Grid Connection Infrastructure, including 132kV Overhead Power Line, Switching Station and Ancillaries, for the Great Karoo Wind Farm - Avifauna Impact Assessment

Sutherland, Northern Cape

October 2020

CLIENT

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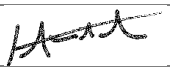
Report Name	**Grid Connection Infrastructure, including 132kV Overhead Power Line, Switching Station and Ancillaries, for the Great Karoo Wind Farm - Avifauna Impact Assessment**
Reference	**Great Karoo Wind Farm OHL**
Submitted to	savannah environmental
Report Writer	**Mahomed Desai**  Dr. Mahomed Desai has extensive experience in assessing estuarine, freshwater and terrestrial biodiversity. He obtained his M.Sc. in Environmental Engineering and Ph.D. in Ecological Sciences, and has over 10 years of experience working with African fauna and flora as a researcher and consultant, through various projects.
Reviewer	**Andrew Husted**  Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

DECLARATION

I, Mahomed Desai, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Mahomed Desai

Biodiversity and Aquatic Specialist

The Biodiversity Company

October 2020

Executive Summary

The authorised Great Karoo Wind Farm substation requires grid connection infrastructure to connect to the Hidden Valley (Karusa) substation, at the Karusa Wind Farm, currently under construction. The infrastructure required includes a switching station (up to 100 m x 100 m), 132 kV double- or single-circuit overhead powerline, with a length of up to 14 km. A grid connection corridor of 300 m has been identified for the power line and a 500 m assessment area for the switching station. The proposed infrastructure will be appropriately placed within the respective corridors. The pylon structures of the power line will be up to 32 m high and the power line will be developed within the servitude of up to 40 m wide. The Biodiversity Company was appointed to undertake an avifauna assessment for the development of the specific grid connection infrastructure required.

This assessment describes the composition of the avifaunal community within the area affected by the proposed development, and the possible impacts on the local avifauna. In order to achieve this, a review of available avifaunal information and a field assessment for the assessment area was undertaken. An expected 101 species of avifauna were expected to occur within the assessment area, with 30 species recorded during the field survey. Two red-listed species were observed within the assessment corridor, namely namely *Afrotis afra* (Southern Black Korhaan) and *Neotis ludwigii* (Ludwig's Bustard). The latter species is nomadic, and it is postulated that the species inhabits the area during the spring and summer period, based on the observations made during the field survey periods. However, the number of individuals that use the area it is not known, as well as their flight paths within the landscape, and accordingly the long-term evaluation of this should be considered. Flight paths for the *A. afra* and *N. ludwigii* within the assessment corridor are provided in section 3.2.3 of this report.

A pair of *Bubo africanus* (Spotted Eagle-Owl) were recorded to be nesting along a drainage line adjacent to the Karusa Wind Farm substation. The species pairs for life and tends to re-use nesting sites. The breeding season is during late winter (August) and therefore it is recommended that construction of this portion of the development be undertaken prior to this period to avoid disturbance. If this is not possible, a 50 m buffer around the nest site should be maintained to ensure no construction activity occurs within the buffer. The location of the *B. africanus* nest is provided in section 3.2.3 of this report. Although, the risk of collision for owls tend to be minimal due to their eyesight, the species is at risk of electrocution. No pylons are to be erected within 100 m of the nest site to reduce the risk of electrocution. Where technically feasible, pylons should be positioned 200 m or more away from the nest location.

The expected impacts of the proposed infrastructure will include the following:

- habitat loss and fragmentation;
- disturbance and displacement caused during the construction phase;
- direct mortality of avifauna colliding with the power lines during the operational phase;
- electrocutions with power line infrastructure during the operational phase;
- continued habitat degradation arising from disturbance during the decommissioning phase; and
- cumulative habitat loss at a broader scale from renewable energy developments in the area.

In order to reduce the significance of the impacts several mitigation measures can be implemented during the construction and operational phase of the proposed grid connection. During the construction phase, displacement and disturbance of avifauna can be reduced by restricting habitat loss and disturbance to within the footprint of the development corridor. All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting or hunting terrestrial species such as bustards, korhaans, francolins, and owls, of which the latter are often persecuted out of superstition.

Based on the species that were observed to utilise the assessment area for feeding and breeding, it is postulated that collision is a greater risk than electrocution. This is due to the high probability of direct mortality of *N. ludwigii* from collisions with power lines, even with the implementation of bird flappers and diverters. Nevertheless, with the implementation of the appropriate mitigation measures, such as the installation of bird diverters and bird flaps, the impact of the proposed grid connection can be reduced for other priority species. Ideally, Bird Strike Indicators could be installed to alert about collisions. Bird Strike Indicators are an automated vibration-sensing and recording tool designed to detect bird strikes on aerial cables. The assumption is that a collision will result in vibration being induced into the wires that can be detected through the use of accelerometer. The BSI sensor integrates several components to provide the needed functionality for monitoring and recording bird strikes.

During the first year of the operational phase monthly monitoring along the grid connection must be undertaken to identify areas of high collision and electrocution risk. This monitoring is essential to ascertain the efficacy of these mitigation measures. During the first year, quarterly reports must be sent to BirdLife South Africa and based on the outcomes of these reports, these can be undertaken annually from the second year of the operational phase.

Rehabilitation of disturbed areas must occur to mitigate against erosion and the encroachment of invasive plants as this will lead to a negative shift in the wellbeing of the avifauna community. It is important to ensure that regular monitoring for invasive plant encroachment occurs during the operation phase. This should be undertaken every 6 months during the first two years of the operation phase and annually for the life of the project. This is to ensure that the area is not degraded further. Monitoring for signs of erosion must be undertaken in parallel and rectified as soon as possible.

Cumulative impacts in the area are a concern due to the proliferation of Wind Energy Facilities. In terms of habitat loss, the overall footprint of all authorised Wind Energy Facilities is extensive, and the network of wind turbines and powerlines increase the risk of collision or electrocution for priority species. Bearing in mind that the Great Karoo Wind Farm has already received authorisation, and the proposed grid connection infrastructure is a necessity for the distribution of energy, development may proceed. Considering that this area has been identified as being of significance for biodiversity maintenance and ecological processes (CBAs and NPAES focus area), development may proceed but with caution and only with the implementation of mitigation measures. All mitigations measures prescribed herein must be considered by the issuing authority for authorisation.

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1 Introduction

1.1 Background

The Biodiversity Company was appointed to undertake an avifauna baseline assessment for the development of specific grid connection infrastructure required to connect and evacuate the generated power of the authorised Great Karoo Wind Farm to the national electricity grid. Following consultation with Eskom, it has been confirmed that the Great Karoo Wind Farm must connect to the Hidden Valley substation (Karusa substation) located at the Karusa Wind Farm (currently under construction). The project is located ~44 km south of Sutherland and ~50 km north of Matjiesfontein within the Northern Cape Province and falls within the Namakwa District Municipality and the Karoo Hoogland Local Municipality.

The grid connection infrastructure required includes a switching station (up to 100 m x 100 m) to be developed adjacent to the authorised Great Karoo Wind Farm substation. A 132 kV double- or single-circuit overhead powerline, with a length of up to 14 km, will connect the proposed switching station to the Eskom Hidden Valley substation. The proposed infrastructure will be appropriately placed within the respective corridors. The pylon structures of the power line will be up to 32 m high and the power line will be developed within the servitude of up to 40 m wide.

Other associated infrastructure includes a service track ("jeep track) along the length of the power line servitude (which may be up to 6 m wide during construction), a 6 m wide access road to provide access to the switching station and temporary laydown area/s that will be rehabilitated upon completion of the construction phase.

The grid connection infrastructure will be located within three affected properties:

- Farm Kentucky 206;
- Remainder of Portion 1 of the Farm Orange Fontein 203; and
- Remaining Extent of the Farm De Hoop 202.

The approach adopted for the assessments has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 20 March 2020: "Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation". The National Web based Environmental Screening Tool has characterised the terrestrial biodiversity for the project area/corridor as "very high sensitivity" and that an avifauna assessment must be undertaken prior to authorization.

1.2 Scope of Work

The principle aim of the assessment was to provide information to guide the risk of the proposed activity to the avifauna community of the associated ecosystems within the project area/corridor. This was achieved through the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the proposed development area and surrounding landscape;
- Desktop assessment to compile an expected species list and possible threatened avifauna species that occur within the proposed landscape;
- Field survey to ascertain the species and guild structure of the present avifauna community and their habitat associations within the proposed development area;
- Identify the manner that the proposed development impacts the avifauna community and evaluate the level of risk of these potential impacts; and
- The prescription of mitigation measures and recommendations for identified risks.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- The assessment area/corridor was based on the route provided by the client and any alterations to the route and/or missing GIS information pertaining to the assessment area would have affected the area surveyed;
- The fieldwork component of the assessment comprised one assessment only and therefore, this study has not assessed any long-term temporal trends. Moreover, the fieldwork could only be conducted for 1.5 days. This limits the opportunity for discerning longer term flight-paths;
- The avifauna assessment was undertaken in parallel with the flora, herpetofauna and mammal surveys, and as such data could not be captured in a manner so that multivariate analyses could be performed;
- The field survey was undertaken in early spring and therefore the probability of detection of certain species will be lowered as migratory species may not be present yet; and
- Due to accessibility constraints, no night survey was undertaken and thus will limit the likelihood of observing nocturnal species.

1.4 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 1-1 are applicable to the current project in terms of biodiversity and ecological support systems. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Table 1-1 A list of key legislative requirements relevant to biodiversity and conservation in Northern Cape

Region	Legislation
International	Convention on Biological Diversity (CBD, 1993)
	The Convention on Wetlands (RAMSAR Convention, 1971)
	The United Nations Framework Convention on Climate Change (UNFCC,1994)
	The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973)
	The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)
National	Constitution of the Republic of South Africa (Act No. 108 of 2006)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)
	The National Environmental Management Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management Biodiversity Act (Act No. 10 of 2004)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998) Section 24 , No 42946 (January 2020)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998) Section 24 , No 43110 (March 2020)
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
	The Environment Conservation Act (Act No. 73 of 1989) and associated EIA Regulations
	National Protected Areas Expansion Strategy (NPAES)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	National Biodiversity Framework (NBF, 2009)
	National Forest Act (Act No. 84 of 1998)
	National Veld and Forest Fire Act (101 of 1998)
	National Spatial Biodiversity Assessment (NSBA)
	World Heritage Convention Act (Act No. 49 of 1999)
	Municipal Systems Act (Act No. 32 of 2000)
	Alien and Invasive Species Regulations, 2014
	South Africa's National Biodiversity Strategy and Action Plan (NBSAP)
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
	Sustainable Utilisation of Agricultural Resources (Draft Legislation).
	White Paper on Biodiversity
Provincial	Northern Cape Nature Conservation Act No. 9 of 2009

2 Methods

2.1 Project Area

The proposed development area (i.e. affected properties) is situated approximately ~44 km south of Sutherland in the Namakwa District Municipality, Northern Cape (Figure 2-1). The area is located south of the Great Escarpment and the Klein Roggeveldberge traverses in an approximately north-south trajectory. The corridor is located east of the R354 that connects Matjiesfontein to Sutherland. The affected land portions comprise of Kentucky 206, Portion 1 of the Orange Fontein 203 and the remaining extent of the farm De Hoop 202. The South African National Land-cover database indicates that the affected properties are predominantly shrubland (fynbos), with patches of natural grassland and fallow lands.

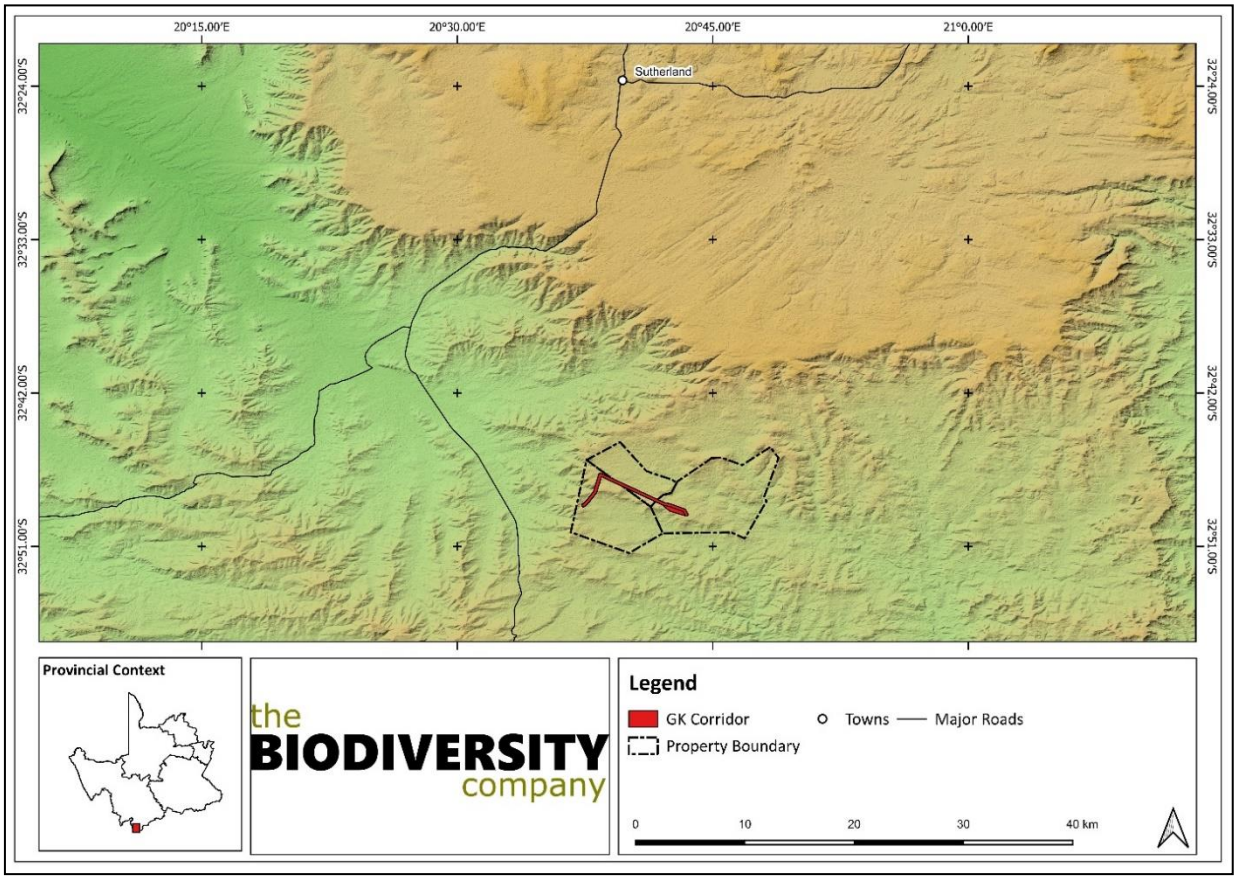

Figure 2-1 ***Map illustrating the location of the proposed Great Karoo OHL and Switching Station corridor, and the associated affected properties***

2.2 Desktop Assessment

The desktop assessment was principally undertaken using a Geographic Information System (GIS) to access the latest available spatial datasets in order to develop digital cartographs and species lists. These datasets and their date of publishing are provided below.

2.2.1 Ecologically Important Landscape Features

Existing ecologically relevant data layers were incorporated into a GIS to establish how the proposed development might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

- National Biodiversity Assessment 2018 (Skowno *et al*, 2019) - The purpose of the National Biodiversity Assessment (NBA) is to assess the state of South Africa's biodiversity based on best available science, with a view to understanding trends over time and informing policy and decision-making across a range of sectors. The NBA deals with all three components of biodiversity: genes, species and ecosystems; and assesses biodiversity and ecosystems across terrestrial, freshwater, estuarine and marine environments. The two headline indicators assessed in the NBA are:
    - Ecosystem Threat Status – indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition.

- Ecosystem Protection Level – indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. Not Protected, Poorly Protected or Moderately Protected ecosystem types are collectively referred to as under-protected ecosystems.

- Protected areas:
  - South Africa Protected Areas Database (SAPAD) (DEA, 2020) – The South African Protected Areas Database (SAPAD) contains spatial data for the conservation of South Africa. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. SAPAD is updated on a continuous basis and forms the basis for the Register of Protected Areas which is a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003.
  - National Protected Areas Expansion Strategy (NPAES) (SANBI, 2010) – The National Protected Area Expansion Strategy (NPAES) provides spatial information on areas that are suitable for terrestrial ecosystem protection. These focus areas are large, intact and unfragmented and are therefore, of high importance for biodiversity, climate resilience and freshwater protection.

- Critical Biodiversity Areas (Northern Cape Department of Environment and Nature Conservation, 2016) – Critical Biodiversity Areas (CBAs) are natural or near-natural features, habitats or landscapes that include terrestrial, aquatic and marine areas that are considered critical for:
  - meeting national and provincial biodiversity targets and thresholds;
  - safeguarding areas required to ensure the persistence and functioning of species and ecosystems, including the delivery of ecosystem services; and/or
  - conserving important locations for biodiversity features or rare species.

  The identification of Critical Biodiversity Areas for the Northern Cape was undertaken using a Systematic Conservation Planning approach. Available data on biodiversity features (incorporating both pattern and process, and covering terrestrial and inland aquatic realms), their condition, current Protected Areas and Conservation Areas, and opportunities and constraints for effective conservation were collated. Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated.

- Important Bird and Biodiversity Areas (BirdLife South Africa, 2015) – Important Bird and Biodiversity Areas (IBAs) constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria; and

- South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Van Deventer *et al.,* 2018) – A South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was established during the National Biodiversity Assessment of 2018. It is a collection of data layers that represent the extent of river and inland wetland ecosystem types as well as pressures on these systems.

2.2.2 Avifauna Assessment

The desktop component of the avifauna assessment comprised of:

- Literature review of avifauna species that are likely to be impacted by the development of power grids;
- Compiling an expected avifauna list using the South African Bird Atlas Project 2 (SABAP2) using the 3230_2030, 3235_2025, 3240_2030 and 3235_2035 pentads (2020);
- Compiling an expected avifauna list with records from the Co-ordinated Avifaunal Road Count (CAR) project (Taylor et. al. 1999);
- Review of the Great Karoo Battery Energy Storage System Biodiversity Report (3Foxes Biodiversity Solutions, 2020a); and
- Review of the Extension of Grid Connection Infrastructure for the Gunstfontein Wind Farm – Avifauna Specialist Report (3Foxes Biodiversity Solutions, 2020b).

2.3 Field Assessment

A single field survey was undertaken during the 15th – 16th September 2020 (Spring) to determine the presence of Species of Conservation Concern (SCC). The extent of the fieldwork survey consisted of a 300 m wide corridor along the proposed OHL route, which widens to approximately 740 m on the eastern portion, which also includes a 500 m assessment area (Figure 2-2). Effort was made to cover all the different habitat types within the limits of time and access.

Sightings and observations made during a previous survey of the area by the specialist (author of this report) within the Karusa and Soetwater Wind Farms (WFs) were also considered in this assessment (Karusa and Soewater are located immediately west of Great Karoo Wind Farm. The proposed OHL traverses the Great Karoo, Karusa and Soetwater sites) The survey occurred from the 18th – 25th August 2020 (late Winter). Although the survey focused on the Soetwater and Karusa WFs, the assessment area for the Great Karoo OHL overlaps with the Karusa WF and the vegetation types are the same with no substantial barrier to avifauna movement. Species that were recorded were also assigned trophic guilds according to the groups defined in González-Salazar (2014).

The outcomes of the assessments previously undertaken for the Great Karoo Battery Energy Storage System (3Foxes Biodiversity Solutions, 2020a) and extension of grid connection infrastructure for the Gunstfontein Wind Farm (3Foxes Biodiversity Solutions, 2020b) were also considered for the purposes of the risk/impact assessment.

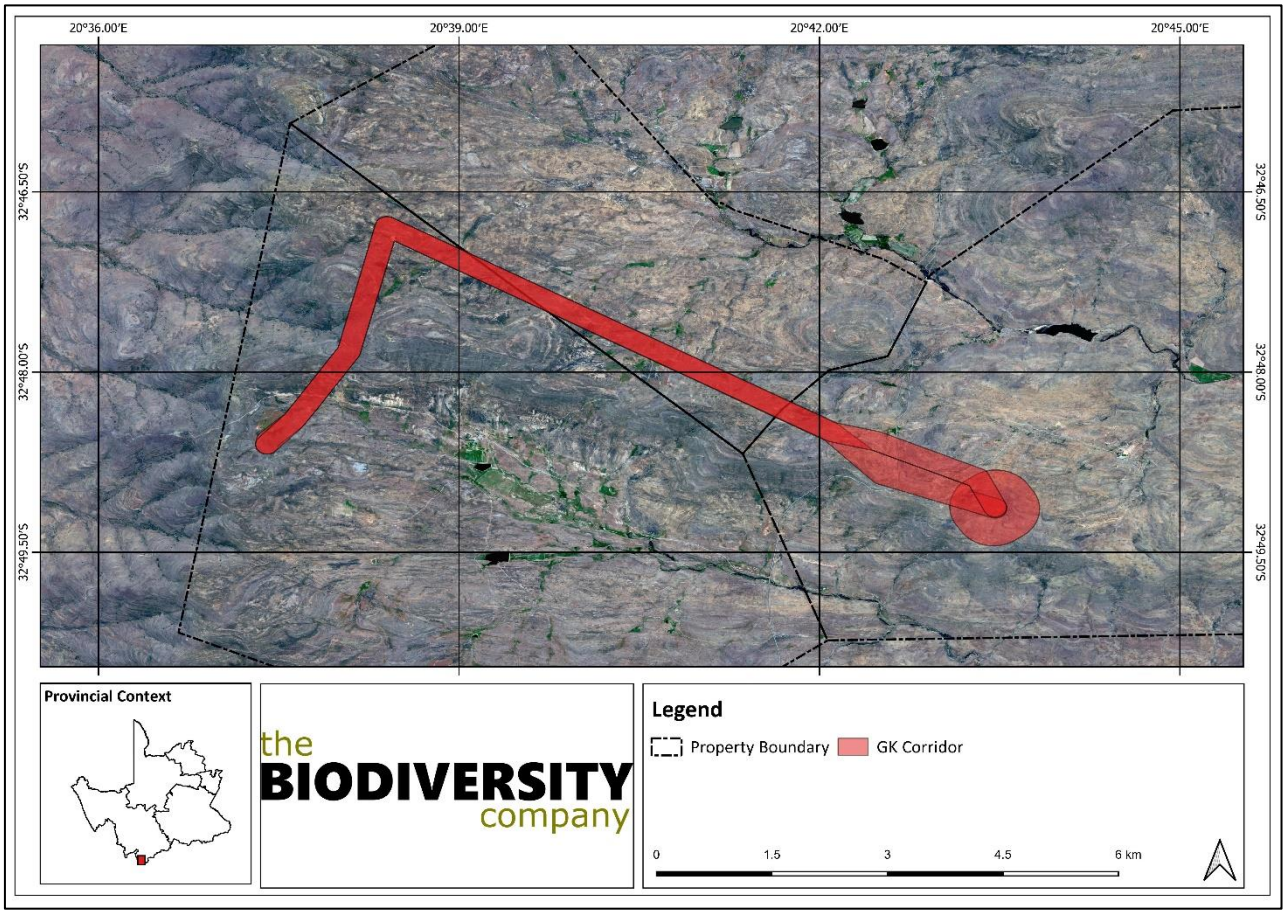

Figure 2-2 ***Map illustrating the field assessment area pertaining to the proposed Great Karoo OHL and Switching Station***

3 Results & Discussion

3.1 Desktop Assessment

3.1.1 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed development to ecologically important landscape features are summarised in Table 3-1.

Table 3-1 ***Summary of relevance of the proposed Great Karoo OHL and Switching Station to ecologically important landscape features.***

Desktop Information Considered	Relevant/Irrelevant	Section
Ecosystem Threat Status	Irrelevant – Located within a Least Concern ecosystem	3.1.1.1
Ecosystem Protection Level	Relevant – Located in a Not Protected ecosystem	3.1.1.2
Protected Areas	Relevant – Located within a NPAES focus area	3.1.1.3
Critical Biodiversity Area	Relevant – Intersects CBAs	3.1.1.4
Important Bird and Biodiversity Areas	Irrelevant – More than 50 km to the closest IBA	3.1.1.5
South African Inventory of Inland Aquatic Ecosystems	Relevant – Least Threatened river systems within 500 m	3.1.1.6

3.1.1.1 Ecosystem Threat Status

The Ecosystem Threat Status is an indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition. According to the spatial dataset the proposed development is located within a LC ecosystem (Figure 3-1).

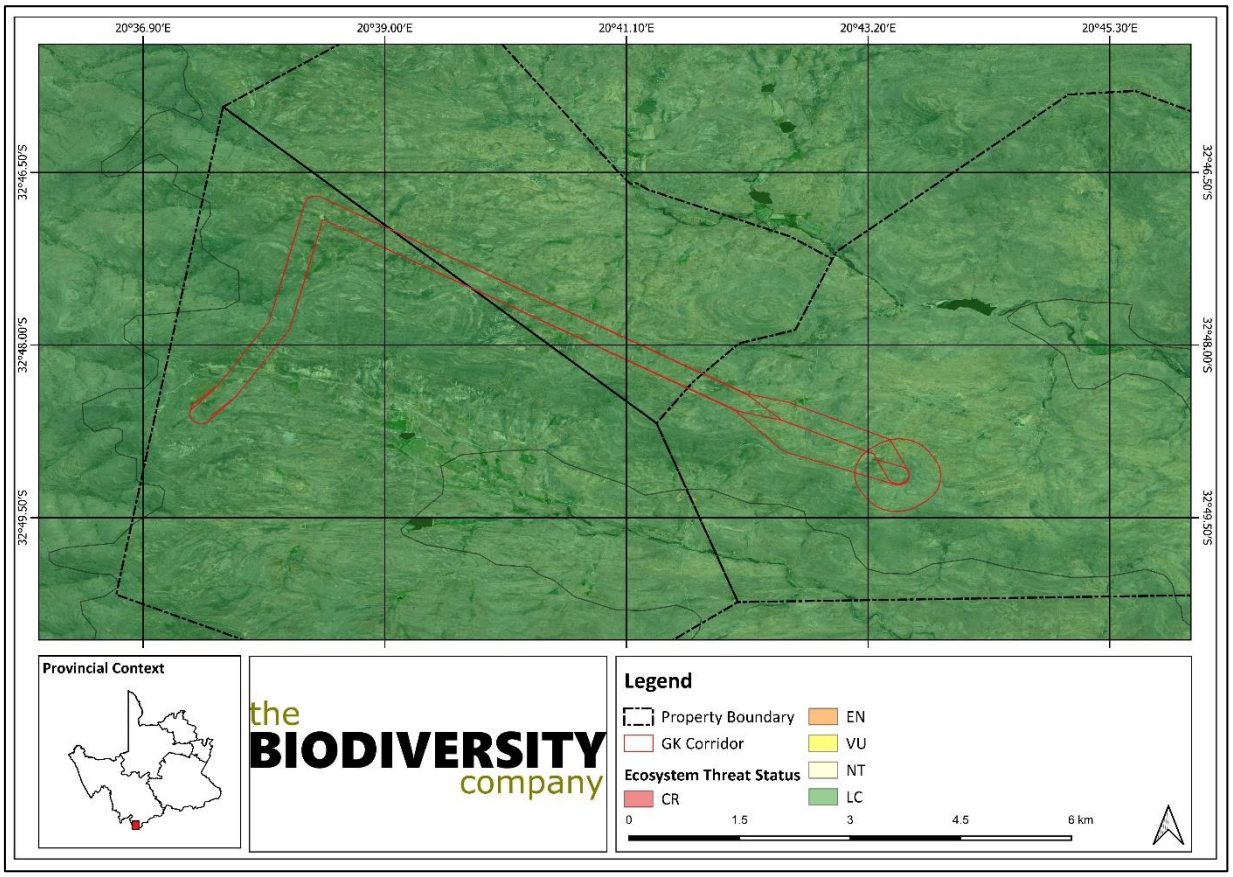

Figure 3-1 ***Map illustrating the ecosystem threat status associated with the proposed Great Karoo OHL and Switching Station***

3.1.1.2 Ecosystem Protection Level

Indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. Not Protected, Poorly Protected or Moderately Protected ecosystem types are collectively referred to as under-protected ecosystems. The proposed development is located within a NP ecosystem (Figure 3-2).

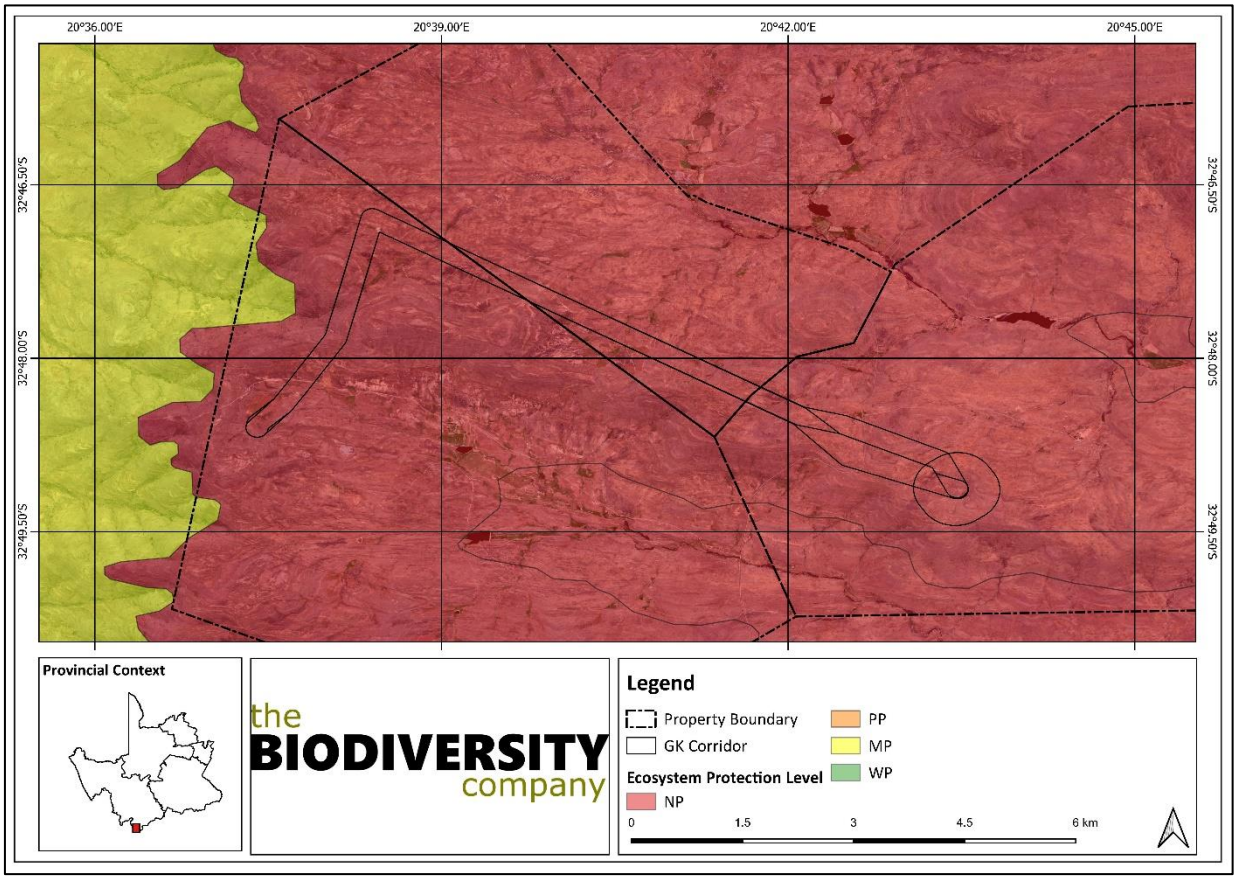

Figure 3-2 ***Map illustrating the ecosystem protection level associated with the proposed Great Karoo OHL and Switching Station***

3.1.1.3 Protected Areas

According to the protected area spatial datasets from SAPAD (2019), the proposed development does not occur within any protected area (Figure 3-3). The Witteberg Nature Reserve, Anysberg Provincial Nature Reserve and Zuurkloof Private Nature Reserve are located approximately 50 km to the south of the proposed development and the Tankwa Karoo National Park occurs approximately 60 km to the north-west of the proposed development.

The proposed development is located within the Western Karoo focus area for the National Protected Area Expansion Strategy (NPAES) (Figure 3-3). Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance, suitable for the creation or expansion of large protected areas. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. Therefore, development, depending on its level of impact, may occur within a portion of these areas.

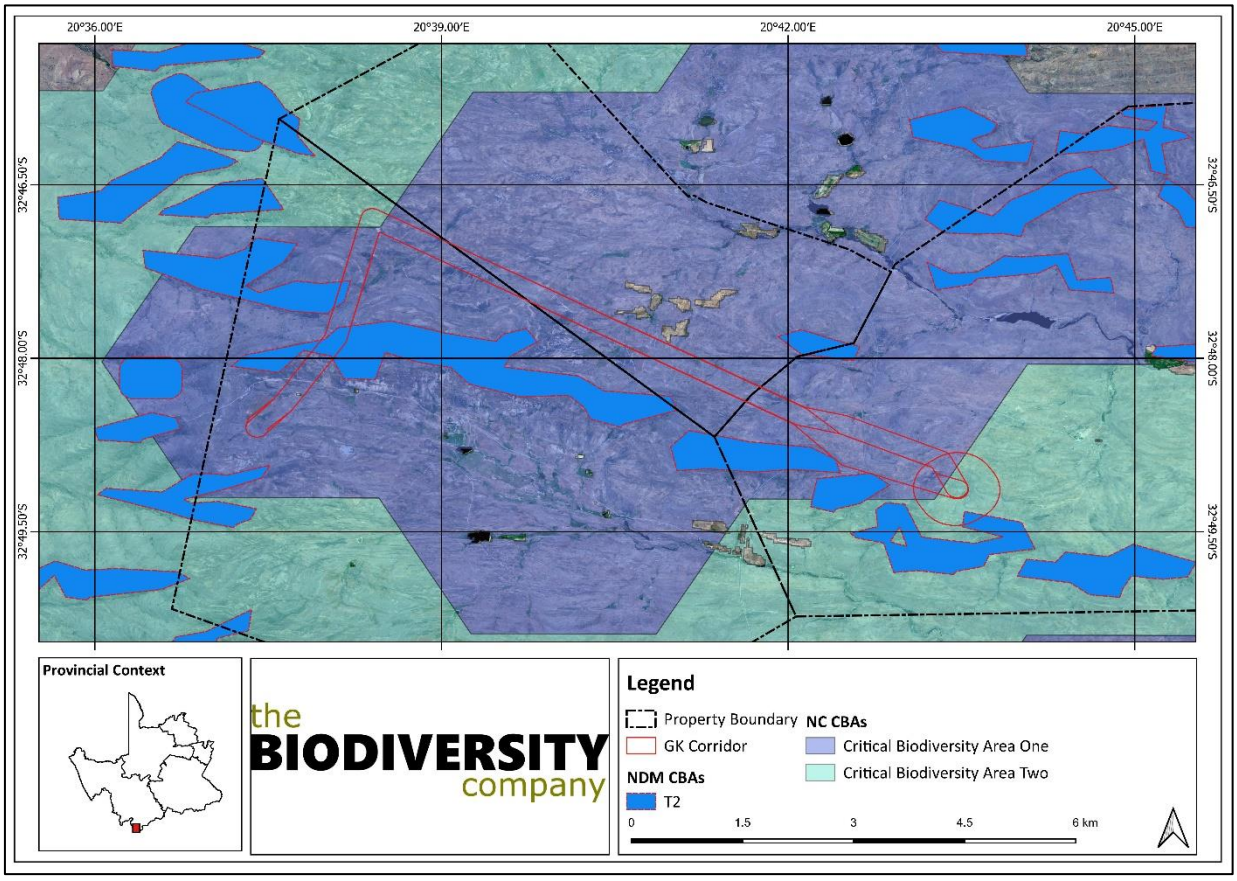

Figure 3-3 ***Map illustrating the location of protected areas and National Protected Area Expansion Strategy focus areas proximal to the proposed Great Karoo OHL and Switching Station***

3.1.1.4 Critical Biodiversity Areas (CBA)

Conservation of CBAs is crucial, in that if these areas are not maintained in a natural or near-natural state, biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

The National CBA spatial data indicates that the proposed development overlaps with a CBA 1 and marginally with a CBA 2.

The Namakwa District Biodiversity Spatial Plan (NDBSP) categorises CBAs into the following types:

- T1 – Critically Endangered (CR) vegetation types and irreplaceable biodiversity areas (areas definitely required to meet conservation targets);
- T2 – Endangered (EN) and Vulnerable (VU) vegetation types and important terrestrial habitats; and
- ESA – Ecological Support Areas including corridors.

The proposed development traverses T2 CBAs that have been defined as such because they are slope habitats (Figure 3-4).

The Northern Cape Critical Biodiversity Area (CBA) Map updates, revises and replaces all older systematic biodiversity plans and associated products for the province. Therefore, the most relevant categorisation for the assessment area is CBA 1 and CBA 2

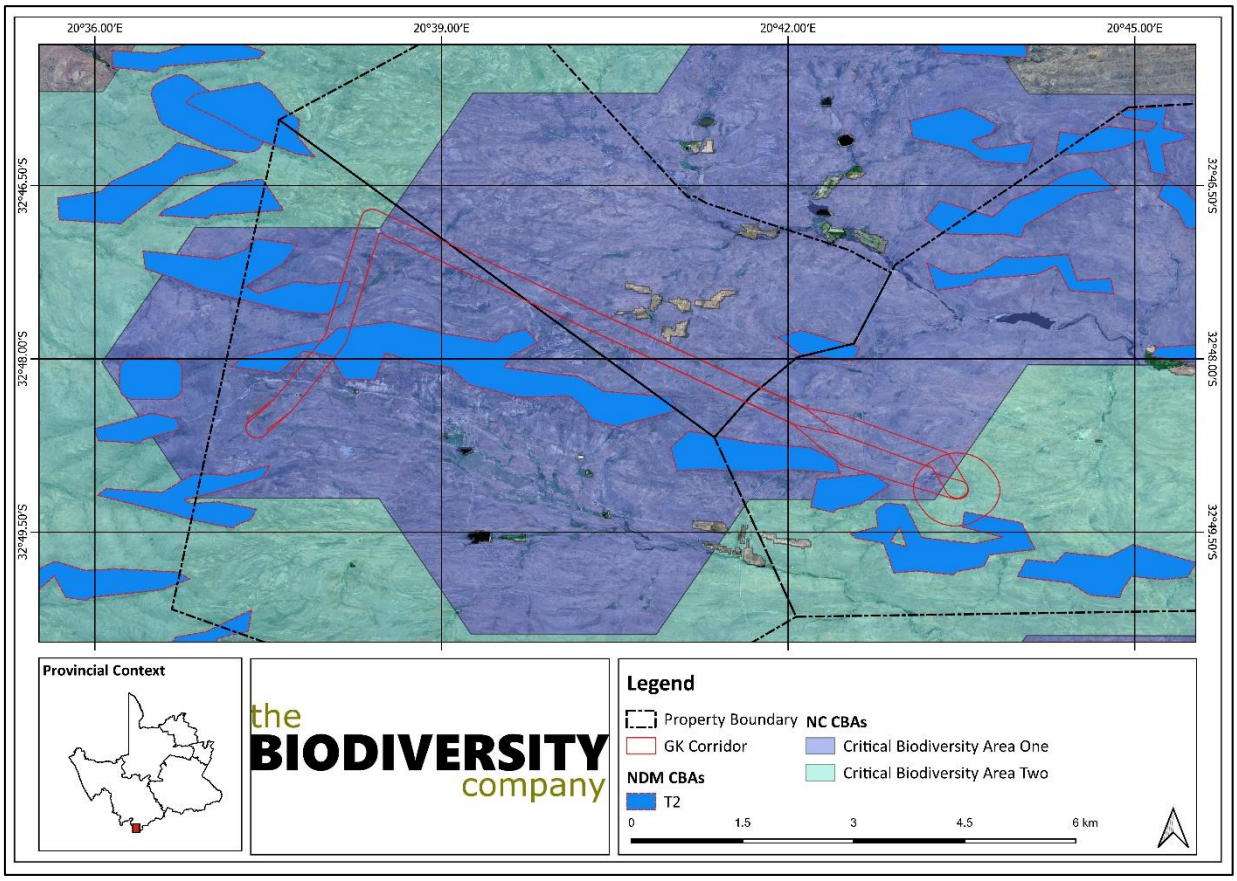

Figure 3-4 ***Map illustrating the locations of Critical Biodiversity Areas proximal to the Great Karoo OHL and Switching Station***

3.1.1.5 Important Bird & Biodiversity Areas

The proposed development is not located within an IBA. The Anysberg Nature Reserve IBA is located approximately 50 km to the south of the proposed development and the Cedarberg-Koue Bokkeveld Complex IBA is located approximately 70 km to the west of the proposed development (Figure 3-5).

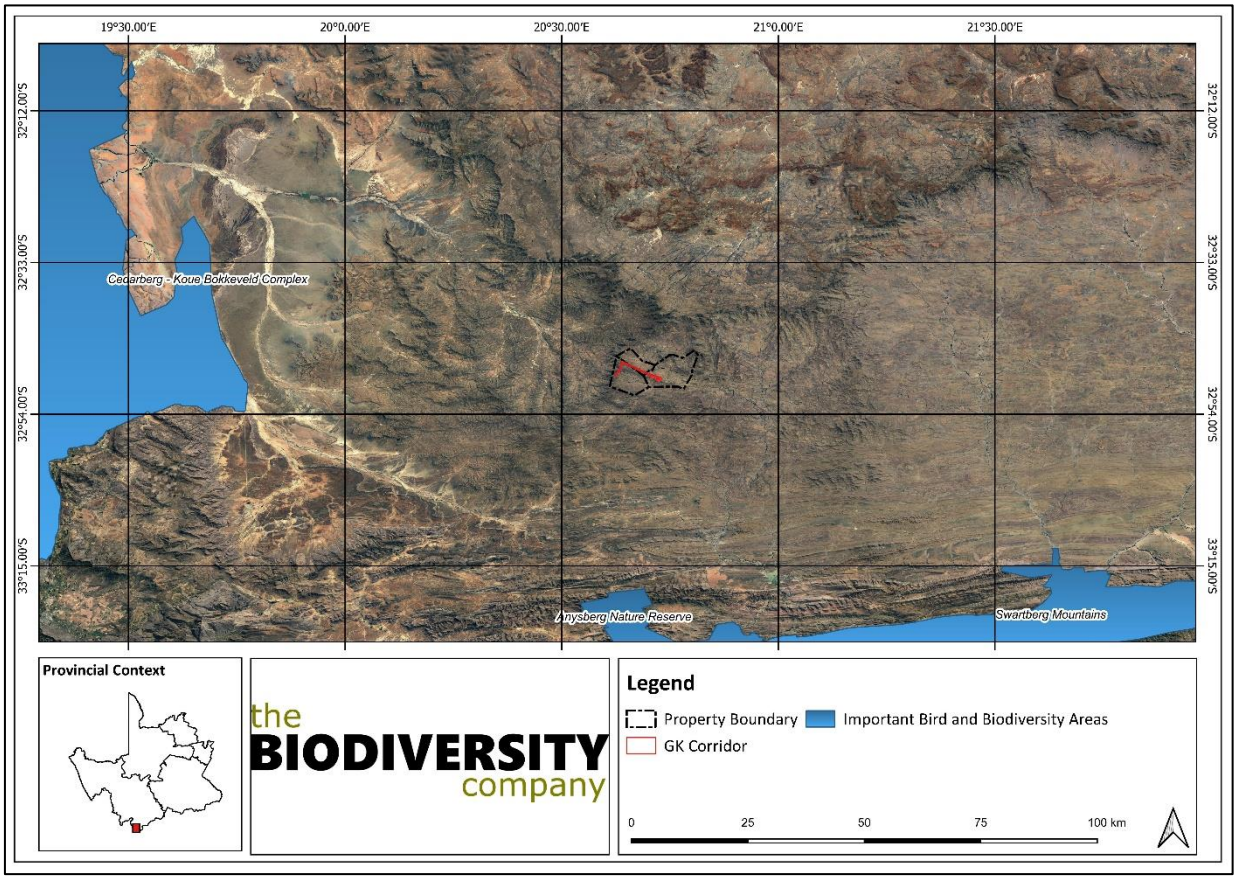

Figure 3-5 Map illustrating the location of the nearest Important Bird & Biodiversity Areas to the proposed Great Karoo OHL and Switching Station

3.1.1.6 Hydrological Setting

The proposed development is located predominantly within the Groot River catchment, specifically quaternary catchments J11A and J11D (Figure 3-6). There is minor overlap with the Doring River catchment, specifically quaternary E23A. There are no major river systems that overlap with the assessment area, but there are drainage lines that drain into the Meintjiesplaas River towards the south, and an unnamed system to the north (Figure 3-6).

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the National Biodiversity Assessment (NBA) 2018. Ecosystem threat status (ETS) of river ecosystem types is based on the extent to which each river ecosystem type had been altered from its natural condition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), with CR, EN and VU ecosystem types collectively referred to as 'threatened' (Van Deventer *et al.,* 2019; Skowno *et al.,* 2019). The river systems proximal to the proposed development are regarded as LT (Figure 3-6).

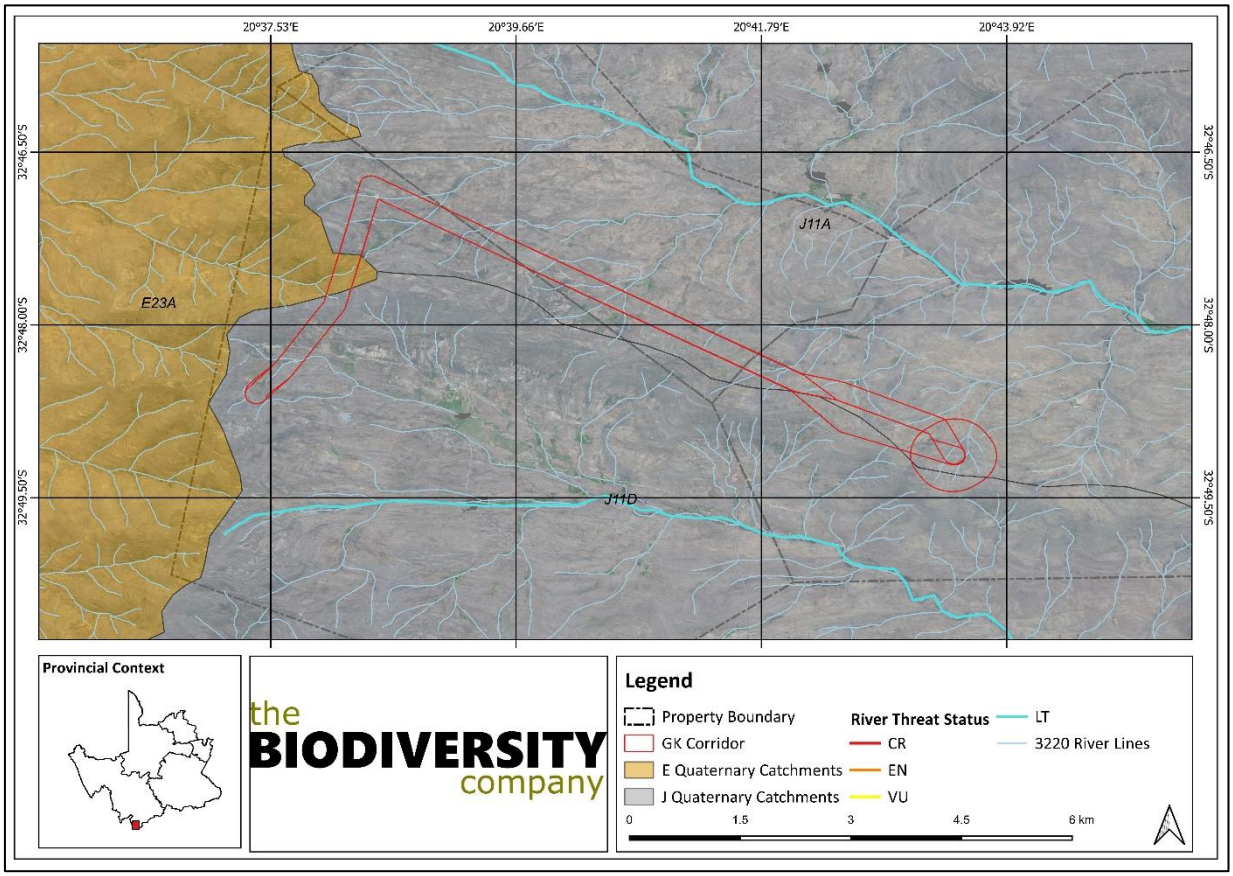

Figure 3-6 ***Map illustrating the hydrological setting of the proposed Great Karoo OHL and Switching Station***

3.1.2 Expected Avifauna

Based on the SABAP2 database, 101 species of avifauna are expected to occur within the area. Of the expected bird species list generated, four (4) species are regarded as threatened (Table 3-2). There is no CAR data available for the region.

Table 3-2 ***Threatened avifauna species that may occur within the assessment area associated with the proposed Great Karoo OHL and Switching Station. EN = Endangered, LC = Least Concern, NT= Near Threatened and VU = Vulnerable***

Family	Scientific Name	Common Name	Conservation Status	Endemism	Habitat	Likelihood of Occurrence
Accipitridae	*Aquila verreauxii*	Verreaux's Eagle	VU		Mountain ridges and cliffs	High
Accipitridae	*Circus maurus*	Black Harrier	EN	Near-Endemic	Open fynbos, renosterveld and grassland areas.	Low
Ciconiidae	*Ciconia nigra*	Black Stork	VU		Wetlands, pans and river systems. Requires tall trees or cliffs for nesting	Low
Otididae	*Eupodotis vigorsii*	Karoo Korhaan	NT		Shrubland habitat with a preference for denser growths.	Low

3.2 Field Assessment

3.2.1 Avifauna Species

Thirty (30) avifauna species were observed within the assessment area and surrounding landscape during the survey period, based on either direct observations or species calls (Table 3-3, Figure 3-7). The species recorded could be regarded as species typical of Renosterveld. The most speciose families were the Accipitridae and Muscicapidae, represented by four species each. Species from the Alaudidae and Muscicapidae families were the most ubiquitous within the assessment area. Majority (30%) of the species are categorised as omnivorous ground-foragers, with four (4) species categorised as carnivorous ground-hawkers.

Table 3-3 ***Summary of avifauna species recorded within the assessment area associated with the proposed Great Karoo OHL and Switching Station during the field survey. Species highlighted in bold are of conservation concern as they are either threatened. EN = Endangered, LC = Least Concern and VU = Vulnerable. CGH = Carnivore-Ground Hawker, CN = Carnivore-Nocturnal, OGF = Omnivore-Ground Forager, HGF = Herbivore-Ground Forager, IGG = Invertivore-Ground Gleaner, IFG = Invertivore-Foliage Gleaner, C/S = Carnivore/Scavenger, GGUG = Granivore-Ground to Undergrowth Gleaner, IAHAC = Invertivore-Aerial Hawker Above Canopy and FUCG = Frugivore-Upper Canopy Gleaner***

Family	Scientific Name	Common Name	Conservation Status	Endemism	Guild
Accipitridae	***Aquila verreauxii***	**Verreaux's Eagle**	**VU**		CGH
Accipitridae	*Buteo rufofuscus*	Jackal Buzzard	LC	Near-Endemic	CGH
Accipitridae	*Circaetus pectoralis*	Black-chested Snake-eagle	LC		CGH
Accipitridae	*Melierax canorus*	Pale Chanting Goshawk	LC		CGH
Alaudidae	*Calendulauda albescens*	Karoo Lark	LC	Near-Endemic	OGF
Alaudidae	*Galerida magnirostris*	Large-billed Lark	LC		OGF
Alaudidae	Mirafra apiata	Cape Clapper Lark	LC	Near-Endemic	OGF
Anatidae	*Alpochen aegyptica*	Egyptian Goose	LC		HGF
Anatidae	*Tadorna cana*	South African Shelduck	LC		OGF
Charadriidae	*Vanellus coronatus*	Crowned Lapwing	LC		IGG
Cisticolidae	*Cisticola subruficapilla*	Grey-backed Cisticola	LC		IFG
Cisticolidae	*Prinia maculosa maculosa*	Shrub Karoo Prinia	LC	Near-Endemic	IFG
Corvidae	Corvus albus	Pied Crow	LC		C/S
Emberizidae	*Emberiza capensis*	Cape Bunting	LC		OGF
Falconidae	*Falco rupicolus*	Rock Kestrel	LC		CGH
Fringillidae	*Crithagra flaviventris*	Yellow Canary	LC		GGUG
Hirundinidae	*Hirundo fuligula*	Rock Martin	LC		IAHAC
Muscicapidae	*Cercomela schlegelii*	Karoo Chat	LC		IGG
Muscicapidae	*Cercomela sinuata*	Sickle-winged Chat	LC	Near-Endemic	IGG
Muscicapidae	*Cercotrichas coryphoeus*	Karoo Scrub-robin	LC		IGG
Muscicapidae	*Oenanthe monticola*	Mountain Wheatear	LC		IGG/FUCG
Nectariniidae	*Nectarinia famosa*	Malachite Sunbird	LC		N
Otididae	***Afrotis afra***	**Southern Black Korhaan**	**VU**	**Endemic**	**OGF**
Otididae	***Neotis ludwigii***	**Ludwig's Bustard**	**EN**	**Near-Endemic**	**OGF**

Family	Scientific Name	Common Name	Conservation Status	Endemism	Guild
Phasianidae	*Corturnix corturnix*	Common Quail	LC		OGF
Phasianidae	*Pternistis capensis*	Cape Spurfowl	LC	Endemic	OGF
Phasianidae	*Scleroptila africanus*	Grey-winged Francolin	LC	SLS	OGF
Pycnonotidae	*Pycnonotus capensis*	Cape Bulbul	LC	Endemic	FUCG
Strigidae	*Bubo africanus*	Spotted Eagle-owl	LC		CN
Sturnidae	*Onychognathus nabouroup*	Pale-winged Starling	LC		FUCG/IGG

Majority of the avifauna species recorded are protected under provincial legislation, with three (3) species regarded as red-listed.

Afrotis afra (Southern Black Korhaan) is listed as VU on a global scale (BirdLife International, 2016a). The species is endemic to southwestern South Africa. The species is restricted to the non-grassy, winter rainfall or mixed winter-summer rainfall fynbos, renosterveld and succulent Karoo biomes, and the extreme south of the Nama-Karoo biome, in a narrow strip along the southern and western coastlines of South Africa. The diet comprises of insects, small reptiles and plant material. The global population has not been quantified. The principle threat is habitat loss and fragmentation due to expanding agriculture (BirdLife International, 2016a). Moreover, agricultural activity decreases breeding success due to increased chick and egg predation because of a general decrease in vegetation cover and an increase in predators such as Pied Crows. Collisions with power lines are also an emerging threat. It is unknown if the size of the power lines affects the probability of collision. The specimens observed within the assessment area were displaying breeding behaviour and therefore, the area forms part of the species breeding range. Considering the decrease in breeding success within the species' range, the area is considered vital for the continued population wellbeing.

Aquila verreauxii (Verreaux's Eagle) is listed globally as LC but VU on a regional scale with the regional population to be between 3 500 and 3 750 mature individuals (Taylor, 2015). The species occupies mountainous areas including savannah and semi-desert, where there is a relatively high abundance of *Procavia capensis* (Rock Hyrax) (BirdLife International, 2016b). More than 60% of its prey are Rock Hyraxes but it will occasionally also take other mammals, birds, tortoises and rarely, other reptiles. The population is estimated to be in the tens of thousands. The principle threat in southern Africa is persecution where it coincides with livestock farms, but because the species does not take carrion, it is little threatened by poisoned carcasses. Furthermore, numbers have declined in areas where Rock Hyraxes have been intensely hunted. Although Taylor et al. (2015) suggests that wind farms present a potentially significant new threat to the species, up until relatively recently, no wind farms had been constructed within the range of Verreauxs' Eagle and hence, there has been limited opportunity to evaluate the impacts. Preliminary results of a survey undertaken by BirdLife South Africa (2017) have indicated that at least five (5) deaths have occurred due to collisions with wind turbines. "Prior to the construction of the wind farm, low flight activity of Verreaux's Eagle was recorded, and the assessment did not predict that the species was particularly at risk at this site "(Ralston *et al*, 2017). Risk of electrocution is a further threat (Prinsen *et al*, 2011).

Neotis ludwigii (Ludwig's Bustard) is listed as EN on a global scale (BirdLife International, 2018). The species has a large range centred on the dry biomes of the Karoo and Namib in southern Africa, being found in the extreme south-west of Angola, western Namibia and South Africa. This species inhabits open lowland and upland plains with grass and light thornbush, sandy open shrub-veld and semi-desert in the arid and semi-arid Namib and Karoo biomes. Ludwig's

Bustard is nomadic and a partial migrant, moving to the western winter-rainfall part of its range in winter. The diet includes invertebrates, small vertebrates and vegetable matter. The global population is estimated to be 100 000 – 499 999 individuals. The primary threat to the species is collisions with overhead power lines, irrespective of size, with potentially thousands of individuals involved in such collisions each year (Jenkins et al. 2011). Collision rates on high voltage transmission lines in the Karoo may exceed one Ludwig's Bustard per kilometre per year. Bustards have limited frontal vision so may not see power lines, even if they are marked (Martin and Shaw 2010). A total of seven (7) individuals were observed within the assessment area, specifically around the eastern portion, and an additional specimen was observed within the broader landscape. It is important to note that the species was not observed during winter and was only observed during the spring survey. It is imperative that staff be informed about the sensitivity of the species, and during the construction phase, any specimens within the working area must be allowed to evacuate prior to commencement construction activity.

The SABAP 2 reporting rate for these species as well as those species that are known to occur within the broader landscape that are identified as exhibiting a high potential for impacts by energy generation and distribution are provided in Table 3-4.

Table 3-4 Summary of avifauna species within the assessment area that are prone to impacts by the energy production and distribution sector, based on the priority score (Retief et al, 2011) and their respective SABAP 2 pentad reporting rate

Scientific Name	Common Name	Priority Score	SABAP2 Pentad Reporting Rate			
			3230_2030	3235_2025	3235_2035	3240_2030
Afrotis afra	Southern Black Korhaan	270				
Aquila pennatus	Booted Eagle	230	3.23			
Aquila verreauxii	Verreaux's Eagle	360	19.35	14.29	66.67	
Bubo africanus	Spotted Eagle-owl	170			33.33	
Buteo rufofuscus	Jackal Buzzard	250	3.23		33.33	100.00
Ciconia nigra	Black Stork	330	3.23	0.00		
Circaetus pectoralis	Black-chested Snake-eagle	230		0.00		
Circus maurus	Black Harrier	345		0.00		
Eupodotis vigorsii	Karoo Korhaan	240		28.57		
Neotis ludwigii	Ludwig's Bustard	320				

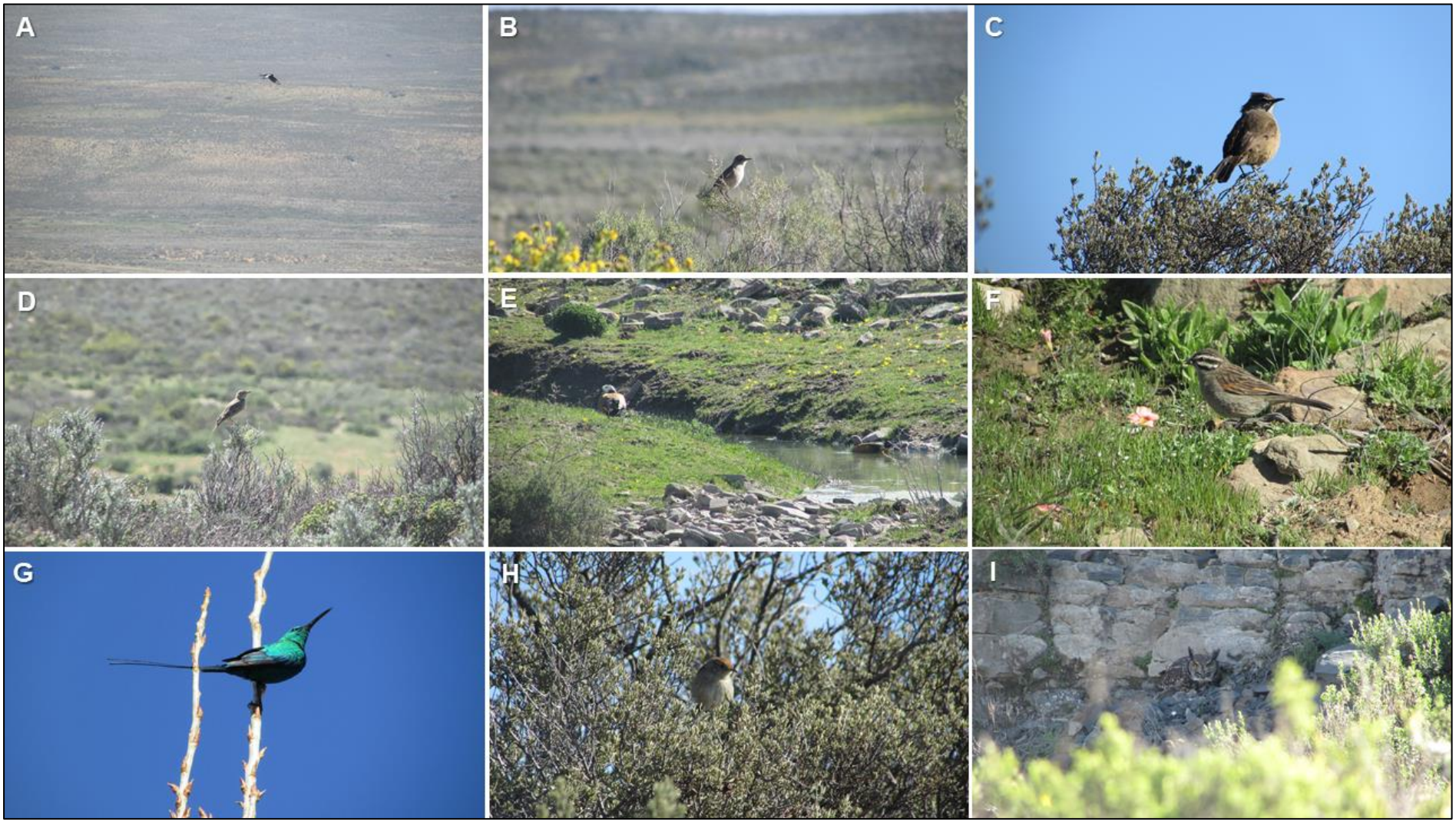

Figure 3-7 ***Photographs illustrating the avifauna species recorded within the assessment area associated with the proposed Great Karoo OHL and Switching Station during the survey period. A) Aquila verreauxii, B) Cercomela sinuata, C) Cercotrichas coryphoeus, D) Galerida magnirostris, E) Tadoma cana, F) Emberiza capensis, G) Nectarinia famosa, H) Cisticola subruficapilla and I) Bubo africanus***

3.2.2 Fine-scale Habitat Use

Fine-scale habitats within the landscape are important in supporting a diverse avifauna community as they provide differing nesting, foraging and reproductive opportunities. The assessment area overlaps with four avifaunal fine-scale habitats, namely lowlands, rocky slopes, ridges/cliffs and drainage lines (Figure 3-8).

The lowland vegetation was the most expansive habitat and supports an abundance of small omnivorous ground-gleaning passerines, especially *Calendulauda albescens* (Karoo Lark) and *Mirafra apiata* (Cape Clapper Lark), as well as non-passerines, including priority species such as *Scleroptila africanus* (Grey-winged Francolin), *Afrotis afra* (Southern Black Korhaan), *Neotis ludwigii* (Ludwig's Bustard) and *Pternistis capensis* (Cape Spurfowl). *Melierax canorus* (Pale Chanting Goshawk) was the most ubiquitous raptor within the lowland habitats. These lowland areas graduated into rocky slopes and although they were inhabited by a similar species assemblage, species such as *Oenanthe monticola* (Mountain Wheatear) and *Crithagra flaviventris* (Yellow Canary) were only recorded here. The rocky slope habitat also possessed a lower richness and abundance of non-passerine species, albeit these species use the rocky slopes as flyways.

Ridges/cliffs tended to possess unique avifaunal communities within the landscape, generally being dominated by *Cercomela schlegelii* (Karoo Chat) and *Cercomela sinuata* (Sickle-winged Chat). Majority of the raptor sightings were observed within this habitat type, including *Aquila verreauxii* (Verreaux's Eagle), *Buteo rufofuscus* (Jackal Buzzard), *Circaetus pectoralis* (Black-chested Snake-eagle), *Falco rupicolus* (Rock Kestrel), as they utilise the thermals to forage more efficiently. It is also important to consider that the main prey item of *Aquila verreauxii*, *Procavia capensis* (Rock Hyrax), occupy these habitats. Drainage lines within the landscape formed a distinct vegetation structure as they were dominated by larger shrub and smaller tree species, such as *Diospyros austro-africana* and *Roepera spinosa* forming a denser canopy cover when compared to the surrounding vegetation. Avifauna species that exhibited a preference for this habitat type comprised of invertivore foliage-gleaners such as *Cisticola subruficapilla* (Grey-backed Cisticola) and *Prinia maculosa maculosa* (Shrub Karoo Prinia), as well as *Cercotrichas coryphoeus* (Karoo Scrub-robin). In addition, in drainage lines where surface water was available, species such as *Alpochen aegyptica* (Egyptian Goose), *Tadorna cana* (South African Shelduck) and *Vanellus armatus* (Blacksmith Lapwing) were present.

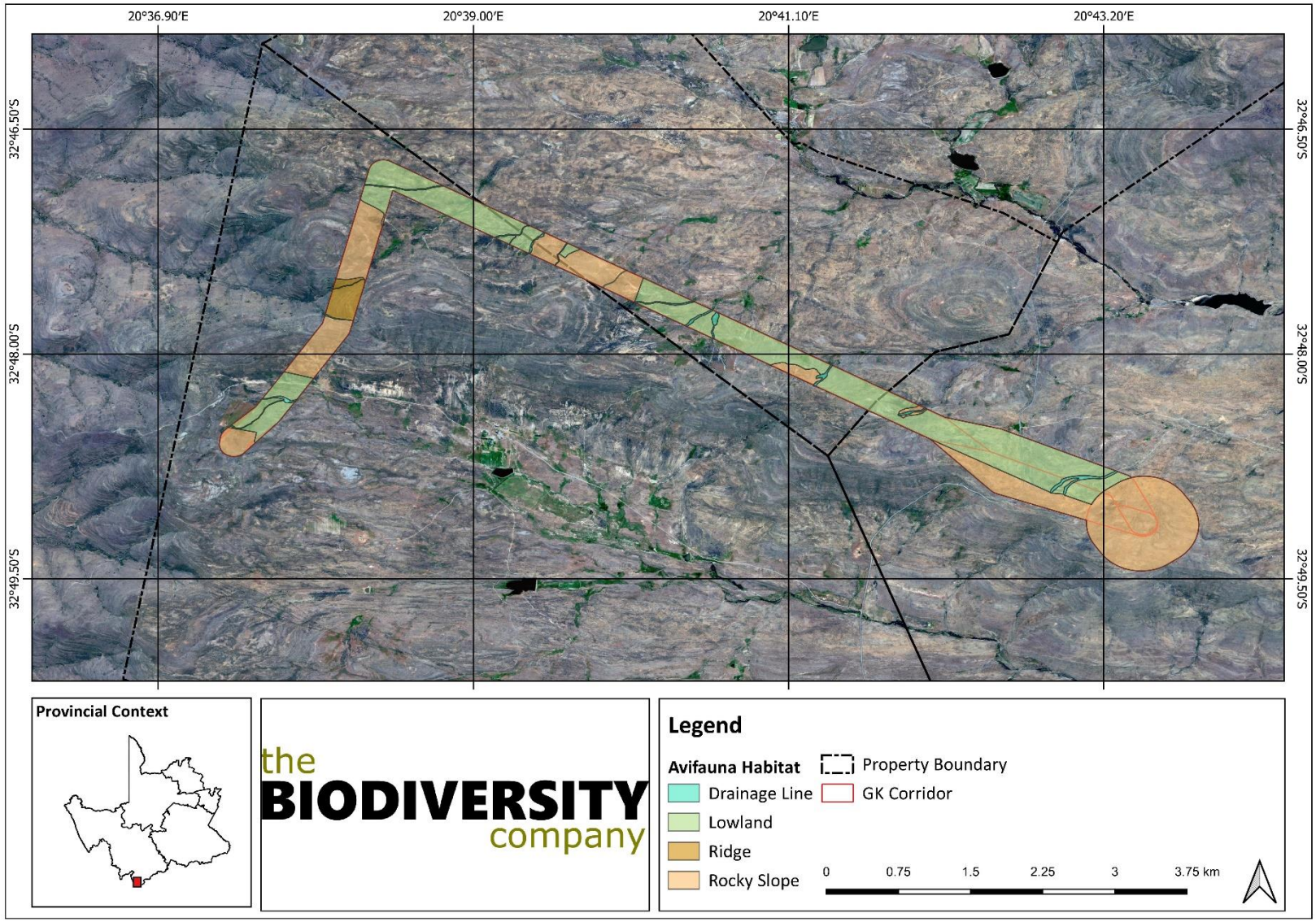

Figure 3-8 ***Map illustrating the location and extent of avifauna fine-scale habitat types delineated within the assessment area associated with the proposed Great Karoo OHL and Switching Station***

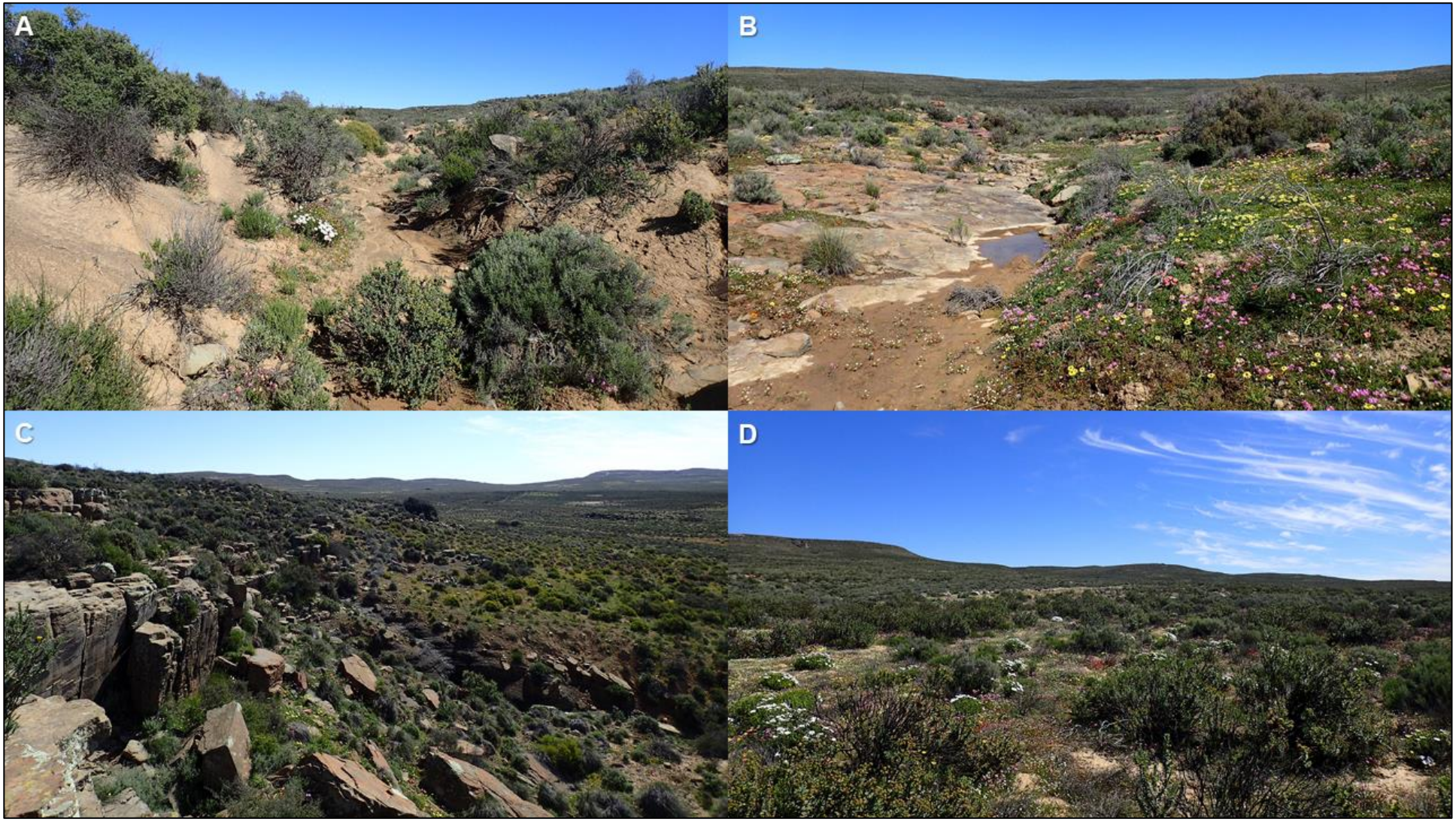

Figure 3-9 ***Photographs illustrating examples of the habitat types delineated within the assessment area associated with the proposed Great Karoo OHL and Switching Station. A) Drainage Line, B) Drainage Line, C) Ridges and Rocky Slopes and D) Lowlands***

3.2.3 Flight Paths and Nest Locations

Observing and monitoring flight paths and nesting sites are important in ascertaining habitat sensitivity and evaluating the impact risk significance of any proposed development. Given that there are three (3) SCC, and ten species are regarded as priority species for wind energy development and power line infrastructure, during the field survey recording flight-paths and nesting sites were undertaken for certain species. However, given the limited time available the results of this section must be interpreted with caution, as each species movement is likely to be more extensive and there may have been nesting sites that were not observed. Figure 3-10 below illustrates the location and extent of flight paths and nesting sites of select priority species within the assessment area.

The flight path of the *Neotis ludwigii* (Ludwig's Bustard) group indicates that their flight path overlaps with the 500 m buffer of the Great Karoo switching station in the SE corner of the assessment area. The group circled the area and landed to feed in proximal areas out of the corridor boundary. Given that the species is a large non-passerine that is an omnivorous ground-forager. It likely uses a greater airspace that is indicated, and the footprint of the switching station will reduce habitat, albeit this is considered minimal if considered in isolation.

The flight path of the *Afrotis afra* (Southern Black Korhaan) male individual that was observed flying was typical breeding display behaviour. It is not known what the flight path of this individual or other specimens in the area are. Nevertheless, based on the behaviour of the species and risk to collision, the appropriate mitigation measures stipulated in this report must be implemented.

A pair of *Bubo africanus* (Spotted-Eagle Owl) were observed to be nesting within the drainage line parallel to the OHL adjacent to the Karusa Substation. The species forms life-long pair bonds and tends to re-use nesting sites. The breeding season starts in late winter to spring in southern Africa, with the incubation period between 32-34 days. The fledgling period is around 7 weeks. Therefore, it is recommended that construction and installation within this portion of the OHL be undertaken in late August to avoid disturbance. If this is not possible, a 50 m buffer around the nest site should be maintained to ensure no construction activity occurs within the buffer (Figure 3-11). Although, the risk of collision for owls tend to be minimal due to their eyesight, the species is at risk of electrocution (Prinsen *et al*, 2011). No pylons are to be erected within 100 m of the nest site to reduce the risk of electrocution (Figure 3-11). Where technically feasible, the distance between the nest and the nearest pylons should be increased to 200m.

Aquila verreauxii (Verreauxs' Eagle) were not observed flying within the assessment corridor but in adjacent areas. Nevertheless, it is possible that they use the area for hunting due to the availability of suitable prey. They fly at low heights and at speed over rocky terrain during surprise attacks on sun-basking *P. capensis* (BirdLife South Africa, 2017). They also engage in aerial displays during courtship and "cartwheeling" is usually associated with the defence of territories. Therefore, they are possibly at risk to collision during hunting, and during mating and territorial displays. Furthermore, there is also the risk of electrocution if using pylons for perching due to their relatively large size.

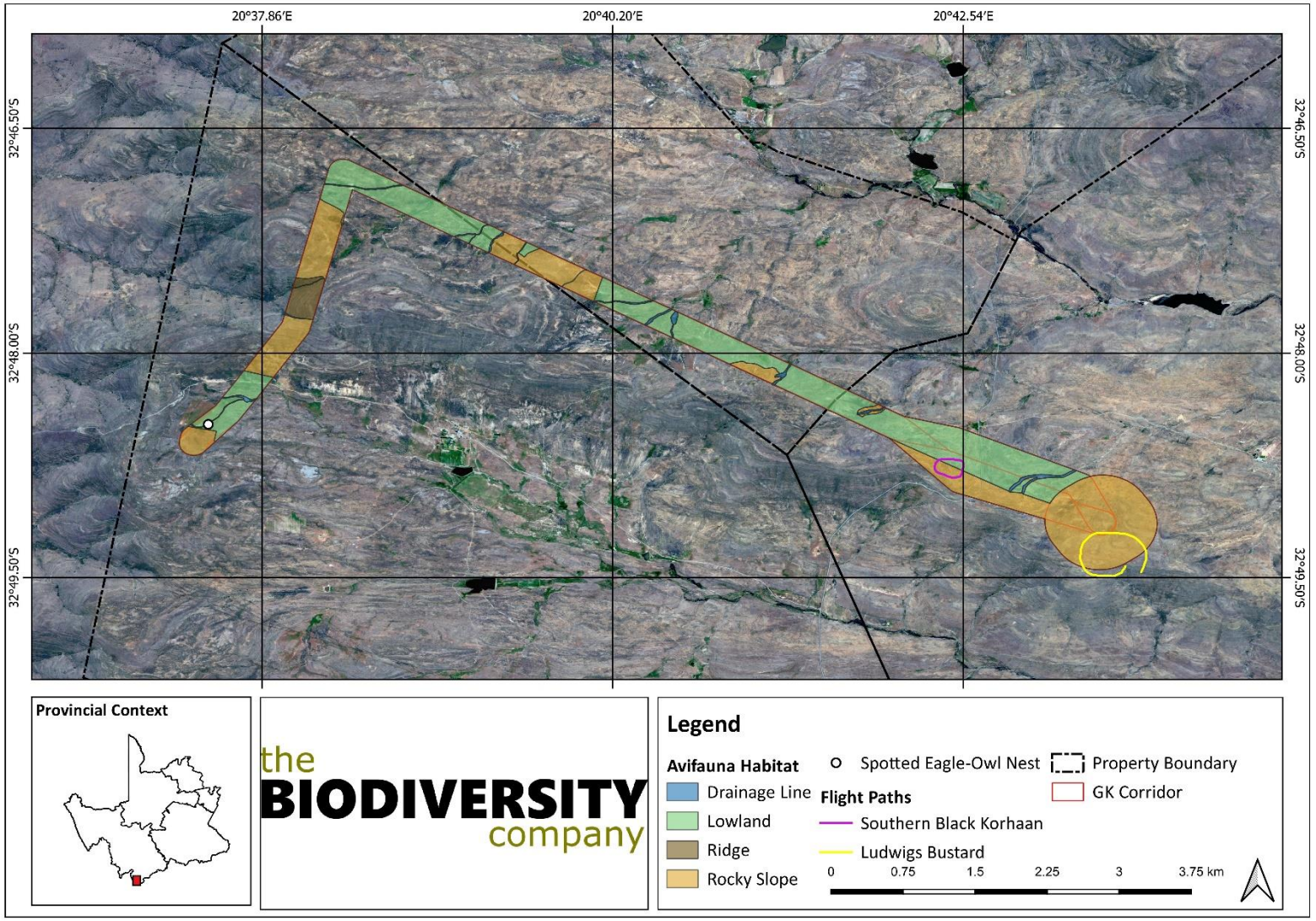

Figure 3-10 Map illustrating the flight paths and nests observed of priority species within the assessment area associated with the proposed Great Karoo OHL and Switching Station

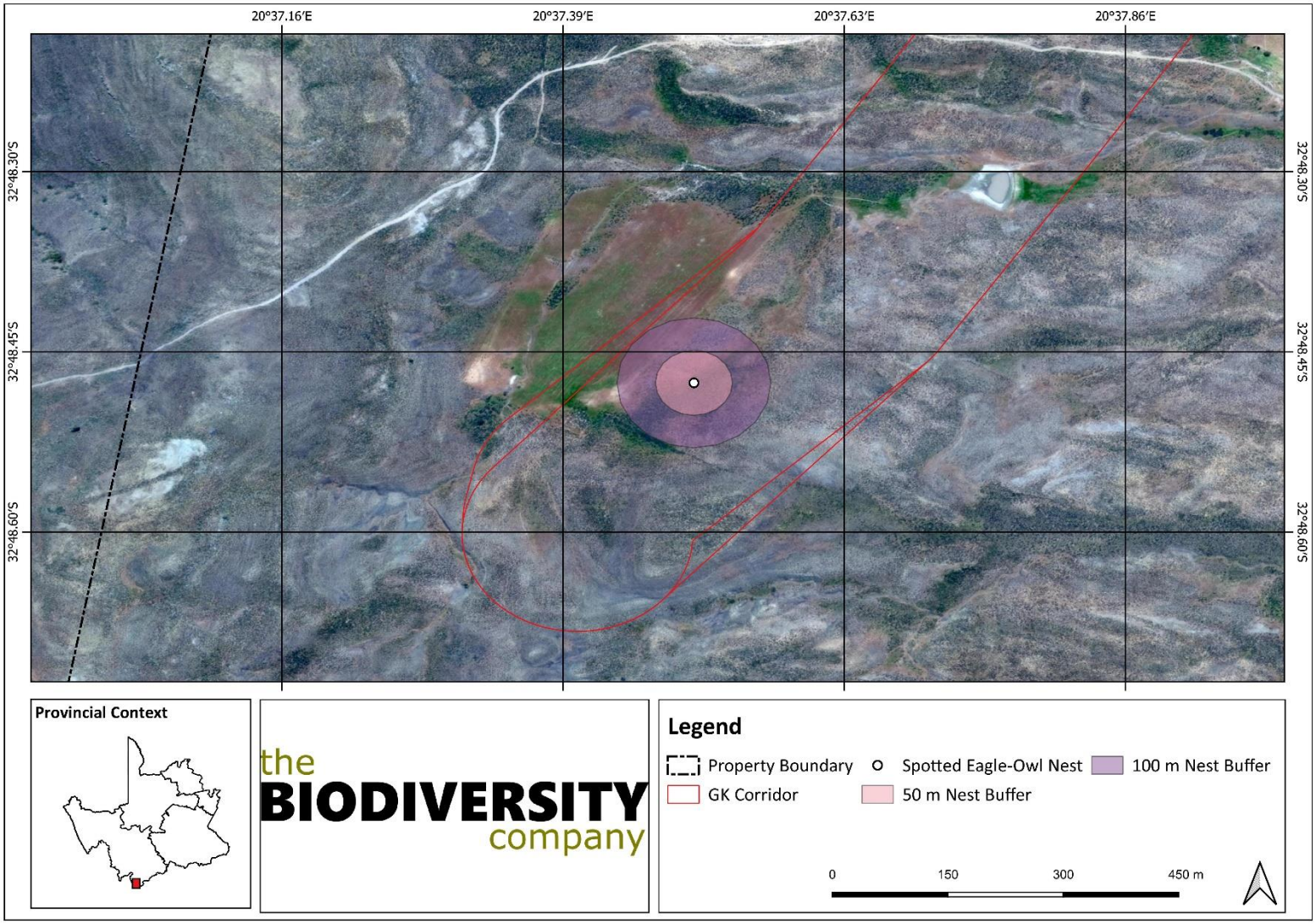

Figure 3-11 Map illustrating the location of the Spotted Eagle-Owl (Bubo africanus) nest and associated buffer zones within the assessment area associated with the proposed Great Karoo OHL and Switching Station

3.2.4 Priority Areas (Areas of Stringent Mitigation)

The fine-scale avifauna habitats that were delineated within the assessment area as described in section 3.2.2 of this report were assigned a priority category based on the characteristics of the avifauna assemblage within each one (Figure 3-12). The priority categories range from 'Low' to 'Very High', with 'Very High' areas requiring stringent mitigation measures and 'Low" areas not of concern or requiring minimum mitigation measures. Generally, lowland areas and rocky slopes were assigned a 'Moderate' category as they were typically dominated by small passerine species. However, where threatened or priority species occurred or displayed breeding behaviour, these areas were categorised as a 'Very High' priority (Figure 3-12). Drainage lines are likely to be used as flyways, especially by heavy-bodied waterfowl, and therefore were assigned a 'High' priority category.

The proposed grid extension corridor also intersects a turbine exclusion zone identified during the pre-construction bird monitoring study for the Wind Farm (EWT, 2014). The point of intersection lies just to the north of the Hidden Valley substation, where the grid connection passes over mountain ridges. The turbine exclusion zone was predicted by flight models, and the report stated that associated turbine infrastructure, including roads, power lines and buildings, should avoid the exclusions zones as far as possible (EWT, 2014). This turbine exclusion zone is therefore considered to be of 'Very High' priority. Considering there is an existing powerline, the Great Karoo OHL can proceed within this mountain ridge with the utmost caution and the appropriate mitigation measures must be implemented. This can include consolidation with the current powerline and installation of bird diverters and flappers.

It is important to note that the priority category of the habitat does not necessarily dictate that the area is a 'no-go' area but indicates where extra caution is required due to the presence of particular species and that the implementation of mitigation measures to reduce collision must be implemented. Monitoring the efficacy of the mitigation measures within these priority areas of the route must be implemented.

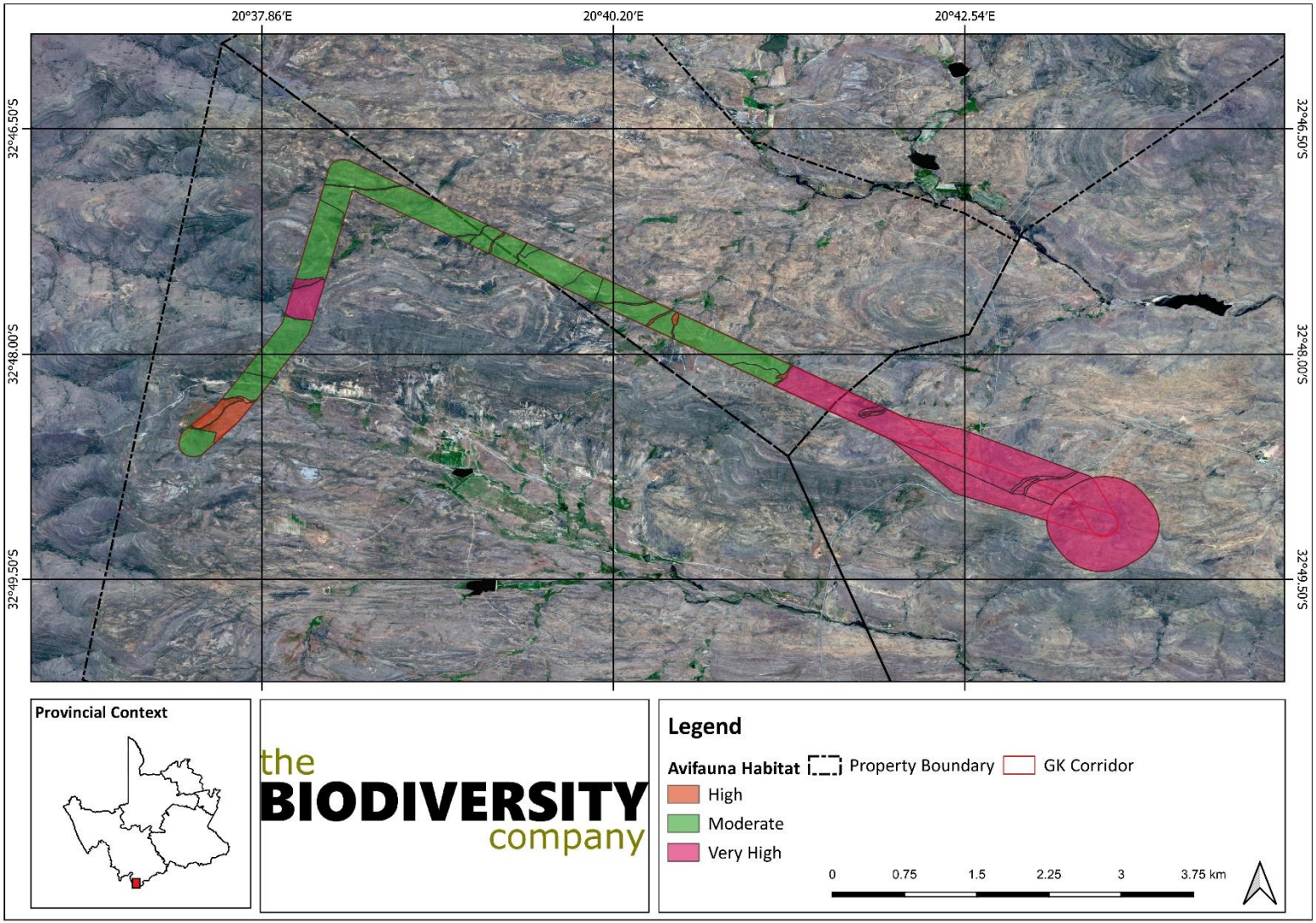

Figure 3-12 Map illustrating the priority category of fine-scale avifauna habitats within the assessment area associated with the proposed Great Karoo OHL and Switching Station

4 Avifauna Risk Assessment

The proposed activity is for the development of a 132 kV OHL that will link the Great Karoo WF substation to the Hidden Valley substation on Karusa WF. The grid connection infrastructure required includes a switching station (up to 100 m x 100 m) to be developed adjacent to the authorised Great Karoo Wind Farm substation. A 132 kV double- or single-circuit overhead powerline, with a length of up to 14 km, will connect the proposed switching station to the Eskom Hidden Valley substation. The pylon structures of the power line will be up to 32m high and the power line will be developed within a servitude of up to 40 m wide.

Other associated infrastructure includes a service track along the length of the power line servitude (6 m wide), a 6 m wide access road to provide access to the switching station and temporary laydown area/s that will be rehabilitated upon completion of the construction phase.

4.1 Risk Assessment Method

The assessment of the significance of direct, indirect and cumulative impacts was undertaken using the method as developed by Savannah Environmental (Pty) Ltd. The assessment of the impact considers the following:

- the nature of the impact, which shall include a description of what causes the effect, what will be affected, and how it will be affected;
- the extent of the impact, indicating whether the impact will be local or regional;
- the duration of the impact, very short-term duration (0-1 year), short-term duration (2-5 years), medium-term (5-15 years), long-term (> 15 years) or permanent;
- the probability of the impact, describing the likelihood of the impact actually occurring, indicated as improbable, probable, highly probable or definite;
- the severity/beneficial scale indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit with no real alternative to achieving this benefit), severe/beneficial (long-term impact that could be mitigated/long-term benefit), moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight, or have no effect;
- the significance which shall be determined through a synthesis of the characteristics described above and can be assessed as low medium or high;
- the status which will be described as either positive, negative or neutral;
- the degree to which the impact can be reversed;
- the degree to which the impact may cause irreplaceable loss of resources; and
- the degree to which the impact can be mitigated.

4.2 Present Impacts to Avifauna

Considering the anthropogenic activities and influences within the landscape, several negative impacts to the avifauna community were observed within the assessment area. These include:

- Construction of the Soetwater and Karusa Wind Farms;
- Erosion from livestock overgrazing and trampling;
- Invasive Alien Plants;
- Roads and associated vehicle traffic;
- Powerlines; and
- Fences.

4.3 Identification of Additional Potential Impacts

This section describes the potential impacts on avifauna associated with the construction, operational and decommissioning phases of the proposed development. During the construction phase vegetation clearing for the associated infrastructure will lead to direct habitat loss. Vegetation clearing will create a disturbance and will therefore potentially lead to the displacement of avifaunal species. The operation of construction machinery on site will create will generate noise and dust pollution. Increased human presence can lead to poaching and the increase in vehicle traffic will potentially lead to roadkill.

The principle impacts of the operational phase are electrocution and collisions due to the powerlines. Large passerines are particularly susceptible to electrocution because owing to their relatively large bodies, they are able to touch conductors and ground/earth wires or earthed devices are simultaneously. The chances of electrocution are increased when feathers are wet, during periods of high humidity or during defecation. Prevailing wind direction also influences the rate of electrocution casualties. Winds parallel or diagonal to cross-arms are the most detrimental, due to exacerbating the difficulty in manoeuvrability during landing or take-off. Medium to large species are also particularly susceptible to collisions with powerlines, as owing to their size, they have a higher chance of collision. The frontal vision of many avifauna species is not high-resolution vision and many species mainly use their lateral vision to detect details. Moreover, they often tend to look downwards in flight (e.g., to look for conspecifics or food) by which (for some species) the trajectory of flight falls completely inside their blind zone. Behaviour can also influence the probability that a species will collide with a powerline. Species that fly in flocks, such as certain waterfowl, are susceptible as birds in the rear are not able to detect the powerline. Species that have display flights or pursuit their prey, are also particularly susceptible. An additional impact of the operational phase is roadkill during maintenance procedures.

The decommissioning phase will cause disturbance due to the removal of associated infrastructure. Furthermore, if the area is not rehabilitated, this will likely result in habitat degradation due to erosion and the encroachment of invasive alien plants.

A summary of the potential impacts during the construction, operation and decommissioning phases of the proposed activity are presented in Table 4-1.

Table 4-1 Summary of expected impacts due to the proposed development

Phase	Expected Impacts
Construction Phase	• Habitat loss • Noise and dust pollution from heavy machinery use • Collection of eggs and poaching • Roadkill
Operational Phase	• Collisions with powerlines • Electrocution with powerlines • Roadkill during maintenance procedures
Decommissioning Phase	• Disturbance • Habitat degradation

4.4 Assessment of Impact Significance

The assessment of impact significance considers pre-mitigation as well as implemented of post-mitigation scenarios. Although different species and groups will react differently to the development, the risk assessment was undertaken bearing in mind the potential impacts to the priority species listed in section 3.2.1 of this report. Moreover, the north-south section of the OHL will run directly adjacent to an existing 132kV OHL currently under construction by Soetwater wind farm, denoting that this will not be a new disturbance within the landscape and was consequently considered for the impact rating.

4.4.1 Construction Phase

Impact Nature: Habitat loss and degradation		
Degradation and loss of surrounding natural vegetation arising from construction activities and dust precipitation.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Short term (2)
Magnitude	Moderate (6)	MIinor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, although the loss of vegetation cannot be mitigated against.	
Mitigation:		
• Construction activity to only be within the project footprint and the area is to be well demarcated. • Areas where vegetation has been temporarily cleared must be re-vegetated within local indigenous plant species. • The affected area must be monitored for invasive plant encroachment and erosion and must be controlled. • Unnecessary damage to important habitats such as drainage lines and cliffs must not occur. Appropriate crossings must be constructed where the access road traverses drainage lines. • The use of laydown areas within the corridor should be used where feasible, to avoid habitat loss and disturbance to adjoining areas.		
Residual Impacts:		
The loss of habitat is a residual impact that is unavoidable. The disturbance may still cause some erosion and invasive alien plant encroachment.		

Impact Nature: Direct mortality		
Direct mortality within the construction area and surrounds due to collisions with vehicles and poaching of eggs and adults.		
	Without mitigation	**With mitigation**
Extent	Very low (1)	Very low (1)
Duration	Short term (2)	Very short term (1)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
• All personnel should undergo environmental induction and awareness training with regards to avifauna and in particular awareness about not harming, collecting or hunting terrestrial species (e.g. bustards, korhaans, francolin), and owls, which are often persecuted out of superstition. • All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area. • All vehicles (construction or other) accessing the site should adhere to a low speed limit on site (40 km/h max) to avoid collisions with susceptible avifauna, such as nocturnal and crepuscular species (e.g. nightjars and owls) which sometimes forage or rest on roads, especially at night.		
Residual Impacts:		
There is the possibility that roadkill may still occur.		

4.4.2 Operational Phase

Impact Nature: Collisions with powerlines		
Several priority species occur within the assessment area that exhibit a high probability of colliding with powerlines.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Low (4)
Probability	Definite (5)	Highly probable (4)
Significance	**High**	**Moderate**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
• The design of the proposed power line must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa. • Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used. This would involve using existing/approved pylons and associated infrastructure for different lines. • The power line should be marked with bird diverters along all high-priority sections in order to make the lines as visible as possible to collision-susceptible species. Recommended bird diverters such as brightly coloured 'aviation' balls, thickened wire spirals and flapping devices that increase the visibility of the lines should be fitted where considered necessary (collision hot-spots). These should be identified during the preconstruction walk-through. • If lights are to be used at night for ensuring that infrastructure on site is lit, this should be done with downward-directed low-UV type lights (such as most HPS or LPS bulbs), which do not attract insects and their avian predators., so as to minimise disturbance to birds flying over the site at night.		

Impact Nature: Collisions with powerlines
Several priority species occur within the assessment area that exhibit a high probability of colliding with powerlines.
• A recommended option (but not a requirement) is that Bird Strike Indicators could be installed to alert about collisions. • Ensure that monitoring is sufficiently frequent to detect collisions reliably and that any areas where regular collisions occur are fitted with flight diverters. • During the first year of operation quarterly reports, summarising interim findings should be complied and submitted to BirdLife South Africa. If the findings indicate that collisions have not occurred or are minimal with no red-listed species, an annual report can be submitted.
Residual Impacts:
There is still the risk of Ludwig's Bustard colliding due to the species poor eyesight. This can be reduced further by 'staggering' the pylons as far as practicable in relation to neighbouring pylons during construction (subject to other environmental and technical considerations), rather than aligning the pylons of adjacent power lines, so that the profile of the combined power lines will be more visible to flying birds. The consolidation of infrastructure will also aid in mitigation against collision.

Impact Nature: Electrocution with powerlines		
Several priority species occur within the assessment that exhibit a high probability of electrocution by powerlines. These are typically the raptor species that use the powerlines as perching spots.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Moderate term (3)
Magnitude	High (8)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**High**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
• The design of the proposed power line must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa. • Infrastructure should be consolidated where possible/practical in order to minimise the amount of ground and air space used. This would involve using the existing/approved pylons and associated infrastructure for different lines. • Ensure that monitoring is sufficiently frequent to detect electrocutions reliably and that any areas where regular collisions occur are fitted with flight diverters. • During the first year of operation quarterly reports, summarising interim findings should be complied and submitted to BirdLife South Africa. If the findings indicate that electrocutions have not occurred or are minimal with no red-listed species, an annual report can be submitted.		
Residual Impacts:		
There may still be the possibility of electrocution although the severity of the impact is mimised if the appropriate mitigation measures are implemented.		

Impact Nature: Direct mortality during maintenance procedures		
The maintenance of infrastructure may possibly lead to roadkills along the access road.		
	Without mitigation	**With mitigation**
Extent	Very low (1)	Very low (1)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Mlinor (2)

Impact Nature: Direct mortality during maintenance procedures		
The maintenance of infrastructure may possibly lead to roadkills along the access road.		
Probability	Definite (5)	Improbable (2)
Significance	**High**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
• All personnel should undergo environmental induction and awareness training with regards to avifauna and in particular awareness about not harming, collecting or hunting terrestrial species (e.g. bustards, korhaans, francolin), and owls, which are often persecuted out of superstition. • All vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed. • All vehicles accessing the site should adhere to a low speed limit on site (40 km/h max) to avoid collisions with susceptible avifauna, such as nocturnal and crepuscular species (e.g. nightjars and owls) which sometimes forage or rest on roads, especially at night.		
Residual Impacts:		
There may still be the possibility of roadkills although the severity of the impact is mimised if the appropriate mitigation measures are implemented.		

4.4.3 Decommissioning Phase

Impact Nature: Disturbance and direct mortality		
Disturbance will occur during the removal of infrastructure and direct mortality due to collisions with vehicles and poaching of eggs and adults.		
	Without mitigation	**With mitigation**
Extent	Very low (1)	Very low (1)
Duration	Short term (2)	Very short term (1)
Magnitude	Moderate (6)	Mlinor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes to an extent, the noise generated from heavy machinery is difficult to mitigate against.	
Mitigation:		
• All personnel should undergo environmental induction and awareness training with regards to avifauna and in particular awareness about not harming, collecting or hunting terrestrial species (e.g. bustards, korhaans, francolin), and owls, which are often persecuted out of superstition. • All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area. • All vehicles (construction or other) accessing the site should adhere to a low speed limit on site (40 km/h max) to avoid collisions with susceptible avifauna, such as nocturnal and crepuscular species (e.g. nightjars and owls) which sometimes forage or rest on roads, especially at night.		
Residual Impacts:		
There is the possibility that roadkill may still occur, and the noise generated will be difficult to mitigate against.		

Impact Nature: Habitat degradation		
Disturbance created during the decommissioning phase will potentially lead to habitat erosion and encroachment of invasive alien plants. This will degrade the habitat within the project footprint and proximal surrounding environment, thereby leading to a negative shift in the avifauna community.		
	Without mitigation	**With mitigation**
Extent	Low (2)	Very low (1)
Duration	Permanent (5)	Very short term (1)
Magnitude	High (8)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation:		
• Rehabilitation in accordance with the Rehabilitation Plan for the development must be undertaken in areas disturbed during the decommissioning phase. • Monitoring of the rehabilitated area must be undertaken for a minimum of 3 years after the decommissioning phase. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous flora. • IAP management must occur annually for at least 2 years after decommissioning. A further 1-3 years of monitoring and control may be required, depending on the condition of the site at the end of year 2. Woody aliens should be controlled using the appropriate alien control techniques as determined by the species present. This might include use of herbicides where no practical manual means are feasible.		
Residual Impacts:		
No significant residual risks are expected, although IAP encroachment and erosion might still occur but would have a negligible impact if effectively managed.		

4.4.4 Cumulative Impacts

The following is the cumulative impact that is assessed as being a likely consequence of the development (construction, operational and decommissioning phases) of the Great Karoo Grid Connection Infrastructure. It is assessed in context of the extent of the current site, other developments in the area as well as general habitat loss and transformation resulting from other activities in the area. The assessment for site in isolation assumes that the appropriate mitigation measures are implemented.

Nature: Cumulative impacts to avifauna within the southern Roggeveld region		
Impact on avifaunal habitats, migration routes and nesting areas due to cumulative loss and fragmentation of habitat, as well collisions and electrocutions along the grid connection (dealt with specifically under Operational Impacts).		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Very low (1)	High (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	High (8)
Probability	Probable (3)	Probable (3)
Significance	**Low**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	High	Low
Irreplaceable loss of resources?	No	Yes
Can impacts be mitigated?	Yes, the impacts can be mitigated to some degree, but many of the long-term impacts from the presence of the Wind Energy Facilities in the area cannot be well mitigated.	

Nature: Cumulative impacts to avifauna within the southern Roggeveld region
Impact on avifaunal habitats, migration routes and nesting areas due to cumulative loss and fragmentation of habitat, as well collisions and electrocutions along the grid connection (dealt with specifically under Operational Impacts).
Mitigation:
• The design of the proposed power facilities must be congruent with best-practice guidelines as indicated by the Endangered Wildlife Trust and BirdLife South Africa. • Ensure that monitoring is sufficiently frequent to detect fatalities reliably and that any areas where regular electrocutions or collisions occur are fitted with the appropriate mitigation measures. Reports should be complied and submitted to BirdLife South Africa. • Rehabilitation of disturbed areas must occur throughout the corridor to mitigate against habitat degradation within the broader southern Roggeveld area.
Residual Impacts:
No significant residual risks are expected, although IAP encroachment and erosion might still occur but would have a negligible impact if effectively managed.

4.5 Biodiversity Management Outcomes

The purpose of the management outcomes is to allow for the mitigations associated with the impact assessment to be incorporated into the EMPr. These are provided in Table 4-2.

Table 4-2 Summary of management outcomes pertaining to impacts to biodiversity associated with the proposed Great Karoo OHL and Switching Station

Management Action	Phase	Responsible Party for Implementation
Prior to construction activity a walk-through survey must be undertaken to tag/mark flora species to be relocated.	Pre-Construction	Project Manager Environmental Officer Undertaken by Specialist
The areas to be developed and access roads must be specifically demarcated to prevent movement of workers into sensitive surrounding environments, and so that during the construction phase, only the demarcated areas may be impacted upon.	Construction	Environmental Officer
Temporary construction areas that are denuded during construction needs to be re-vegetated with indigenous vegetation. This will also reduce the likelihood of encroachment by Invasive Alien Plant species.	Construction	Project Manager Environmental Officer
It should be made an offence for any staff to bring or plant any plant species into any portion of the project area, unless undertaken in line with the required/approved rehabilitation. No plant species whether indigenous (unless undertaken in line with the required/approved rehabilitation) or exotic should be brought into the project area, to prevent the spread of exotic or invasive species.	Construction	Environmental Officer
An extensive alien plant management plan must be compiled to remove the alien vegetation from within the project footprint. The use of herbicides needs to be monitored and only be used by a qualified person.	Construction	Environmental Officer
Areas of indigenous vegetation, even secondary communities, should under no circumstances be fragmented or disturbed further or used as an area for dumping of waste.	Construction	Environmental Officer
A fire management plan must be in place for the areas surrounding the project area and the road to restrict the impact from fire on the natural flora and fauna communities. A fire expert should be consulted for suitable guidelines for the area and project requirements.	Construction	Project Manager Environmental Officer Health and Safety Officer
Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered during the construction process. The intentional killing of any animals should be strictly prohibited.	Construction	Environmental Officer Health and Safety Officer
Where possible, work should be restricted to one area at a time. This will give the birds a chance to vacate the area.	Construction	Project Manager Environmental Officer
Prior to site activities, the area to be disturbed should be walked on foot by 1-2 individuals to create a disturbance for fauna to vacate the area. Sites should be disturbed on a needs basis only, and just prior to the activities on the site.	Construction	Project manager, Environmental Officer
A site plan of the area must be made available onsite for all contractors and personnel indicating parking & storage areas, site offices and placement of ablution facilities.	Construction	Project Manager Environmental Officer
The Contractor should inform all site staff to the use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities. Toilets must be provided as per the relevant Health & Safety legislation.	Construction	Health and Safety Officer Environmental Officer

Management Action	Phase	Responsible Party for Implementation
The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed recycling or disposal facility.	Construction	Health and Safety Officer Environmental Officer
Where a registered disposal facility is not available close to the site, the Contractor shall provide a method statement with regard to waste management. Under no circumstances may domestic waste be burned on site. Temporary storage of domestic waste shall be in covered waste skips.	Construction	Health and Safety Officer Environmental Officer
Any topsoil that is removed during construction must be appropriately removed and stored according to the national and provincial guidelines. This includes on-going maintenance of such topsoil piles so that they can be utilised during decommissioning phases and re-vegetation.	Construction	Environmental Officer
All livestock must always be kept out of the project area during construction and rehabilitation, especially areas that have been recently re-planted	Construction	Environmental Officer
Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and dumps especially. This includes wetting of exposed soft soil surfaces and not conducting activities on windy days which will increase the likelihood of dust being generated.	Construction	Environmental Officer
Stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised and be surrounded by bunds.	Construction	Environmental Officer
A pest control plan must be put in place and implemented. It is imperative that poisons not be used.	Construction	Health and Safety Officer
Construction activities and vehicles could cause spillages of lubricants, fuels and waste material potentially negatively affecting the functioning of the ecosystem. All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas outside of the project area.	Construction	Project Manager Environmental Officer
Have action plans on site, and training for contactors and employees in the event of sewage spills, leaks and hazardous chemical spills to the surrounding environment. A specialist Contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site.	Construction	Project Manager Environmental Officer
Monitoring of the OHL route must be undertaken to detect bird carcasses, to enable the identification of any potential areas of high impact to be marked with bird flappers if not already done so. Monitoring should be undertaken at least once a month for the first year of operation.	Operational	Project Manager Environmental Officer
Appropriate induction of workers and/or appropriate speed reducing measures, such as speed bumps and/or speed limit signs (40 km/h), should be incorporated into the road design to reduce the chance of road-kills on site.	Operational	Project Manager Contractor
Effective and sustainable stormwater designs must be incorporated into the road design to prevent excessive runoff into the surrounding natural environment and thereby, causing erosion.	Operational	Project Manager Contractor
The design of the proposed power line must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa.	Operational	Project Manager Environmental Officer
Ensure that monitoring is sufficiently frequent to detect electrocutions reliably and that any areas where regular collisions occur are fitted with flight diverters.	Operational	Environmental Officer
During the first year of operation, quarterly reports summarising interim findings should be complied and submitted to BirdLife South Africa. Subsequently, reports can be provided on an annual basis if the findings indicate no/limited mortality.	Operational	Project Manager Environmental Officer

5 Conclusion and Impact Statement

5.1 Conclusion

The proposed development overlaps with a single vegetation type, the Central Mountain Shale Renosterveld. The Central Mountain Shale Renosterveld is a poorly studied vegetation type, although it possesses a high level of biodiversity. The conservation status is classified as Least Threatened albeit the protection level is regarded as 'Not Protected'. Moreover, the proposed development overlaps with a CBA 1 and CBA 2, as well as a NPAES focus area. However, the proposed development does not overlap with an Important Bird and Biodiversity Area.

The avifauna of the assessment area can be regarded as typical of the Succulent Karoo Biome. The species richness could be regarded as low with only 30 of the 101 expected species observed but this may be due to the time constraints. This number is likely to increase with increased sampling effort as well as during periods there are influxes of nomadic species. The most speciose families were the Accipitridae and Muscicapidae, represented by four species each. Species from the Alaudidae and Muscicapidae families were the most ubiquitous within the assessment area. Majority (30%) of the species are categorised as omnivorous ground-foragers, with four (4) species categorised as carnivorous ground-hawkers. Three (3) red-listed species were recorded within the assessment area and surrounding landscape during the survey period, namely *Afrotis afra* (Southern Black Korhaan), *Aquila verreauxii* (Verreaux's Eagle) and *Neotis ludwigii* (Ludwig's Bustard). The latter species is nomadic, and it is postulated that the species inhabits the area during the spring and summer period, based on the observations made during the field survey periods.

Disparity in the structure of the species assemblages between fine-scale habitats was observed during the survey period/ Generally, lowland areas and rocky slopes were assigned a 'moderate' category as they were typically dominated by small passerine species. However, where threatened or priority species occurred or displayed breeding behaviour, these areas were categorised as a 'very high' priority for mitigation. Drainage lines possessed priority species and therefore, were assigned a 'high' mitigation priority category and cliffs a 'very high' mitigation priority.

5.2 Impact Statement

The main expected impacts of the proposed OHL and Switching Station will include the following:

- habitat loss and fragmentation;
- degradation of surrounding habitat;
- disturbance and displacement caused during the construction and maintenance phases;
- collisions with powerlines; and
- electrocution by powerlines.

Mitigation measures as described in this report can be implemented to reduce the significance of the risk but there is still a possibility of collision by large non-passerine avifauna species. Considering that this area that has been identified as being of significance for biodiversity maintenance and ecological processes (CBAs and NPAES focus area), development may proceed but with caution and only with the implementation of mitigation measures. Furthermore, the proposed Great Karoo OHL will be wholly located within 3 wind farms and will run adjacent to an existing (under construction) 132kV OHL for a portion of the line. These factors may ameliorate the impact of the GK OHL and therefore, regarded as fairly "minor" in the context of the surrounding infrastructure). Development of infrastructure can occur within any area of the corridor footprint, but pylons and the switching station are not to be located in

drainage lines. Formal crossings must be developed for the road to traverse these drainage lines. The location of the proposed infrastructure is not to exceed the boundary of the corridor.

6 References

3Foxes Biodiversity Solutions. 2020a. Basic Assessment for the Great Karoo Battery Energy Storage System (Bess), Northern Cape Province: Fauna & Flora Basic Assessment Specialist Report. Report prepared for Savannah Environmental.

3Foxes Biodiversity Solutions. 2020b. Basic Assessment for the extension of grid connection infrastructure for the Gunstfontein Wind Farm, Northern Cape Province: Fauna & Flora Basic Assessment Specialist Report. Report prepared for Savannah Environmental.

ADU (Animal Demography Unit) Virtual Museum. http://vmus.adu.org.za/. Accessed September 2020.

BirdLife International. 2016a. *Afrotis afra*. The IUCN Red List of Threatened Species 2016: e.T22691975A93331501. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22691975A93331501.en.

BirdLife International. 2016b. *Aquila verreauxii*. The IUCN Red List of Threatened Species 2016: e.T22696067A95221980. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22696067A95221980.en.

BirdLife International. 2018. *Neotis ludwigii* (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2018: e.T22691910A129456278. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22691910A129456278.en.

BirdLife South Africa. 2017. Verreauxs' Eagle and Wind Farms: Guidelines for impact assessment, monitoring, and mitigation. BirdLife South Africa Occasional Report Series.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J & de Villiers, M.S. (Eds). 2014. Atlas and Red List of Reptiles of South Africa, Lesotho and Swaziland. Suricata 1. South African Biodiversity Institute, Pretoria.

Donaldson, J., Nänni, I., Zachariades, C., Kemper, J. 2002. Effects of habitat fragmentation on pollinator diversity and plant reproductive success in renosterveld shrublands of South Africa. Conservation Biology 16: 1267–1276.

Endangered Wildlife Trust (EWT). 2014. Pre-construction Bird Monitoring Report and Updated Avifaunal Assessment: Three Phased Hidden Valley Wind Energy Facility. Unpublished Report

González-Salazar, C., Martínez-Meyer, E. and López-Santiago, G. 2014. A hierarchical classification of trophic guilds for North American birds and mammals. Revista Mexicana de Biodiversidad 85: 931-941.

Hofmeyr, M.D., Leuteritz, T. & Baard, E.H.W. 2018b. *Psammobates tentorius*. The IUCN Red List of Threatened Species 2018: e.T170524A115656793. http://dx.doi.org/10.2305/IUCN.UK.2018- 2.RLTS.T170524A115656793.en

IUCN. The IUCN Red List of Threatened Species. www.iucnredlist.org. Accessed September 2020.

Jenkins, A.R., Shaw, J.M., Smallie, J.J., Gibbons, B., Visagie, R. & Ryan, P.R. 2011. Estimating the impacts of power line collisions on Ludwig's Bustards *Neotis ludwigii*. Bird Conservation International 21: 303-310.

Martin, G. R. & Shaw, J. M. 2010. Bird collisions with power lines: Failing to see the way ahead? Biological Conservation 143: 2695-2702.

Mucina, L. & Rutherford, M.C. (Eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria, South African.

Mucina, L., Rutherford, M.C. & Powrie, L.W. (Eds.). 2007. Vegetation map of South Africa, Lesotho and Swaziland. 1:1 000 000 scale sheet maps. 2nd ed. South African National Biodiversity Institute, Pretoria.

National Biodiversity Assessment spatial data. 2018. http://bgis.sanbi.org/. Accessed September 2020.

Prinsen, H.A.M., G.C. Boere, N. Píres and J.J. Smallie (Compilers), 2011. Review of the conflict between migratory birds and electricity power grids in the African-Eurasian region. CMS Technical Series No. XX, AEWA Technical Series No. XX. Bonn, Germany.

Ralston Paton, S., Smallie J., Pearson A., and Ramalho R. 2017. Wind energy's impacts on birds in South Africa: A preliminary review of the results of operational monitoring at the first wind farms of the Renewable Energy Independent Power Producer Procurement Programme in South Africa. BirdLife South Africa Occasional Report Series No. 2. BirdLife South Africa, Johannesburg, South Africa

Retief, E.F, Diamond, M., Anderson, M.D., Smit, H.A., Jenkins, A. & Brooks, M. 2011 (updated 2014). Avian Wind Farm Sensitivity Map for South Africa: Criteria and procedures used. Birdlife South Africa and Endangered Wildlife Trust.

SABAP2 (Bird Atlas Project). http://vmus.adu.org.za/. Accessed September 2020.

SANBI-BGIS. 2017. Technical guidelines for CBA Maps: Guidelines for developing a map of Critical Biodiversity Areas & Ecological Support Areas using systematic biodiversity planning.

SADAP (South Africa Protected Areas Database) and SACAD (South Africa Conservation Areas Database) (2019). http://egis.environment.gov.za

Sinclair, I., Hockey, P. and Tarboton, W. 2002. SASOL Birds of Southern Africa 3rd Edition. Struik Nature, Cape Town.

Skowno, A.L., Raimondo, D.C., Poole, C.J., Fizzotti, B. & Slingsby, J.A. (eds.). 2019. South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm. South African National Biodiversity Institute, Pretoria.

Taylor, M.R., Peacock, F. & Wanless, R.M. (Eds). 2015. The 2015 Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

Taylor, A., Cowell, C. & Drouilly, M. 2017. *Pelea capreolus*. The IUCN Red List of Threatened Species 2017: e.T16484A50192715. http://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T16484A50192715.en

Van Deventer H, Smith-Adao L, Collins NB, Grenfell M, Grundling A, Grundling P-L, Impson D, Job N, Lötter M, Ollis D, Petersen C, Scherman P, Sieben E, Snaddon K, Tererai F. and Van der Colff D. 2019. *South African National Biodiversity Assessment 2018: Technical Report.* Volume 2b: Inland Aquatic (Freshwater) Realm. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6230.

7 Appendix Items

7.1 Appendix A – Avifauna species expected to occur within the project area

Common Name	Scientific Name	Conservation Status
Barbet, Acacia Pied	*Tricholaema leucomelas*	LC
Batis, Pririt	*Batis pririt*	LC
Bee-eater, European	*Merops apiaster*	LC
Bishop, Southern Red	*Euplectes orix*	LC
Bokmakierie, Bokmakierie	*Telophorus zeylonus*	LC
Bulbul, Cape	*Pycnonotus capensis*	LC
Bunting, Cape	*Emberiza capensis*	LC
Bunting, Lark-like	*Emberiza impetuani*	LC
Buzzard, Jackal	*Buteo rufofuscus*	LC
Canary, Black-headed	*Serinus alario*	LC
Canary, Cape	*Serinus canicollis*	LC
Canary, White-throated	*Crithagra albogularis*	LC
Canary, Yellow	*Crithagra flaviventris*	LC
Chat, Familiar	*Cercomela familiaris*	LC
Chat, Karoo	*Cercomela schlegelii*	LC
Chat, Sickle-winged	*Cercomela sinuata*	LC
Cisticola, Grey-backed	*Cisticola subruficapilla*	LC
Cormorant, Reed	*Phalacrocorax africanus*	LC
Crombec, Long-billed	*Sylvietta rufescens*	LC
Crow, Cape	*Corvus capensis*	LC
Crow, Pied	*Corvus albus*	LC
Dove, Laughing	*Streptopelia senegalensis*	LC
Dove, Namaqua	*Oena capensis*	LC
Dove, Red-eyed	*Streptopelia semitorquata*	LC
Duck, African Black	*Anas sparsa*	LC
Duck, Yellow-billed	*Anas undulata*	LC
Eagle, Booted	*Aquila pennatus*	LC
Eagle, Verreaux's	*Aquila verreauxii*	VU
Eagle-owl, Spotted	*Bubo africanus*	LC
Eremomela, Yellow-bellied	*Eremomela icteropygialis*	LC
Fiscal, Common (Southern)	*Lanius collaris*	LC
Flycatcher, Fairy	*Stenostira scita*	LC
Flycatcher, Fiscal	*Sigelus silens*	LC
Francolin, Grey-winged	*Scleroptila africanus*	LC
Goose, Egyptian	*Alopochen aegyptiacus*	LC

Common Name	Scientific Name	Conservation Status
Goose, Spur-winged	*Plectropterus gambensis*	LC
Goshawk, Southern Pale Chanting	*Melierax canorus*	LC
Hamerkop, Hamerkop	*Scopus umbretta*	LC
Harrier, Black	*Circus maurus*	EN
Harrier-Hawk, African	*Polyboroides typus*	LC
Heron, Grey	*Ardea cinerea*	LC
Hoopoe, African	*Upupa africana*	LC
Ibis, African Sacred	*Threskiornis aethiopicus*	LC
Ibis, Hadeda	*Bostrychia hagedash*	LC
Kestrel, Rock	*Falco rupicolus*	LC
Korhaan, Karoo	*Eupodotis vigorsii*	NT
Lapwing, Blacksmith	*Vanellus armatus*	LC
Lark, Karoo	*Calendulauda albescens*	LC
Lark, Karoo Long-billed	*Certhilauda subcoronata*	LC
Lark, Large-billed	*Galerida magnirostris*	LC
Lark, Red-capped	*Calandrella cinerea*	LC
Lark, Spike-heeled	*Chersomanes albofasciata*	LC
Martin, Brown-throated	*Riparia paludicola*	LC
Martin, Rock	*Hirundo fuligula*	LC
Masked-weaver, Southern	*Ploceus velatus*	LC
Mousebird, Red-faced	*Urocolius indicus*	LC
Mousebird, White-backed	*Colius colius*	LC
Neddicky, Neddicky	*Cisticola fulvicapilla*	LC
Pigeon, Speckled	*Columba guinea*	LC
Plover, Three-banded	*Charadrius tricollaris*	LC
Prinia, Karoo	*Prinia maculosa*	LC
Raven, White-necked	*Corvus albicollis*	LC
Reed-warbler, African	*Acrocephalus baeticatus*	LC
Robin-chat, Cape	*Cossypha caffra*	LC
Sandgrouse, Namaqua	*Pterocles namaqua*	LC
Scrub-robin, Karoo	*Cercotrichas coryphoeus*	LC
Shelduck, South African	*Tadorna cana*	LC
Shoveler, Cape	*Anas smithii*	LC
Snake-eagle, Black-chested	*Circaetus pectoralis*	LC
Sparrow, Cape	*Passer melanurus*	LC
Sparrow, House	*Passer domesticus*	LC
Sparrow, Southern Grey-headed	*Passer diffusus*	LC
Spurfowl, Cape	*Pternistis capensis*	LC

Common Name	Scientific Name	Conservation Status
Starling, Common	*Sturnus vulgaris*	LC
Starling, Pale-winged	*Onychognathus nabouroup*	LC
Starling, Pied	*Spreo bicolor*	LC
Starling, Wattled	*Creatophora cinerea*	LC
Stilt, Black-winged	*Himantopus himantopus*	LC
Stork, Black	*Ciconia nigra*	VU
Sunbird, Dusky	*Cinnyris fuscus*	LC
Sunbird, Malachite	*Nectarinia famosa*	LC
Sunbird, Southern Double-collared	*Cinnyris chalybeus*	LC
Swallow, Barn	*Hirundo rustica*	LC
Swallow, Greater Striped	*Hirundo cucullata*	LC
Swift, Alpine	*Tachymarptis melba*	LC
Swift, Little	*Apus affinis*	LC
Swift, White-rumped	*Apus caffer*	LC
Teal, Cape	*Anas capensis*	LC
Thrush, Karoo	*Turdus smithi*	LC
Tit, Grey	*Parus afer*	LC
Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*	LC
Tit-babbler, Layard's	*Parisoma layardi*	LC
Turtle-dove, Cape	*Streptopelia capicola*	LC
Wagtail, Cape	*Motacilla capensis*	LC
Warbler, Namaqua	*Phragmacia substriata*	LC
Warbler, Rufous-eared	*Malcorus pectoralis*	LC
Waxbill, Common	*Estrilda astrild*	LC
Weaver, Cape	*Ploceus capensis*	LC
Wheatear, Mountain	*Oenanthe monticola*	LC
White-eye, Cape	*Zosterops virens*	LC
Woodpecker, Ground	*Geocolaptes olivaceus*	LC