maximum comparability of these two data sets. This includes sample counts of small terrestrial species, counts of large terrestrial species and raptors, focal site surveys and vantage point surveys according to the current best practice.

7 COLLISIONS

The collision monitoring must have three components:

- Experimental assessment of search efficiency and scavenging rates of bird carcasses on the respective sites.
- Regular searches in the immediate vicinity of the WEF turbines for collision casualties (see Section 9).
- Estimation of collision rates.

8 SEARCHER EFFICIENCY AND SCAVENGER REMOVAL

The value of surveying the area for collision victims is only valid if some measure of the accuracy of the survey method is developed. The probability of a carcass being detected and the rate of removal /

decay of the carcass must be accounted for when estimating collision rates. This must be addressed in the form of searcher and scavenger trails which must be conducted by the avifaunal specialists at least twice a year during each year of post-construction monitoring in order to arrive at an estimated annual collision mortality rate.

9 COLLISION VICTIM SURVEYS

9.1 Aligning carcass search protocols

The carcass search protocol must be agreed upon between the bat and bird specialists to constitute an acceptable compromise between the current best practice guidelines for bird and bat monitoring.

Daily carcass searches must begin as early in the mornings as possible to reduce carcass removal by scavengers. A carcass searcher must walk in straight line transects, 6m apart, covering 3m on each side. A team of searchers and one supervisor must be trained to implement the carcass searches. The searchers must have a vehicle available for transport per site. The supervisor must assist with the collation of the data at each site and to provide the data to the specialist in electronic format on a weekly basis. The specialists must ensure that the supervisor is completely familiar with all the procedures concerning the management of the data. The following must be sent to the specialist on a weekly basis:

- Carcass fatality data (hardcopy and scans as well as data entered into Excel spreadsheets);
- Pictures of any carcasses, properly labelled;
- GPS tracks of the search plots walked; and
- Turbine search interval spreadsheets.

When a carcass is found, it must be bagged, labelled and kept refrigerated for species confirmation by the avifaunal specialist.

9.2 Estimation of collision rates

Observed mortality rates need to be adjusted to account for searcher efficiency and scavenger removal. There have been many different formulas proposed to estimate mortality rates. The available methodologies must be investigated, and an appropriate method will be applied. The current method which is used widely is the GenEst method.

10 DELIVERABLES

10.1 Annual report

An operational monitoring report must be completed at the end of each year of operational monitoring. As a minimum, the report must attempt to answer the following questions:

- How has the habitat available to birds in and around each WEF changed?

- How has the number birds and species composition changed?
- How have the movements of priority species changed?
- How has each WEF affected priority species’ breeding success?
- What are the likely drivers of any changes observed?
- How many, and which species of birds collided with the turbines and associated infrastructure? And are there any patterns to this?
- What is the significance of any impacts observed?
- What mitigation measures are required to reduce the impacts?

10.2 Quarterly reports

Concise quarterly reports must be compiled by the avifaunal specialist for the WEF operator with basic statistics and recommendations for the management of impacts that need to be addressed.

ANNEXURE 1: DETAILED INFORMATION ON THE MARTIAL EAGLE NEST FINDING

Martial Eagle Nest Finding

Following completion of the pre-construction bird monitoring programme (August 2020 – September 2021 for Camden I WEF and July 2020 – May 2021 for Camden II WEF), and after the closure and conclusion of the draft EIA report Public Participation period for the Camden Renewable Energy complex (07 September 2022 to 10 October 2022), Chris van Rooyen consulting was informed of a potential Martial Eagle (*Polemaetus bellicosus*) nest located near the Camden II Wind Energy Facility. This was investigated in-field on 12 October 2022 and the presence of the nest was confirmed by the avifaunal specialists at the location of -26.694075° (latitude) and 30.091790° (longitude). An adult bird and a juvenile were recorded during the field investigation in the stand trees where the nest is located.

In accordance with best practice and in alignment with the buffer distance recommended by BirdLife South Africa, a 5km no-turbine exclusion zone around this nest must therefore be implemented.

The presence of this nest affects the following turbine locations proposed within a 5km radius of the nest and are therefore not supported from an avifaunal perspective:

- Camden I Wind Energy Facility: WTG locations 22 and 33 only.
- Camden II Wind Energy Facility: WTG locations 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 17, 18, 21, 41, 42, 43 and 44 only.

Due to the time constraints the facility layout cannot be updated to remove all these above turbine locations as this would entail all specialists to create new maps and reports. It is further important to note that the facility layout and EMPr are not submitted for final approval and the proponent is therefore still required to complete a final layout approval process (including, amongst others, adherence of the final layout to all specialist constraints). This final layout will therefore be required to adhere to the 5km no-turbine buffer around the nest during the final layout approval process, which will be subject to public participation at the time.

It is important to note that all other turbine locations (both Camden I and II Wind Energy Facilities) presently adhere fully to the avifaunal assessment, findings and recommendations and that all the requested mitigation measures have been incorporated into the respective project EMPrs, including but not limited to pre-construction walkthroughs, avoidance of wetland and dams and adherence to all sensitivity criteria as provided, as well as operational monitoring and pro-active mitigation in the form of shutdown on demand.

The conclusions, impacts and ratings (pre and post mitigation), as well as findings of this report thus remain unchanged and the proposed WEF development is therefore supported, provided the mitigation measures listed in this report are strictly implemented, including ensuring no turbines within the 5km no-turbine buffer around the Martial Eagle nest is approved with the final layout approval. The buffer of 5km is presented on the sensitivity map in the EIA and whilst the above listed turbines are still depicted therein, the Department of Environment, Forestry and Fisheries (DFFE) must exclude these locations from the Environmental Authorisation.