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Appendix D1:

Preconstruction Avifauna Scoping Assessment

Avifaunal Specialist Assessment:
Proposed De Rust Wind Energy Facilities
Southwest of Pofadder
Northern Cape Province

November 2022

For

FE De Rust (Pty) Ltd

Enviro-Insight CC

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Professional Team

The technical team responsible for the pre-construction monitoring surveys and Impact Assessment reporting is presented.

Team member	Qualification	Role on project
Samuel Laurence	*Pr. Sci. Nat.* No. 400450/13	Lead Avifaunal Specialist Field Observer Data analysis Report compilation
AE Van Wyk	*Cand. Sci. Nat.*	Field Observer

Specialist Declaration

I, Sam Laurence *Pr. Sci. Nat.,* declare that the work presented in this report is our own and has not been influenced in any way by the developer or the EAP. At no point has the developer asked us as specialists to manipulate the results in order to make it more favourable for the proposed development. We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP) and the EIA Regulations (2014, as amended). We have the necessary qualifications and expertise (*Pr. Sci. Nat. Zoological Science)* in conducting this specialist report.

Sam Laurence *Pr. Sci. Nat.*

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GLOSSARY AND ACRONYMS

AI	Artificial Intelligence
BA	Basic Assessment
BARESG	Bird and Renewable Energy Specialist Group
CITES	Convention on International Trade in Endangered Species
Cumulative impact	Impacts on a species, ecosystem or resource as a result of the sum of actions in the past, present and foreseeable future, from multiple WEFs or a WEF in combination with other developments.
CWAC	Coordinated Waterbird Counts, a programme of bird censuses at a number of South African wetlands. See http://cwac.adu.org.za for more information.
ESKOM	Electricity Supply Commission (ESCOM), established in 1923.
Environmental Impact Assessment (EIA)	The process of identifying environmental impacts due to activities and assessing and reporting these impacts
GIS	Geographic Information Systems
GN	General Notice
IBA	Important Bird and Biodiversity Area. Part of a global network of sites that are critical for the long-term viability of bird populations. Now known as Important Bird and Biodiversity Areas.
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
Rotor swept area	The area where birds are at risk of colliding with turbine blades. The area of the circle or volume of the sphere swept by the turbine blades.
NEPA	National Freshwater Ecosystem Priority Areas
PA	Project Area (denotes infrastructure footprint)
PAOI	Project Area of Influence
Preconstruction Phase	The period prior to the construction of a wind energy facility

Wind Energy related Priority species	Threatened or rare birds (in particular those unique to the region and especially those which are possibly susceptible to wind-energy impacts as defined by Ralston Paton *et al*. 2017), which occur in the given development area at relatively high densities or have high levels of activity in the area. These species should be the primary (but not the sole) focus of all subsequent monitoring and assessment.
SABAP	The Southern African Bird Atlas Project. A project in which data on bird distribution and relative abundance are collected by volunteers. There have been two SABAP projects; i.e. SABAP1 (completed in 1991) and SABAP2 (started in 2007 and on-going). See http://sabap2.adu.org.za for more information.
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SEA	Strategic Environmental Assessment
STC	Strategic Transmission Corridors
TOPS	Threatened or Protected Species Regulations
REDZ	Renewable Energy Development Zones
VP	Vantage point
WEF	Wind energy facility. A power plant that uses wind to generate electricity, also colloquially known as a wind farm

1 INTRODUCTION AND PROJECT BACKGROUND

Enviro-Insight CC was commissioned by EnergyTeam (Pty) Ltd to conduct a pre-construction avifaunal survey for a proposed wind energy facility (WEF) and associated infrastructure which will be known as the De Rust WEF North and South (also known as the De Rust WEFs). Approximately 70 wind turbines will be constructed, each with a generation capacity up to 7.5 MW with a hub situated 150 m above ground level and a rotor diameter of up to 175 m (blade tip sweep height: 62.5 m above ground level). Turbines will be connected with underground and above-ground cabling and each turbine will be built on a concrete foundation, using a formal adjacent laydown area. Additional infrastructure includes a network of roads between turbines, two battery energy storage systems (BESS), permanent workshop area, office, up to 4 sub-substations and a guard cabin. This report serves as a pre-construction assessment of the avifaunal activity and bird species present in the Project Area (PA) and Project Area of Influence (PAOI) of the proposed De Rust WEFs.

1.1 SCOPE OF WORK

The main objective is to fully understand and successfully mitigate the possible negative impacts of wind energy production (and associated infrastructure) on the avifauna within the Project Area of Influence (PAOI). This report will provide baseline information to assess avifauna habitat use in a pre-construction (impact) scenario and evaluate the potential impact of the Project WEF on avifauna (such as collision mortality, displacement due to disturbance, barrier effects and habitat loss).

1.2 STUDY AREA

The proposed De Rust WEF (boundary in **Error! Reference source not found.**) is located 13 km south-south-east of Pofadder and 47 km east of Aggeneys in the Khâi-Ma Local Municipality in the Northern Cape Province of South Africa. It is accessed from the R358 from Pofadder, which bisects the PA (defined as the boundary shown in **Error! Reference source not found.**). The minimum convex hull of the preferred turbine placement (B), with an 87.5 m buffer (to account for rotor sweep), covers an area of *ca.* 7,731 ha. The only land use in the area is sheep ranching due to the lack of rainfall and nearby permanent water sources, and several occupied farm smallholdings are present within or near to the Project Area (PA) known as the infrastructure footprint. The closest existing WEF is the Kangnas WEF, which is situated approximately 85 km west-south-west of the proposed De Rust WEFs PA (the current project).

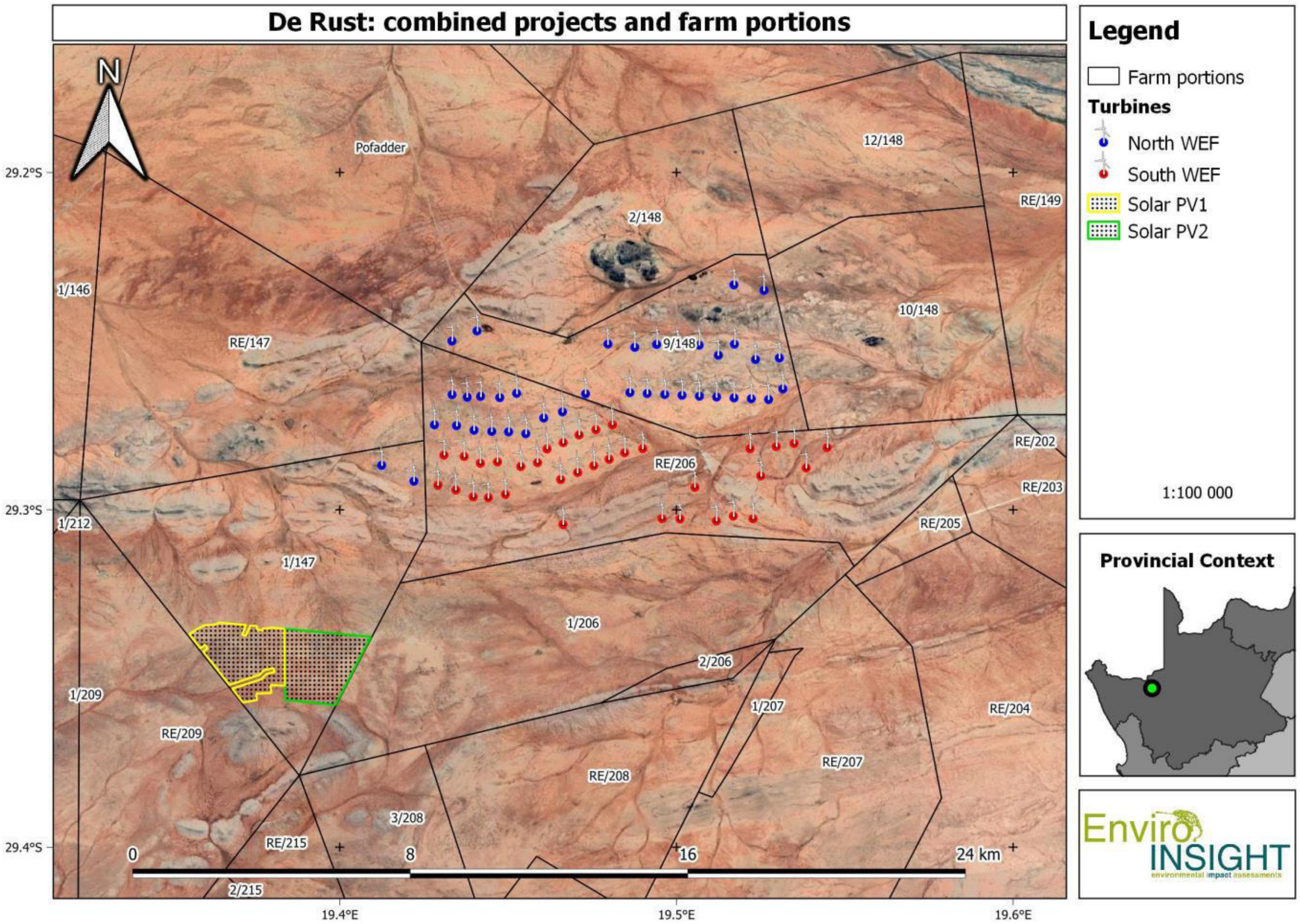

Figure 1-1: Locality map of the proposed Wind Farms.

1.3 STUDY LIMITATIONS

- It is assumed that all third-party information acquired is correct (e.g., GIS data, existing facility mortality data and the prescribed scope of work);
- There is still limited information available on the environmental effects of wind energy facilities in South Africa. Only a summary of the results of post-construction monitoring from eight wind farms in South Africa is available (Ralston Paton *et al*. 2017). Estimates of impacts are therefore also based on knowledge gained internationally, which should be applied with caution to local species and conditions;
- While sampling effort was conducted as recommended in the guidelines, to achieve statistically powerful results it would need to be increased beyond practical possibilities. The data was therefore interpreted using a precautionary approach.
- Vantage point surveys are only conducted during daylight. Therefore, any bird movement occurring at night was recorded under *ad hoc* conditions. Some waterbirds and night migrants are known to make regular flights and migration movements at night.

2 LEGISLATIVE FRAMEWORK

2.1 NATIONAL ENVIRONMENTAL SCREENING TOOL AND ENVIRONMENTAL THEME PROTOCOLS

2.1.1 Screening Report

The Minister of Environment, Forestry and Fisheries, gave notice that the submission of a report generated from the national web-based environmental screening tool[1], as contemplated in Regulation 16(1)(b)(v) of the Environmental Impact Assessment Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, will be compulsory from 4 October 2019 when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the Environmental Impact Assessment Regulations, 2014.

In addition, a set of protocols that an applicant needs to adhere to in the Environmental Authorisation (EA) process were developed and on 20 March 2020 the Minister of Forestry, Fisheries and the Environment gazetted the Protocols for national implementation purposes. The gazette '*Procedures to be followed for the Assessment and Minimum Criteria for Reporting of Identified Environmental Themes in terms of Section 24(5)(a) and (h) of the National Environmental Management Act (1998) when Applying for Environmental Authorisation*', has protocols that have been developed for environmental themes which include agriculture, avifauna, biodiversity (Terrestrial and Aquatic Biodiversity), noise, defence and civil aviation.

The protocols set requirements for the assessment and reporting of environmental impacts of activities requiring EA. The higher the sensitivity rating of the features on the proposed site as identified by the screening tool report, the more rigorous the assessment and reporting requirements. bird species sensitive to wind energy developments.

Based on the screening report generated on 03/02/2021, (**Error! Reference source not found.**), the Animal Combined Sensitivity Theme is indicated as a combination of Medium and **High** sensitivity in areas that are said to contain the following Sensitivity Feature(s).

- High Aves-*Cursorius rufus*
- High Aves-*Neotis ludwigii*
- High Aves-*Falco biarmicus*
- High Aves-*Aquila verreauxii*
- Medium Aves-*Neotis ludwigii*
- Medium Aves-*Sagittarius serpentarius*
- Medium Aves-*Aquila verreauxii*

Due to the coarse scale of the tool and the presence of other Species of Conservation Concern (SCC), the overall theme is to be treated as High Sensitivity. The Avifauna Sensitivity Theme shows Low Sensitivity based upon the fact that the site is out of a recognised REDZ region and is a product of error.

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[1] https://screening.environment.gov.za/screeningtool/#/pages/welcome

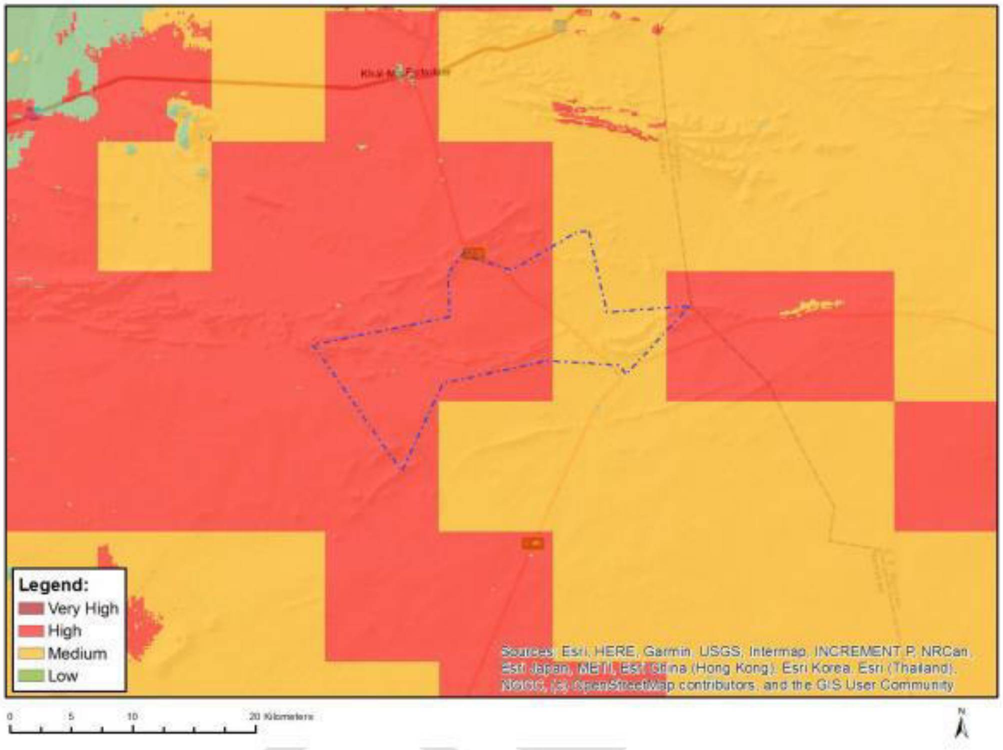


Figure 2-1: Environmental Screening Tool avifauna sensitivity theme map the proposed De Rust North WEF.

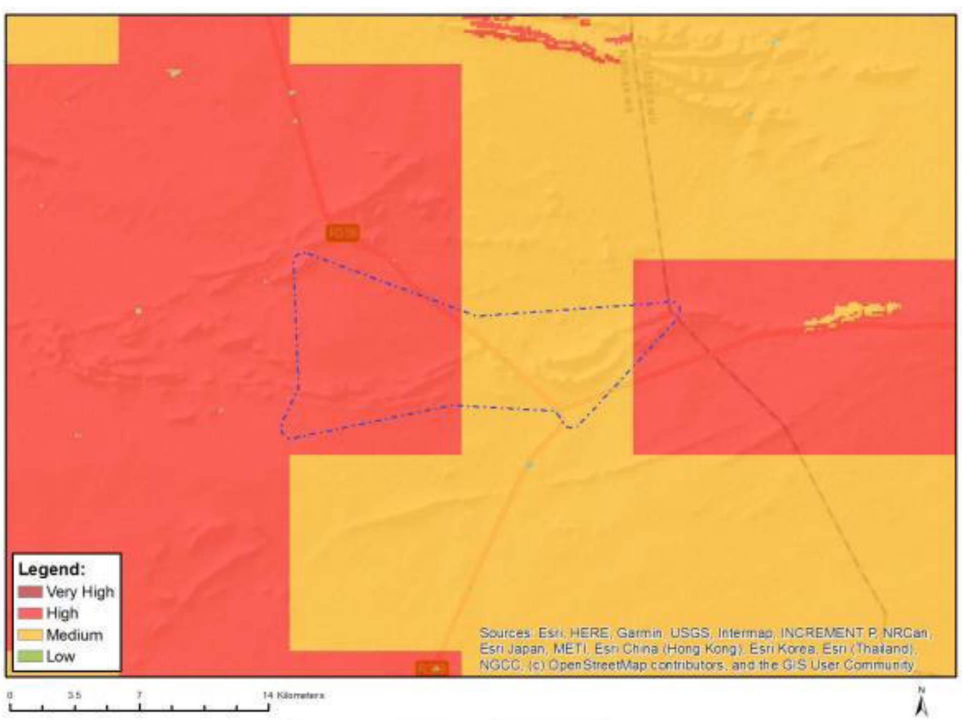


Figure 2-2: Environmental Screening Tool avifauna sensitivity theme map the proposed De Rust South WEF.

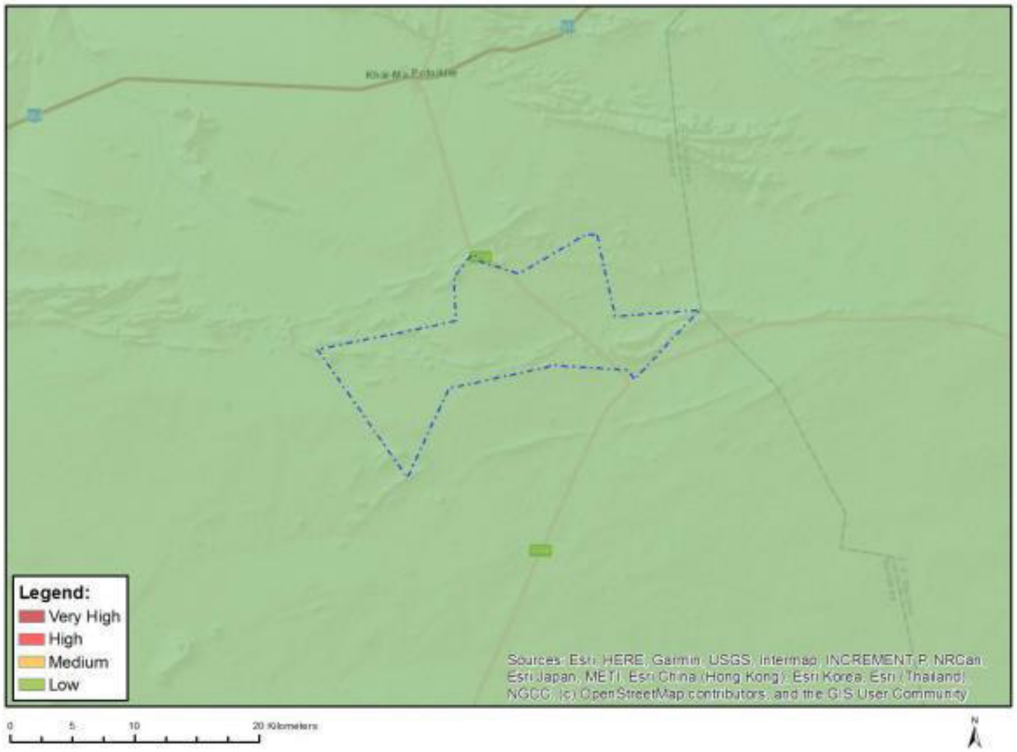


Figure 2-3: Environmental Screening Tool avifauna sensitivity theme map the proposed De Rust North WEF.

Figure 2-4: Environmental Screening Tool avifauna sensitivity theme map the proposed De Rust North WEF.

2.2 RENEWABLE ENERGY DEVELOPMENT ZONE

On 17 February 2016, Cabinet approved the Renewable Energy Development Zones (REDZs) for large scale wind and associated Strategic Transmission Corridors (STC) which support areas where long term electricity grid will be developed. The procedure to be followed in applying for EA for a large-scale project in a REDZ or in a Power Corridor was formally gazetted on 16 February 2018 in GN113 and GN114. On 17 July 2020, Minister Barbara Dallas Creecy, published Government Gazette 43528, Notice 786 for consultation with the intention to identify three additional Renewable Energy Development Zones to the eight Renewable Energy Development Zones published under Government Notice No. 114 in Government Gazette No. 41445 of 16 February 2018. REDZs are also aligned with the powerline corridors that were identified in the Electricity Grid Infrastructure SEA completed in 2016 and gazetted as powerline corridors in February 2018. In this way, the combination of the REDZs and power corridors provides strategic guidance to ESKOM on where to prioritise investment in grid infrastructure. As previously stated, the project is not located within Renewable Energy Development Zones (REDZ) and accordingly, a full EIA process will be followed. Best Practice for both Birds and Wind Energy and Birds Guidelines were followed for the study.

2.3 BIRDS AND WIND-ENERGY BEST-PRACTICE GUIDELINES (2015)

The "*Best-Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa"* (Jenkins et al., 2015) are followed in order to fulfil the outlined requirements. This document became a legal requirement due to the NEMA Protocols (March 2020).

As per Appendix 2 - *Minimum requirements for avifaunal impact assessment*, an avifaunal impact assessment for a WEF should follow a two-tier process:

1. Scoping - a review of the existing literature and data, as well as a site visit to inform the design of a site-specific survey and preconstruction monitoring plan.
2. Impact assessment – systematic and quantified monitoring over four seasons that will inform a full EIA detailing and analysing the significance of likely impacts and available mitigation options.
3. In-depth study – Could including structured and repeated data collection on which to base the impact assessment report and provide a baseline against which post-construction monitoring can be compared.
4. Impact assessment - Informed by the data collected during the preliminary assessment.

3 METHODS

3.1 GIS

Existing data layers were incorporated into a GIS to establish how the proposed WEF layout and associated activities interact with important terrestrial entities. Emphasis was placed on the following spatial datasets:

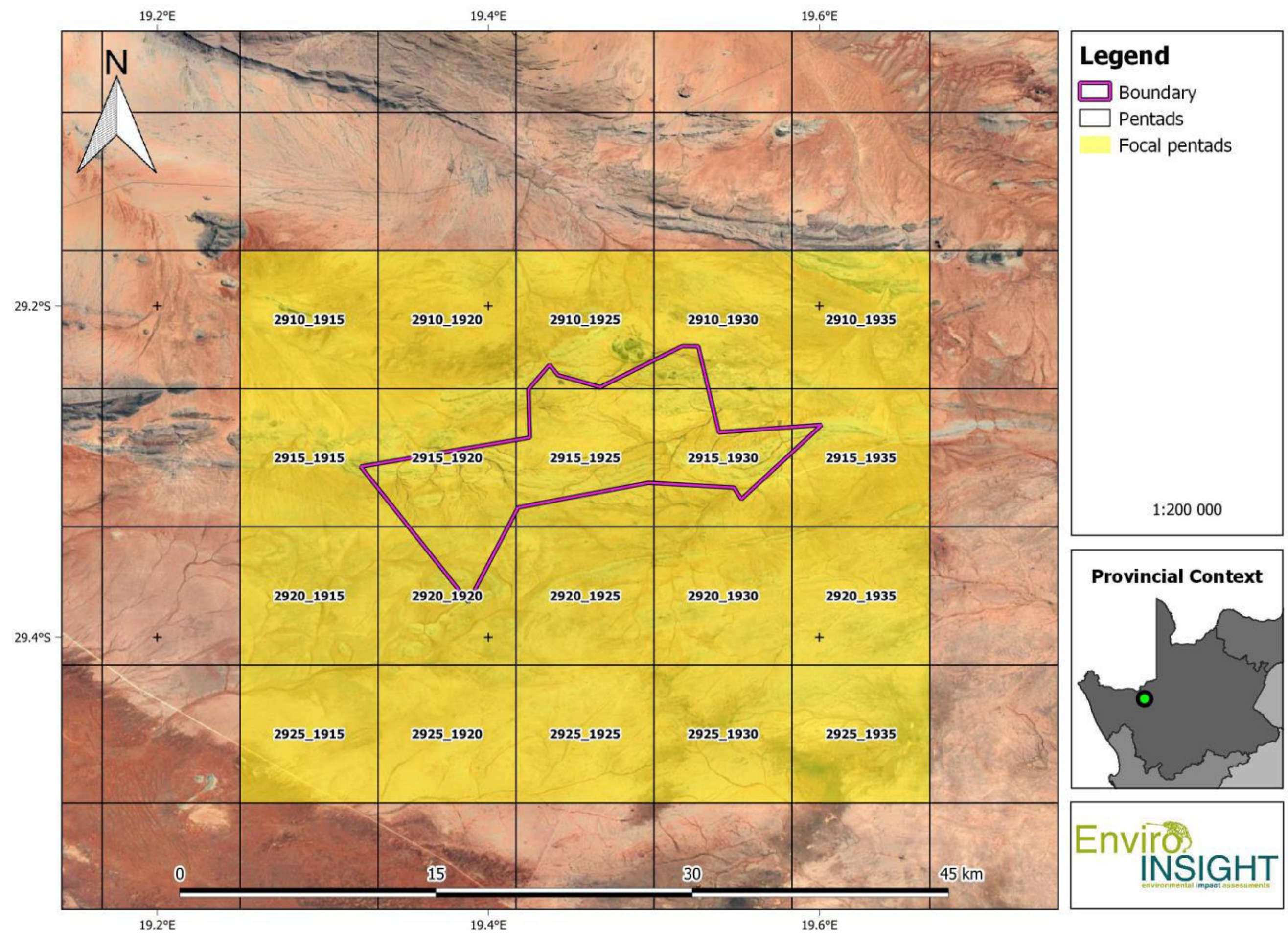
- Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018);
- NFEPA wetlands and rivers (CSIR 2011);
- Important Bird Areas (IBAs) (Marnewick *et al*., 2015); and

- GIS layers provided by the client.

All mapping was performed using open-source GIS software (QGIS[2]).

3.2 DESKTOP AND LITERATURE SURVEY

Prior to the initiation of field surveys, a desktop survey was conducted to consider the best information available, in order to provide a better evaluation of all conditions present within the study area. An initial literature review was undertaken to assess which bird species could potentially occur in the vicinity of the proposed WEF using data from the second South African Bird Atlas Project (SABAP 2[3]; [SABAP2, 2020]). SABAP 2 records were developed based on records per pentad (i.e., 5' X 5'). A list of species potentially occurring was developed from SABAP 2 data for the pentads within which the study area falls (2910_1915, 2910_1920, 2910_1925, 2910_1930, 2910_1935, 2915_1915, 2915_1920, 2915_1925, 2915_1930, 2915_1935,2920_1915, 2920_1920, 2920_1925, 2920_1930, 2920_1935, 2925_1915, 2925_1920, 2925_1925, 2925_1930, 2925_1935, (



2 http://qgis.osgeo.org/en/site/
3 http://sabap2.birdmap.africa/

Figure 3-1). The expected species list (Appendix 1) is therefore based on an area larger than the actual study area and was therefore subsequently refined. This approach was adopted to ensure that all species potentially occurring within the study area, whether resident, nomadic, or migratory, are identified. From the generated expected species list, the sensitivity of avifauna species towards the potential impacts from the Project was evaluated using the Avian Wind Sensitivity Map (Retief *et al.,* 2012). Other species not listed in the referred document were also considered sensitive because of their abundance, flight characteristics, ecological role, population trend and conservation status. A preliminary list of focal species impacts for this study area was compiled based on existing Avifaunal Environmental Impact Assessment and post-construction mortality monitoring reports for similar projects in the region the area and supplemented with sensitive species identified in the previous steps.

The following main literature sources have been consulted for the avifauna study:

- Information relating to avifauna species of conservation concern (SCC) was obtained from Taylor *et al.* (2015) and the IUCN Red List of threatened species (IUCN, 2022);
- del Hoyo *et al.* (1992) and Hockey *et al.* (2005) were consulted for general information on the life history attributes of relevant bird species;
- Distributional data (apart from those obtained during the surveys) was sourced from the Southern Africa Bird Atlas Project (SABAP 2, 2021), del Hoyo *et al.* (1992) and Sinclair & Ryan (2010);
- Nomenclature and taxonomy followed the IOC World Bird Names unless otherwise specified (see www.worldbirdnames.org; Gill & Donsker, 2012); and
- Priority species (including rankings) with regards to wind farms are based on Retief *et al.* (2012) which has been further applied in the region by Ralston-Paton *et al*. (2017).

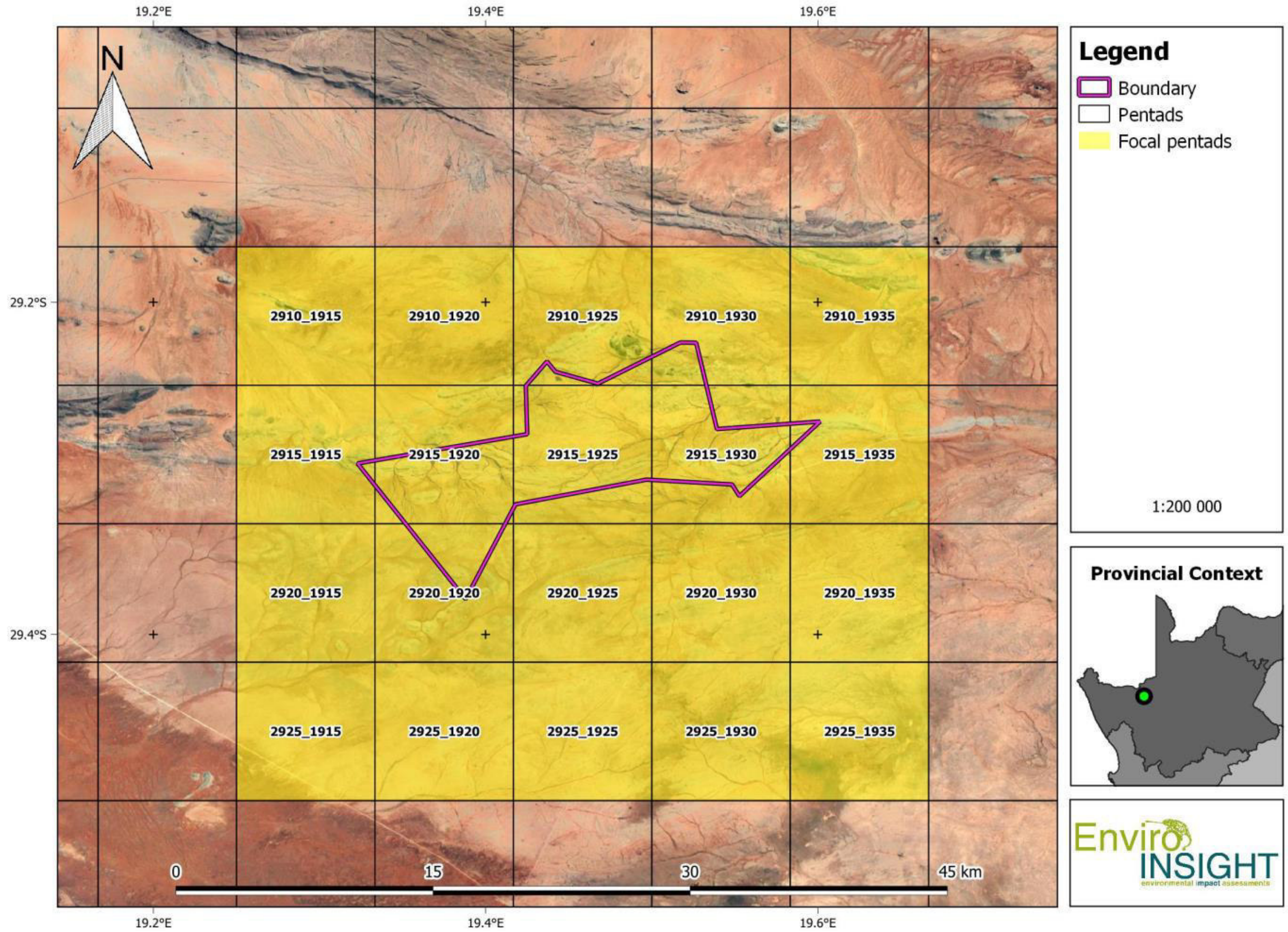


Figure 3-1: The De Rust WEF in relation to the SABAP2 pentads.

3.3 PRECONSTRUCTION BIRD MONITORING SURVEY DESIGN

The field surveys were arranged so that the study area and control sites were surveyed for a total of 12 months and completed in September 2022. This complies with the requirements of the Best Practice Guidelines available at the time (Jenkins *et al.* 2015). The preconstruction monitoring programme has included a total of four visits to the site, covering the study area through a twelve-month period that included the spring, summer, autumn and winter seasons of the (non-calendar) year. The surveys conducted per season/ dates are summarised as Table 3-1 below.

Table 3-1: Avifauna monitoring sampling period for De Rust WEF and Control Site.

Date	Season	Methodology applied
October 2021	Spring	VP, DT, WT, WB, NE
January 2022	Summer	VP, DT, WT, WB, NE
May 2022	Autumn	VP, DT, WT, WB, NE
August 2022	Winter	VP, DT, WT, WB, NE

*** VP – Vantage points; WT – Walked transects; DT – Drive transects; NE – Nest searches, inspection and monitoring; WB – Water body inspections.**

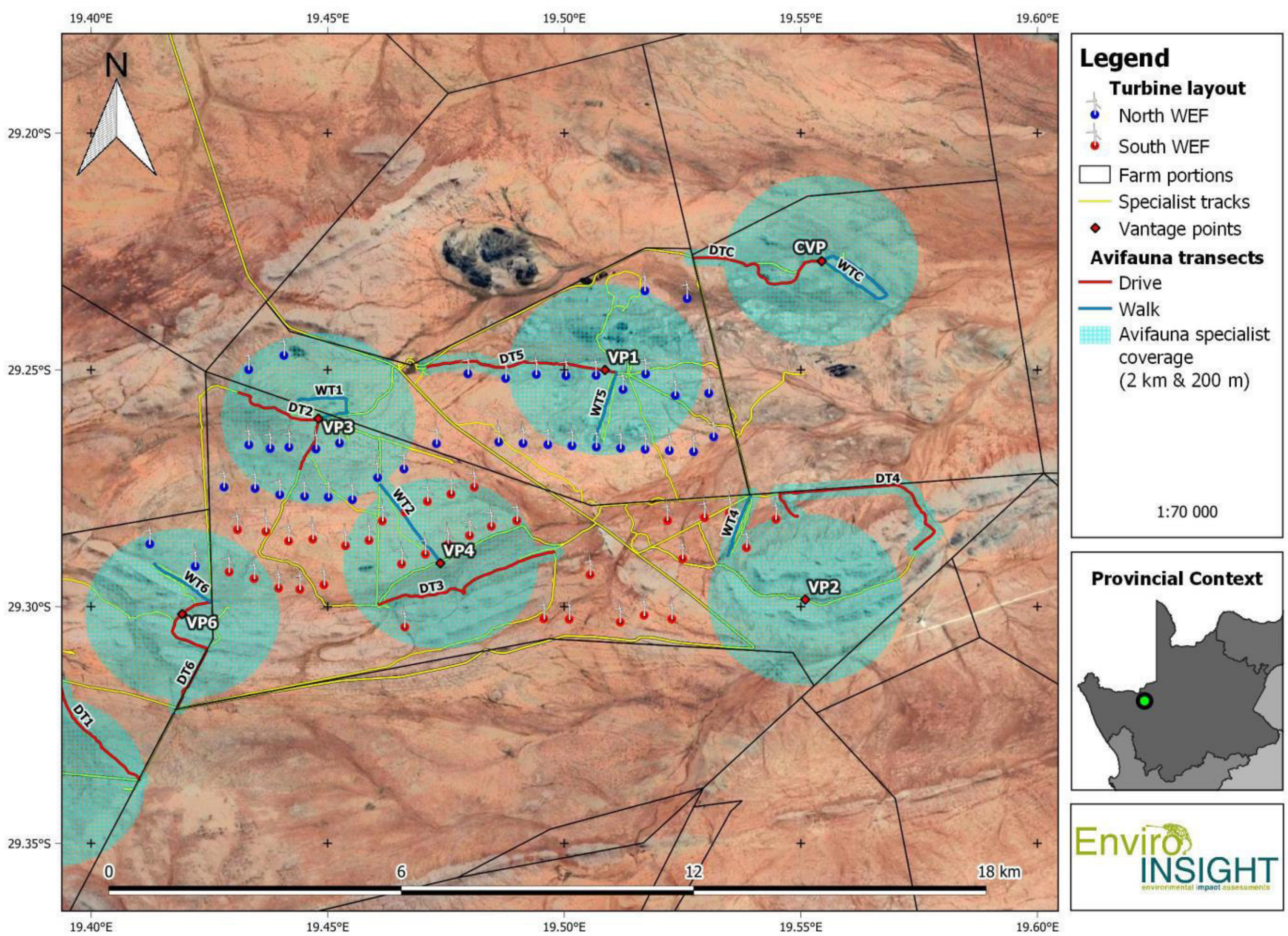


Figure 3-2: Avifauna survey sites and specialist coverage (GPS tracks as well as field of view) for the proposed De Rust WEF.

3.3.1 Vantage Points

Six vantage points (VPs) within the project study area were identified based on the preliminary desktop and scoping survey in the De Rust WEF, and one identified at the control area, to record the flight altitude and patterns of priority species (totaling seven VPs). These sampling points were located at strategic locations within the Project Footprint and set up to allow the visual coverage of the wind farm (placing special emphasis on the proposed turbine locations) and its immediate surroundings. VP surveys were conducted accordingly to the most recent recommendation from the best practice guidelines at the time (Jenkins *et al.* 2015). Each location was surveyed for a minimum of 12 hours of observation per season divided through the early morning, midday and late afternoon times of day (Jenkins *et al.* 2015). For more information on each VP, refer to Table 3-2.

Table 3-2: Locations description of the five Vantage Points surveyed

Vantage Point	Location	
	Latitude	Longitude
1	29°15'00.3"S	19°30'30.2"E
2	29°16'58.2"S	19°33'42.3"E
3	29°15'36.9"S	19°26'53.0"E
4	29°17'26.4"S	19°28'23.8"E
5	29°20'18.8"S	19°23'27.2"E
6	29°18'00.0"S	19°25'17.3"E
Control	29°13'36.0"S	19°33'18.6"E

3.3.2 Walked Transects

This method is utilised to monitor all birds, especially less obvious smaller bird species within the major habitat types within a study area. Transects were positioned at varying distances away from the proposed turbine arrays (see **Error! Reference source not found.**) to maximise the comparative value of the data which will be compared with the surveys from the post-construction phase results.

Seven linear transects ranging from 2 km to 4.1 km in length (140.1 km total), six located in the proposed Project footprint and one within the control area, were walked in order to characterize the passerine and small bird communities (Table 3-3). These transects are representative of the biotopes present within the study area. These transects (excluding that in the control area) were located within the facility and turbine area of influence available at the time (Drewitt & Langston, 2006). To avoid pseudo-replication, transects were located at a minimum distance of 400 m apart from one another (Sutherland, 2006). Each transect was conducted by one expert bird observers at a time (more than one observer for all transects were used), who recorded all bird contacts (both seen and heard) by walking slowly along the predetermined transect. Observations were made on both the left and right side of the predetermined transect. Birds were only recorded (seen or heard) within a fixed maximum width of between 150 to 200 m on either side if the transect line. The same transects were repeated in every season. Surveys started after sunrise and were performed throughout the day to account for temporal variation in bird activity.

As a general rule, transects were not walked in adverse conditions, such as heavy rain, strong winds or thick mist. During the surveys, no adverse conditions were recorded that precluded successful analysis.

Table 3-3: Walk and Drive transect lengths and total length.

Name	length (m)
WT1	2005
WT2	2227
WT3	1789
WT4	1698
WT5	1506
WT6	1512
WT Control	3356
Total	140.1

3.3.3 Driven Transects

Large terrestrial birds (e.g., korhaans, bustards, and most raptors) cannot be adequately surveyed using walked transects. Populations of such birds should be estimated on each visit to the project area by means of road counts (vehicle-based sampling; best applied for relatively large proposed WEFs, especially those with good networks of roads and tracks).

Road counts of large terrestrial birds and raptors require that one or a number of driven transects be executed (depending on site size, terrain and infrastructure), comprising one or a number of set routes, limited by the existing roadways but as far as possible directed to include a representative cross section of habitats within the project area of influence (PAOI).

These transects were driven at a constant and slow speed (± 15 km/h), and all sightings of large terrestrial birds and raptors were recorded in terms of the same data-capture protocols used for walked transects (above), and in general compliance with the road-count protocols described for large terrestrial species (Young et al., 2003) and raptors (Malan, 2009). Nine drive transects were identified in the project footprint and one drive transect in the control area with a combined total length of 26.935 km (**Error! Reference source not found.**; Table 3-4). One observer travelling slowly in a vehicle recorded all species on both sides of the drive transect. The observer stopped at regular intervals (every 100 to 300 m) to scan the environment with binoculars.

Table 3-4: Drive transects lengths and total length.

Name	length (m)
DT1	3802
DT2	3137
DT3	4128
DT4	5147
DT5	3957
DT6	3497

DT Control	3316
Total	26.984

3.3.4 Wetlands

Prior to the initiation of the preconstruction monitoring campaign, the main water bodies (including wetlands) present within the study area were identified on a Geographical Information System (GIS) by using 1:50 000 topographic maps and aerial photos. Several significant water bodies were identified on and surrounding the study area. These identified and mapped water bodies were surveyed to determine their level of utilisation by water birds. Due to seasonality, the birds were only be surveyed during periods with some prevailing inundation or rainfall. Some drainage lines within the greater PAOI were inundated during the 2021 spring surveys and were observed accordingly.

3.3.5 Specialist Nest Survey

Any habitats within the PAOI of the proposed WEF, or equivalent habitats around the study area, deemed likely to support nest sites of key raptor and other species of conservation concern, including power lines, stands of large trees, marshes and drainage lines, were surveyed. All potential breeding sites, once identified fully, were mapped, and checked during each survey to confirm occupancy, and all evidence of breeding and the outcomes of such activity, where possible, recorded.

3.3.6 Incidental Observations of Priority Species

All other sightings of priority species (and particularly those suggestive of breeding or important feeding or roosting sites or flight paths) on the WEF and control site as well as within the broader study area were recorded, along with additional relevant information such as habitat type, abundance, habits and weather data. These observations were used as complementary data to characterise the bird community and its utilisation of the site, as recommended by the Best Practice Guidelines (Jenkins *et al*., 2015).

3.3.7 Species Collision Risk and Bird Passage Rate

For pre-construction surveys of this nature, Collision Risks are usually calculated using the following equation:

Duration of medium and high-altitude flights x collision susceptibility calculated as the sum of morphology and behaviour ratings x number of planned turbines ÷100:

However, and for the survey area, this was not possible due to the extreme variations in undulations at the vantage points, not allowing for standardised measurements of duration. Therefore, and for the final EIA, collision risk is to be calculated based on a measurement of the three assumed variations of crude passage rates as described by Smallie and Strugnell (2020), primarily focusing on passage rate, flight height and total surface area of turbines. The final calculations will be used to inform the final EIA document.

3.4 SPECIES OF CONSERVATION CONCERN

The Red List of threatened species generated by the IUCN (http://www.iucnredlist.org/) provided the global conservation status of avifauna. However, Taylor *et al*. (2015) produced a regional conservation status assessment following the IUCN criteria which was used for this scoping report. The first three categories i.e., Critically Endangered, Endangered and Vulnerable, are collectively called 'threatened' species.

The conservation status categories defined by the IUCN, which are considered here to represent species of conservation concern (SCC), are defined as follows:

- **Critically Endangered (CR)** - Critically Endangered refers to species facing immediate threat of extinction in the wild.
- **Endangered (EN)** - Endangered species are those facing a very high risk of extinction in the wild within the foreseeable future.
- **Vulnerable (VU)** - Vulnerable species are those facing a high risk of extinction in the wild in the medium-term.
- **Near Threatened (NT)** - any indigenous species which does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. NEMBA also deals with endangered, threatened and otherwise controlled species, under the Threatened or Protected Species Regulations (ToPS). A ToPS permit is required for any activities involving the removal or destruction of any ToPS-listed species.

Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

4 RESULTS

4.1 REGIONAL VEGETATION

The project area (PA) consists various vegetation types, with Bushmanland Arid Grassland and Aggeneys Gravel Vygieveld, covering the most area in the low-lying parts of the PA, Bushmanland Inselberg Shrubland and Namaqualand Klipkloppe Shrubland on the quartzite ridges/hills, and Bushmanland Basin Shrubland to the northwest near the dolerite outcrops (SANBI 2018; Figure 4-1). However, structural differences in vegetation between the vegetation types was not obvious during site visits, except for the vegetation associated with the quartzite ridges/hills. Watercourses are typically poorly defined but usually have denser and larger bushes than the surrounding landscapes. There are no large/perennial streams or rivers close to the PA, but there are numerous small ephemeral watercourses, some with extensive alluvial plains, that drain towards the west, north and east. The PA has varied terrain, consisting of a relatively flat plain with small quartzite ridges and koppies that form linear hilly regions across the PA, with especially large hills in the southeast, and dolerite outcrops forming small to large conical koppies in the north east (shown within the Figure 4-3 Topography map). There are some rocky areas on the flats that are not associated with higher terrain, located in the northern central portion of the PA. The PA is situated in an arid region between the summer and winter rainfall zone, with rainfall being highly variable in the region. The nearby town of Pofadder receives most of its rainfall between February and April (data from 1985[4]), and recent data (2009-2021) indicates that most rainfall occurs from October to March, with a mean annual rainfall of 135 mm[5]. The warmest months are October through to April with a mean daily maximum of 33 °C and minimum of 17°C (February) and winter maximum temperatures of 18 °C and minimum 2 °C (July[6]).

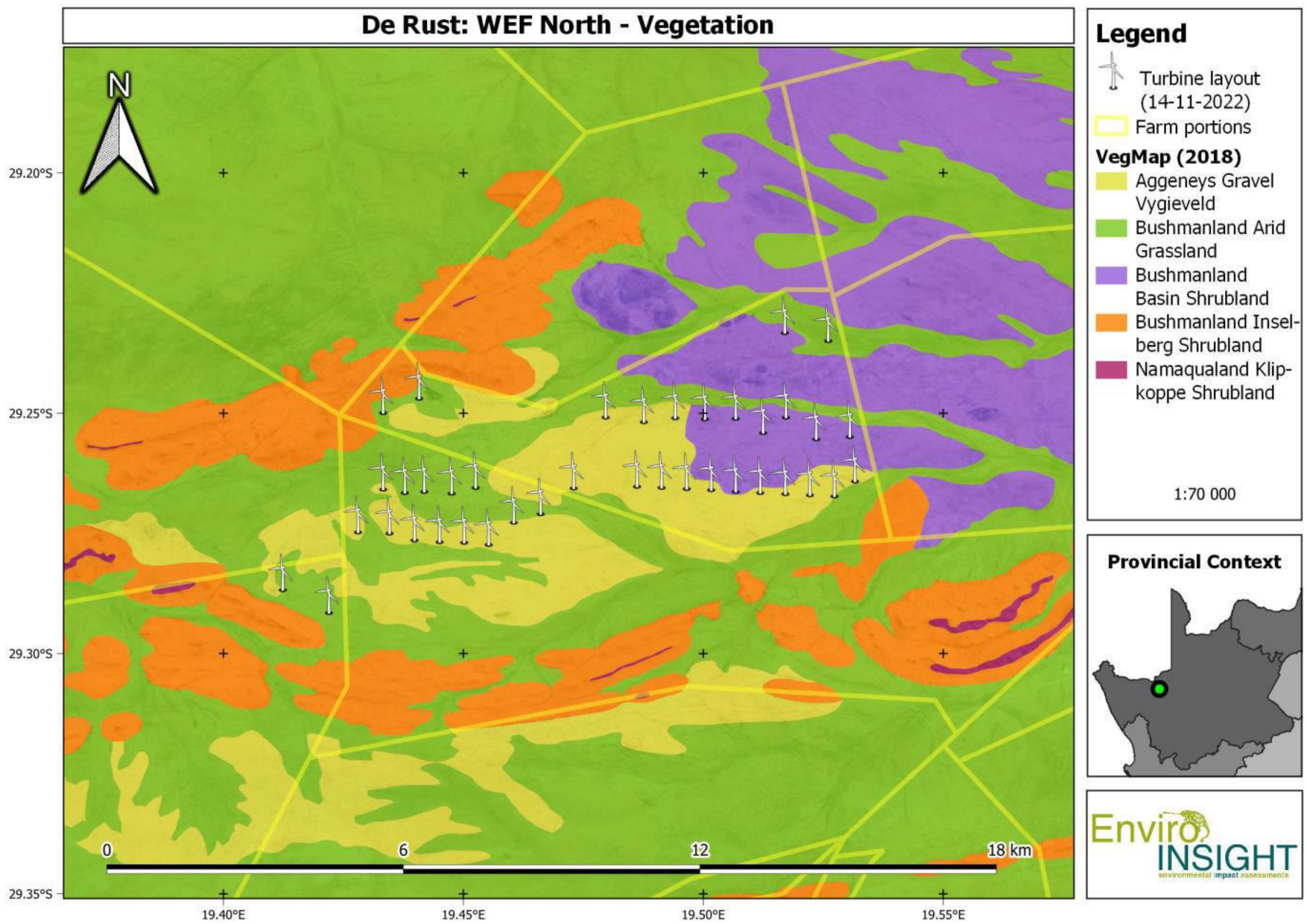


Figure 4-1: Regional vegetation types in relation to De Rust North WEF (SANBI, 2018).

[4] https://www.meteoblue.com/
[5] https://wapor.apps.fao.org/
[6] https://www.meteoblue.com/

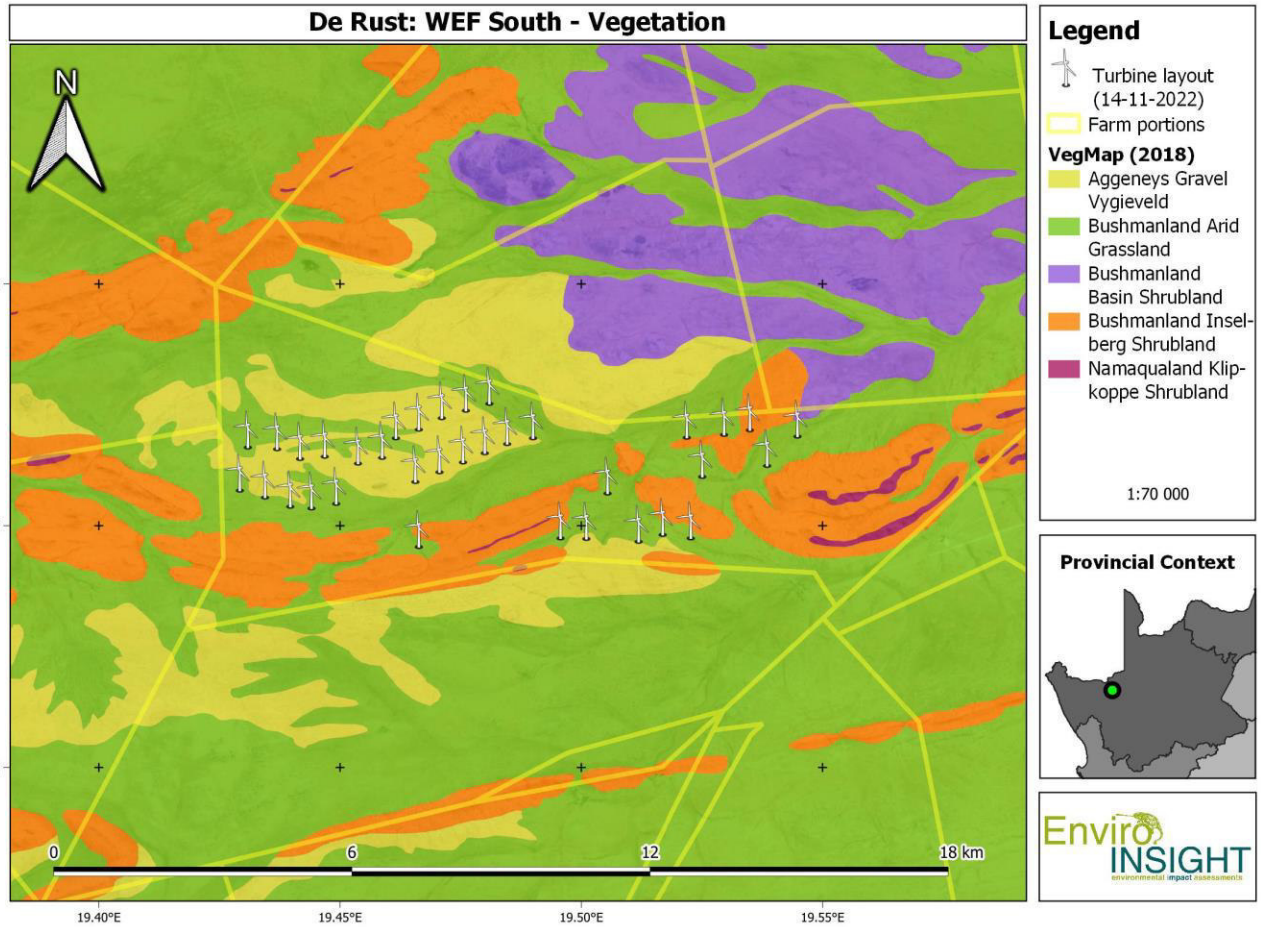


Figure 4-2: Regional vegetation types in relation to De Rust South WEF (SANBI, 2018).

Figure 4-3: Topography in relation to De Rust Northwest WEF (SANBI, 2018).

4.2 PROTECTED AREAS AND IMPORTANT BIRD AREAS

The De Rust WEF is not located in an Important Bird Area (IBA) or protected area but is situated in between the Gamsberg and the Mattheus Cat Conservation Area. Also situated near to the PAOI are the Haramoep Black Mountain IBA, the Bitterputs Conservation Area and the Marietjie van Niekerk Nature Reserve all being situated within a 90 km radius.

- The Bitterputs Conservation Area (SA036) is an arid landscape which consists of extensive sandy and gravel plains covered with sparse, perennial desert grassland. A few large salt pans are a unique habitat type in this IBA. The conservation area falls within the Bushmanland Bioregion and the Nama Karoo Biome. Three vegetation types are present: the Bushmanland Vloere (salt pans), Bushmanland Arid Grassland and Bushmanland Sandy Grassland. The ecosystem status for the entire area is Least Concern.
- The Haramoep Black Mountain IBA is characterised by large sand dunes following the course of the Koa River although dominated by the sparsely vegetated gravel plains that are prevalent in the region. The IBA falls within the Bushmanland Bioregion and three biomes (Desert, Nama Karoo and Succulent Karoo) are represented. Seven vegetation types are present, of which one is Endangered. One Endangered and two Vulnerable habitat units within

these are considered irreplaceable. Approximately 90% of the land is natural and utilised for ranching and disturbance and overgrazing is prevalent.

- All of the IBAs (Mattheus Gat and Haramoep Black Mountain IBA))and many of the other surrounding nature reserves (Gamsberg, Marietjie van Niekerk) are some of a few sites protecting both the globally threatened Red Lark (*Calendulauda burra)*, which inhabits the red sand dunes and sandy plains where there is mixed cover of grasses and dwarf shrubs, and the near-threatened Sclater's Lark (*Spizocorys sclater)i*. The sites also hold 16 of the 23 Namib-Karoo biome-restricted assemblage species and a host of other arid-zone birds. Other priority species, including globally threatened species, within this IBA include Ludwig's Bustard (*Neotis ludwigii),* Kori Bustard (*Ardeotis kor)i*, Karoo Korhaan (*Eupodotis vigorsii)*, Secretarybird (*Sagittarius serpentarius)* and Lanner Falcon (*Falco biarmicus)*. Restricted-range and biome-restricted species are Stark's Lark (*Spizocorys starki)*, Karoo Long-billed Lark (*Certhilauda subcoronata)*, Black-eared Sparrow-lark (*Eremopterix australis)*, Tractrac Chat (*Cercomela tractrac)*, Sickle-winged Chat (*C. sinuate)*, Karoo Chat *C. schlegelii*, Karoo Eremomela *Eremomela gregalis*, Cinnamon-breasted Warbler (*Euryptila subcinnamomea)* and Black-headed Canary (*Serinus alario)*.

There has been a c. 75% loss of optimal habitat for the Red Lark over the past 100 years. The disappearance of this species from ranches where dune grassland has been replaced by ephemerals is probably linked to the reduction in grass awns for nesting, shelter and invertebrate and plant foods.

There is a serious threat from climate change and it is predicted that temperatures will increase and rainfall decrease sharply in arid areas such as Bushmanland. Locally resident endemic larks, in particular, are at risk. Increased CO_2 can lead to the increase of C3 plants (shrubs) at the expense of C4 plants (mainly grasses), causing a shift in vegetation diversity and structure and making the habitat unsuitable for some species. It is expected that the Red Lark will not meet the challenge of global warming (BirdLife International, 2021).

Currently no part of these IBAs are formally conserved and no conservation actions have been implemented. Bitterputs falls within the Central Astronomy Advantage Area, which has restrictions on activities that can take place in it. This could result in some protection for the IBA. The IBAs in relation to the Project footprint is shown as Figure 4-4.

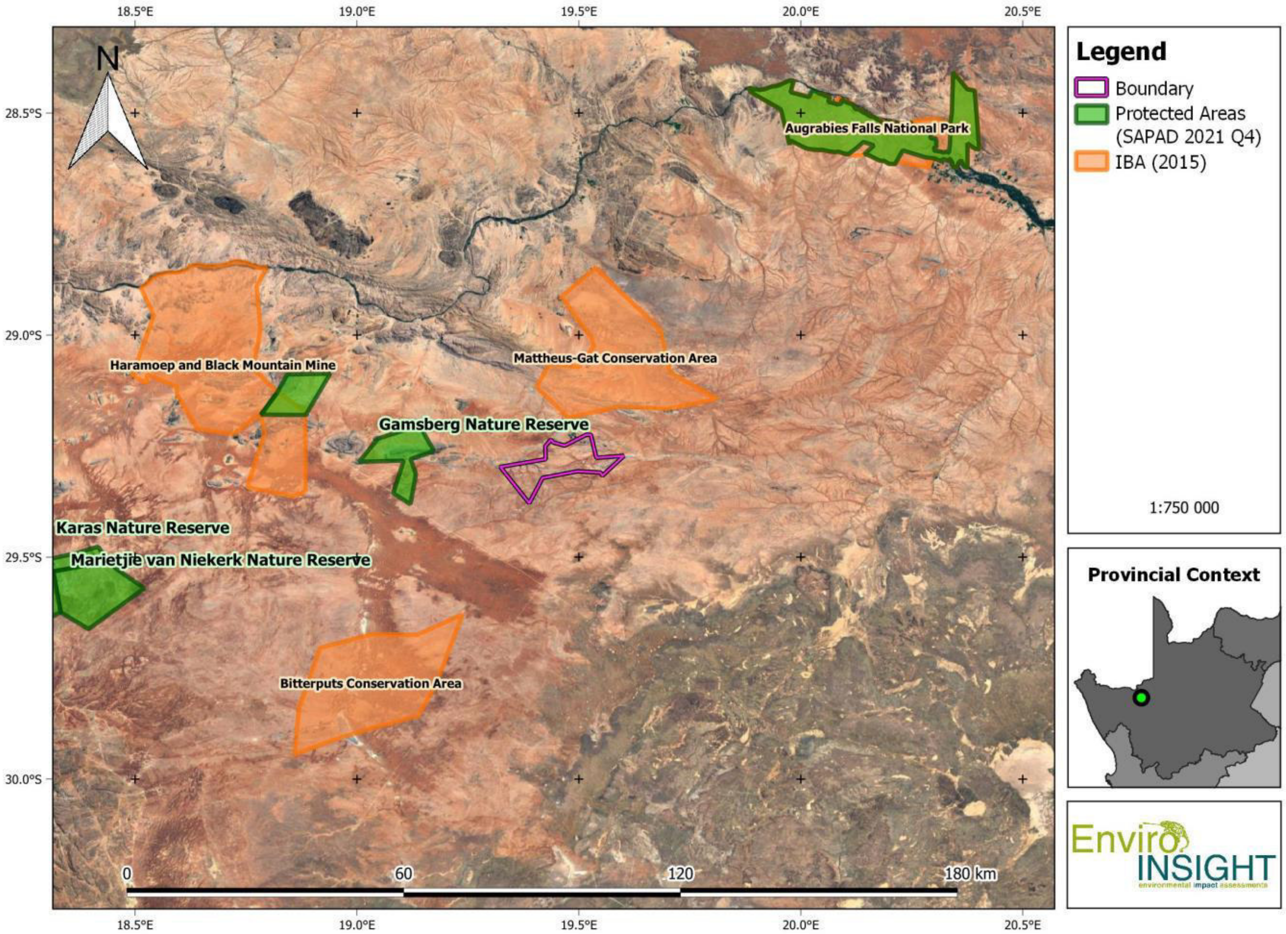


Figure 4-4: De Rust WEF in relation to the adjacent Protected Areas and IBAs

4.3 CRITICAL BIODIVERSITY AREAS

The following CBA information has been extracted and mapped Verbatim from the Enviro-Insight Terrestrial Biodiversity survey conducted as part of the BA application process.

The Northern Cape CBA Map (2016) identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of e landscape as a whole (Holness & Oosthuysen, 2016). 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. Targets for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes.

Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. The primary purpose of CBA's is to inform land-use planning in order to promote sustainable development and protection of important natural habitat and landscapes. Biodiversity priority areas are described as follows:

- Critical biodiversity areas (CBA's) are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then 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. For CBA's the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a populations or habitat). All FEPA prioritized wetlands and rivers have a minimum category of CBA1, while all FEPA prioritised wetland clusters have a minimum category of CBA2.
- Ecological support areas (ESA's) are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas. For ESA's a change from the desired ecological state is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway (e.g. removing a corridor results in a population going extinct elsewhere or a new plantation locally results in a reduction in stream flow at the exit to the catchment which affects downstream biodiversity). All natural non-FEPA wetlands and larger rivers have a minimum category of ESA.

According to the CBA Map, the study area is mainly located in the category "CBA 2 and ESA" (Figure 4-5). The CBA2 is listed due to recorded presence of SCC as well as potential habitat for listed unknown threatened species. The ESA are due to the large expanses of sandy habitat (Red Larks) and other natural non-FEPA Wetlands.

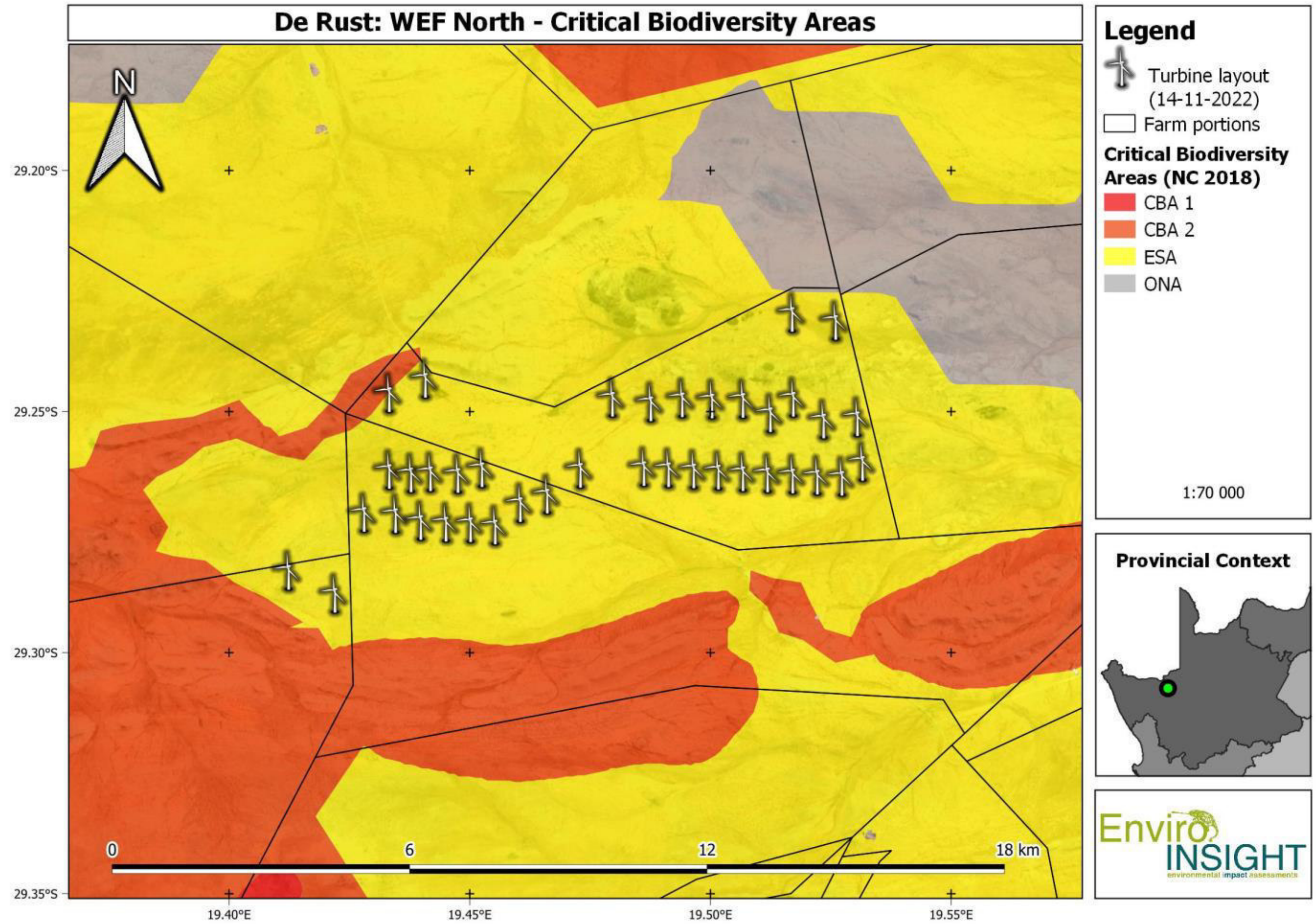


Figure 4-5: De Rust North WEF in relation to the Northern Cape Critical Biodiversity Areas (2016).

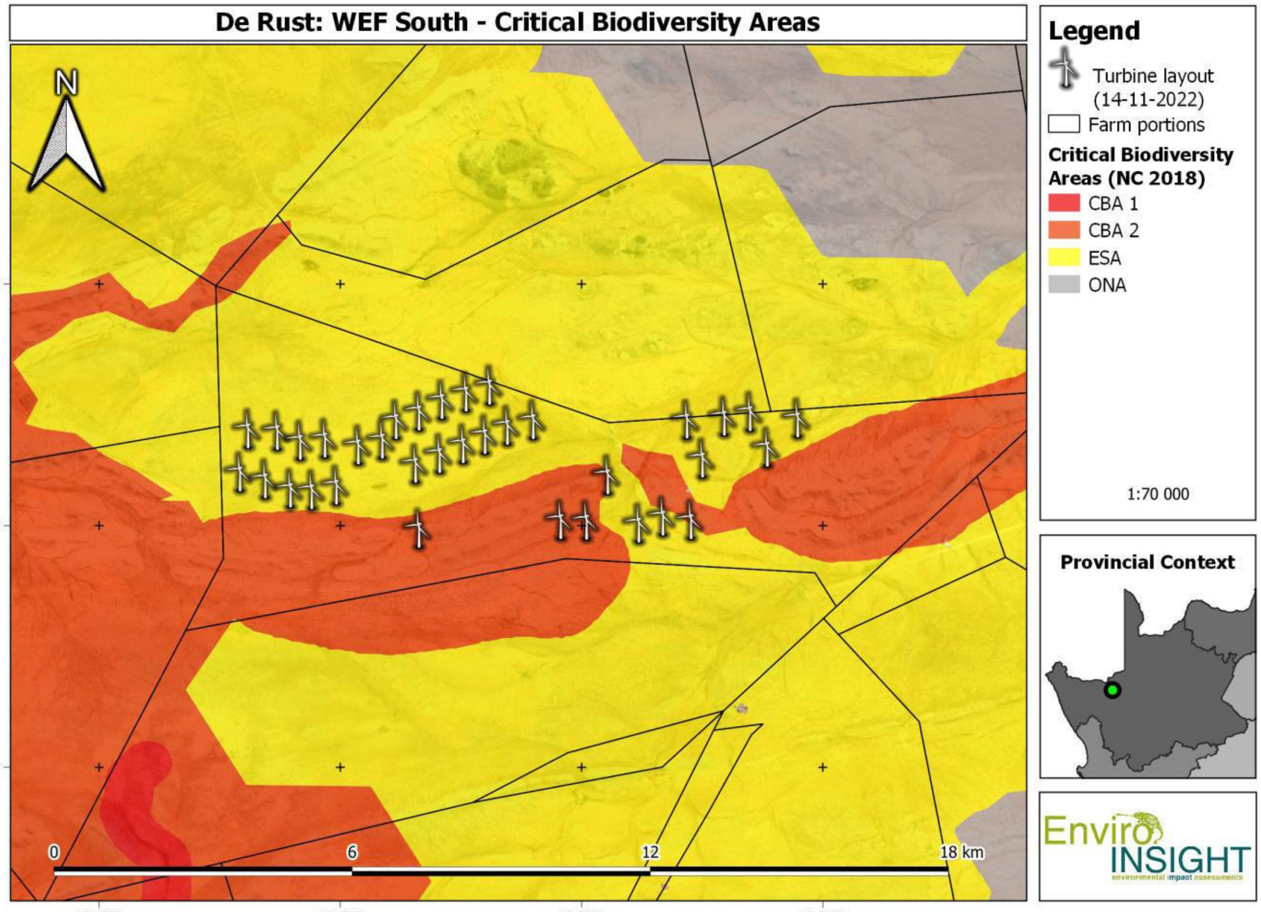


Figure 4-6: De Rust South WEF in relation to the Northern Cape Critical Biodiversity Areas (2016).

4.3.1 lagship species for the region

Flagship species are defined as species that may be highly conspicuous, readily identifiable, of high conservation value (SCC), of high tourism value or are endemic to the region. The Northern Cape is home to the South African (and Northern Cape Province) endemic Red Lark. It is a highly range restricted species that occurs on red dune (Nama Grassland as defined by the habitat delineation) habitat that provides a variety of sandy substrate and vegetation requirements, including annual grasses, perennial grasses and sparse woody vegetation. This species is currently poorly represented within existing protected areas across its range and is threatened by habitat loss and fragmentation primarily through intensive stock farming activities and most recently, renewable energy developments.

This province hosts significant populations of arid-adapted large terrestrial birds which have been recorded (and are expected) within the PAOI such as Kori Bustard, Ludwig's Bustard and Karoo Korhaan. Additional "flagship" bird species include Martial Eagle, Verreaux's Eagle, Secretary Bird, with occasional incursions within the PAOI such as White-backed and Lappet-faced Vulture (incidental sightings).

4.4 DESCRIPTION OF MAJOR BIRD HABITATS

The primary avifaunal habitats are described in tabular formats below with accompanying representative photographs. Sensitivity of these habitat types will largely be based upon "Avifaunal value" which relates to species diversity, endemism and the presence of topographical features or primary habitat units with the intrinsic ability to sustain certain avifaunal assemblages (with specific reference to SCC), their food supply and breeding habits. It is apparent throughout the study area that most of the habitats are ecologically specific in their ability to support general avifaunal species and Red-Listed / SCC with some significant differentiation. However, unique geological (such as red dunes) geographical or topographical features exist which may cause the areas these areas to be buffered from proposed development. Due to the high diversity and density of the above mentioned, Red-Listed species recorded during the survey, (including regionally and globally listed Endangered and Vulnerable birds), the PAOI as a whole is an area of avifaunal importance, and the EIA will be strongly associated with Guidelines at a policy level, prioritising avoidance mitigation and the monitoring of avifaunal SCC.

4.4.1 Pans and Drainage Lines

Photographs	Watercourses and Drainage Lines
	**Classification:** Ephemeral and endorheic drainage lines **Hydrology:** With avoidance, limited major hydrological impacts are expected from the development. **Geomorphology:** Channels varying in width and depth from large multi-channeled sandy gullies to shallow narrow channels with seasonally inundated pans with large surface areas. **Vegetation:** Vegetation varies depending on current levels of disturbance (especially biosphere effects around pans), channel width and depth, where larger deep-rooted trees line larger channels with lower shrub layers characterising smaller drainage line systems. **Avifaunal Characteristics:** Avifaunal assemblages differed depending on the classification of the pan and drainage line systems as well as the season. Most of the drainage line systems are seasonally ephemeral or dry while the pans inundate seasonally. Thus, most of the bird associations are linked to the prevailing vegetation and soil types within the delineated drainage line habitats or standing water. In summary, drainage lines with taller shrub and tree layers showed a much higher diversity of passerine species as well as sand-associates and ground-dwelling birds. Species of conservation concern such as Ludwig's Bustard (*Neotis ludwigii*) can occur in varying but potentially massive densities depending on the prevailing ecological conditions.

Photographs	Watercourses and Drainage Lines
	The seasonal drainage lines and accompanying riparian shrubs act as linear dispersal corridors for terrestrial bird species. Much higher species diversity (as well as a unique composition) was observed in this habitat and therefore, these systems are classified to be of high avifaunal importance. The drainage lines, especially in association with ridges act as important flight corridors for bustards, passerines and raptors between foraging and roosting sites.

4.4.2 Sandy Grassland

Photographs	Nama Grassland
	**Classification:** Sandy Grassland **Hydrology:** No major hydrological impacts are expected from the development. **Geomorphology:** Undulating sandy grassy habitat with fewer flat areas and variable basal layer. **Vegetation:** Vegetation varies depending on slope and depth of topsoil and is characterized by grassland dominated and interspersed by negligible succulent/ Nama/ scrub (in varying ratios) karroid vegetation **Avifaunal Characteristics:** The sandy grassland habitats show a reduced structural complexity and vegetation which provides for a more generic species diversity albeit often higher densities of avifauna. The habitat contains features that provide suitable foraging habitat for Red Lark, Ludwig's Bustard (*Neotis ludwigii*), Kori Bustard (*Ardeotis kori*) and Secretary bird (*Sagittarius serpentarius*). However, the habitat is characterised by a much-reduced rocky substrate and a higher prevalence of grassed red sand infusions which provides infused and highly localized portions of optimal habitat for Red Larks. .

4.4.3 Shrubland

<table>
<tr><th>Photographs</th><th>Shrubland</th></tr>
<tr><td></td><td>Classification: Shrubland
Hydrology: No major hydrological impacts are expected from the development
Geomorphology: Undulating semi-succulent karroid habitat with large extents of flat terrain.
Vegetation: Vegetation varies depending on soil quality but is mostly comprised of karroid shrub interspersed with grassy patches

Avifaunal Characteristics:
The localised high population densities of small mammals such as rodents, springhares and hares within the PAOI as well as the regional linkage to the drainage line habitats, elevates the importance of this habitat for avifauna. The rocky habitats do not provide structural complexity which provides for an increase in species diversity and often showed lower densities of avifauna due to the lack of prey species that are found in this habitat. However, the habitat vegetation provides suitable foraging habitat for the Ludwig's Bustard (Neotis ludwigii), Kori Bustard (Ardeotis kori) and Secretary bird (Sagittarius serpentarius).</td></tr>
</table>

4.4.4 Koppies and Ridges

Photographs	Shrubland
 	**Classification:** Koppies and Ridges **Hydrology:** No major hydrological impacts are expected from the development although some ridges are associated with non-perennial watercourses and facultative wetlands. **Geomorphology:** Undulating semi-succulent karroid habitat with large extents of connected and isolated ridges. The ridges are divided into quartz and dolerite based. **Vegetation:** Vegetation varies depending on soil quality but is mostly comprised of karroid shrub interspersed with grassy patches **Avifaunal Characteristics:** The localised high population densities of small mammals such as rodents, springhares and hares within the PAOI as well as the regional linkage to the drainage line habitats, elevates the importance of this habitat for avifauna. The rocky habitats provide structural complexity which provides for an increase in species diversity and often showed higher diversity and densities of avifauna due to the abundance of prey species that are found in this habitat. The habitat vegetation provides suitable foraging, roosting and breeding habitat for the Ludwig's Bustard (*Neotis ludwigii*), Karoo Korhaan, Kori and Secretary bird (*Sagittarius serpentarius*).

4.4.5 Powerline Infrastructure

Photographs	Shrubland
  	**Classification:** Powerline Infrastructure **Hydrology:** No major hydrological impacts are expected from the development **Geomorphology:** The large powerline structures have been placed on undulating vegetated habitat with large extents of flat terrain. **Vegetation:** Vegetation varies depending on soil quality but is mostly comprised of sandy grassland and karroid shrub. **Avifaunal Characteristics:** The Powerlines have proved to be highly sensitive in regard to large raptors, especially Martial Eagle which nest frequently on the powerline infrastructure and who utilise the powerlines to launch hunts.

4.5 OBSERVED AND EXPECTED AVIFAUNA

4.5.1 Total species composition and abundance

The study area supports a relatively high diversity and abundance of avifauna, which is to be expected in an arid area with a high habitat diversity like the Pofadder region. A total of 83 species have been observed, as shown in Appendix 1. This medium to high diversity is predominantly due to a number of factors including:

- High regional aridity which shows a high temporal variability in species diversity;
- Diverse habitat types (with some highly sensitive habitat such as drainage lines and temporary pans within the PAOI).
- Climate change which is characterised by lower rainfall and increased temperatures but with stochastic high rainfall events as with 2022.
- Powerline infrastructure bisecting the PA (raptor nesting habitat).

It must be noted that stochastic high rainfall events (especially after the prolonged drought periods) and other atypical prevailing influences (persistent mild weather) may have influenced the local avifaunal assemblage densities which were often recorded as being very high.

4.5.2 Priority species list

A list of expected and observed priority species (Retief *et al.* 2012) in the project area is provided in

. A total of 19 priority species are expected to occur on and surrounding the study area, of which fourteen (14) have been recorded.

It is clear from

that numerous priority avifauna species occur within the PAOI and can be expected to interact with the proposed development. With all proposed and approved WEF developments, it is vital to consider the context within which these species are observed in the current study, as congregatory behaviour, nesting behaviour and foraging behaviour may differ from that at the adjacent existing WEF facility. Indeed, Van Rooyen (2020) suggests that displacement effects of the WEF are more significant than direct mortality which can greatly affect habitat specific species such as Red Lark and Ludwig's Bustard. Consequently, all applicable data of priority species observed within the monitoring seasons of field surveys allowed for careful evaluation of potential impacts and application of suitable mitigation measures to reduce these impacts where possible. According to the literature, 14 Red-Listed species are known to occur in the region with nine species highly likely and six species confirmed during the completed surveys, representing a very high success rate given a single year study period. Of the expected species and according to Taylor *et al.* (2015), two of the species are Endangered, four of the species are Vulnerable and three are Near-Threatened. For the current study, it was deemed unnecessary that all SCC should be discussed in intensive detail unless deemed highly relevant to the proposed development. However, all relevant SCC are described in brief (Table 4-2). Three selected relevant species that are possibly susceptible to the proposed development were discussed below in greater detail, which include specific

(Guideline-based) recommendations for monitoring and mitigation. Photographic evidence of SCC and Priority Species observed during the current study is provided in Figure 4-7, Figure 4-8,

Figure 4-7: Martial Eagle observed within the proposed De Rust WEF.

Figure 4-8: Double-banded Courser observed within the proposed De Rust WEF

Figure 4-9: Karoo Korhaan observed within the proposed De Rust WEF

Figure 4-10: Jackal Buzzard observed within the proposed De Rust WEF PA

Figure 4-11: Booted Eagle observed within the proposed De Rust WEF

, Figure 4-10 and Figure 4-11.

Table 4-1: Priority avifauna species list (both expected and recorded as defined by Retief et al. 2012) for the study area.

Common name	Scientific name	Priority species rank	Global Status	Regional Status	South African Endemic	Current pre-construction monitoring
Bustard, Ludwig's	*Neotis ludwigii*	14	EN	EN		X
Buzzard, Jackal	*Buteo rufofuscus*	43	LC	LC	X	X
Courser, Burchell's	*Cursorius rufus*	69	LC	VU	X	X
Courser, Double-banded	*Rhinoptilus africanus*	72	LC	NT		X
Eagle, Booted	*Aquila pennatus*	59	LC	LC		X
Eagle, Martial	*Polemaetus bellicosus*	4	EN	EN		X
Eagle, Verreaux's	*Aquila verreauxii*	2	LC	VU		
Eagle-owl, Spotted	*Bubo africanus*	98	LC	LC		X
Falcon, Lanner	*Falco biarmicus*	24	LC	VU		X
Goshawk, Southern Pale Chanting	*Melierax canorus*	75	LC	LC	X	X
Kestrel, Greater	*Falco rupicoloides*	95	LC	LC		X
Kite, Black-winged	*Elanus caeruleus*	94	LC	LC		X

Korhaan, Karoo	*Eupodotis vigorsii*	51	LC	NT	X	X
Korhaan, Southern Black	*Afrotis afa*	37	VU	VU		X
Korhaan, Northern Black	*Afrotis afraoides*	90	LC	LC		X
Lark, Red	*Calendulauda burra*	40	VU	VU		X
Lark, Sclater's	*Spizocorys sclateri*	50	NT	NT		
Secretarybird	*Sagittarius serpentarius*	13	EN	VU		
Snake- Eagle, Black-chested	*Circaetus pectoralis*	60	LC	LC		X
Vulture, White-backed	*Gyps africanus*	23	CR	CR		

Figure 4-7: Martial Eagle observed within the proposed De Rust WEF.

Figure 4-8: Double-banded Courser observed within the proposed De Rust WEF

Figure 4-9: Karoo Korhaan observed within the proposed De Rust WEF

Figure 4-10: Jackal Buzzard observed within the proposed De Rust WEF PA

Figure 4-11: Booted Eagle observed within the proposed De Rust WEF

Table 4-2: Summary of avifauna species of conservation concern of known distribution, previously recorded in or adjacent to the study area pentads.

Species	Global Conservation Status[7]	National Conservation Status[8]	Preferred Habitat	Potential likelihood of occurrence on study area and potential risk posed from the WEF
Spizocorys sclateri (Sclater's lark)	Near Threatened	Near Threatened	Dry shrubland, karroid drainage lines and karoo shrubveld	**Highly Likely**: High densities throughout the region but uncommon in the study area. The species is likely to be a breeding resident within or adjacent to the study area. A localised low flying passerine, it is not highly susceptible to WEF development activities but is threatened by habitat loss
Calendulauda burra (Red lark)	Vulnerable	Vulnerable	Red dune open shrubland/ grassy duneveld	**Confirmed**: Low densities throughout the region but locally common in the study area The species is likely to be a breeding resident within or adjacent to the study area. A localised low flying passerine, it is susceptible to WEF

[7] IUCN 2021
[8] Taylor et al. 2015

Species	Global Conservation Status[7]	National Conservation Status[8]	Preferred Habitat	Potential likelihood of occurrence on study area and potential risk posed from the WEF
				development activities (high display flights) but is more threatened by habitat loss.
Aquila verreauxii (Verreaux's' Eagle)	-	Vulnerable	Mountainous areas or areas with prominent outcrops with a high prey base (e.g. hyrax)	**Regionally confirmed, absent from study area**: Frequent foraging resident throughout the PAOI but far less frequent within the study areas due to the large distances to the mountainous preferred habitats and a general lack of localised abundant prey. Localised areas exhibiting high abundance of hyraxes and rock rabbits should be considered highly sensitive to the species. The species is susceptible to poisoning events and WEF facilities with a low risk from proposed activities.
Polemaetus bellicosus (Martial Eagle)	Endangered	Endangered	Open bushveld, desert savanna and karoo with adequate roosting and foraging potential.	**Confirmed:** A breeding resident adjacent to the PA and regular foraging visitor dependent on adequate food supply and roosts. No breeding pair nesting within the proposed WEF boundary were recorded but frequent sightings in terms of foraging activity on the development footprint area. Typically, the species would exhibit a Moderate risk.
Falco biarmicus (Lanner Falcon)	-	Vulnerable	Varied, but prefers to breed in mountainous areas.	**Confirmed:** A fairly common foraging migrant recorded in the current study and expected periodically to occur. Not highly vulnerable to the proposed activities.
Neotis ludwigii (Ludwig's Bustard)	Endangered	Endangered	Primary upland grassland, desert savanna and karoo with foraging and roosting particularly on rocky/ hilly terrain.	**Confirmed:** High densities throughout the study areas. The species is likely to be a breeding resident within or adjacent to the study area. A large bodied species, it is highly susceptible to WEF development activities as shown by direct interactions with the existing powerlines in the region.
Sagittarius serpentarius (Secretarybird)	Endangered	Vulnerable	Prefers open grassland or lightly wooded habitat although forages extensively in open karroid savannah.	**Moderate to Highly Likely:** Irregular low-density resident which is most likely of lower risk to the proposed development activities given ground foraging habitats. In addition, persistent long term regional drought may have significantly decimated local prey sources (especially snakes) thus further reducing the likelihood of persisting local populations of significant densities.

Species	Global Conservation Status[7]	National Conservation Status[8]	Preferred Habitat	Potential likelihood of occurrence on study area and potential risk posed from the WEF
Eupodotis vigorsii (Karoo Korhaan)	Near threatened	Near threatened	Karroid habitats, large saline pans and shallow impoundments.	**Confirmed:** Common resident occurring near areas with drainage lines (including ephemeral) and open areas. Individually susceptible to WEF development activities but as a species is considered low risk.
Falco naumanni (Lesser Kestrel)	Near Threatened	Least Concern	Widespread species prefers open grassland or lightly wooded habitat although forages extensively in open karroid savannah. Roosts collectively in locations with tall trees.	**Confirmed:** Regular migrant of fluctuating seasonal density which is most likely of lower risk to the proposed development activities due to most pressures occurring with breeding grounds and migration routes.

4.6 PRECONSTRUCTION MONITORING METHODS AND REQUIREMENTS

4.6.1 Walked and Driven Transects counts

During the walked transects, the total number of individual birds (per species) were recorded regardless of if they are listed as priority or not. Notable Priority Species recorded during walked transects included Ludwig's Bustards that were often flushed from foraging positions as well as Double-banded Coursers, Lesser Kestrel, Northern Black Korhaans and Karoo Korhaans. The main focus of drive transects were the recording of large birds and raptors. Ludwig's Bustards, raptors and korhaans and Red Lark were the most frequently recorded priority species. For the final EIA, the data will be used to calculate the combined Index of Kilometric Abundance (IKA = birds/km) for each priority species.

4.6.2 Vantage Points

The Vantage Point data collection appeared to provide the richest avifaunal observations with priority species recorded during the surveys and were divided into three flight height categories (Low 0 to 50 m, Medium 50 to 150 m and High with all observations of birds flying more than 150 m). The collated data capture is indicated in order to gain some understandings of which species are likely to be most at risk of collision, especially in conjunction with the final turbine layout.

4.6.3 Nest Survey

Nest sites were searched for during the surveys which included windmills, trees, pylons, bridges and masts, representing most potential roost and nesting sites for raptors. Water bodies were potential roost and nesting sites for multiple species, but the high degree of seasonality and above average rainfall conditions was optimal to being representative of optimal breeding habitat for water associates. Highly significant breeding habitat was recorded during the survey and Ludwig's Bustard is considered a resident and to be breeding on site. Pylons were examined for raptor nesting sites to be discussed for Martial Eagles below. However, it is vital to understand that the abandoned large raptor (Martial Eagle) nests driving the site sensitivity analysis still hold significance given the potential for recolonisation as well the use of the nests by other priority species such as Lanner Falcons Figure 4-12 and Figure 4-13.

Figure 4-12: Breeding Lanner Falcon utilising the abandoned Martial Eagle Nest observed adjacent to the proposed De Rust WEF

Figure 4-13: Fledged Lanner Falcon chicks utilising the abandoned Martial Eagle Nest observed adjacent to the proposed De Rust WEF

4.7 COLLISION RISK SUMMARY

1. All heights above ground for contacts are recorded for this analysis. For the pre-construction monitoring, three risk levels are defined considering the species characteristics and the risk behaviours, based upon Retief et al. (2012):
   - **High probability** movements of priority species at rotor swept height and presenting behaviours with potential to increase collision risk with rotating blades.
   - **Medium probability-** movements of priority species at rotor swept height or presenting collision risk behaviours;
   - **Low probability-** movements of sensitive species (regardless of the height or type of flight) and movements of non-priority species at rotor swept height or presenting collision risk behaviours.

4.8 PRELIMINARY WEF SITE SENSITIVITY

Each demarcated sensitive feature was evaluated for the degree of sensitivity based on the complete 12-month data set (minus passage rates) and presented as Figure 4-14. There is an important presence of a number of SCC in the study area, recorded regularly and widespread through the proposed WEF area. In addition, there are several raptors utilising the PAOI, some of them priority species and/or of conservation concern, such as the Martial Eagle, Lanner Falcon, Pale-chanting Goshawk and Jackal Buzzard. Areas of drainage lines and natural vegetation which are vital to maintaining populations of habitat obligate sensitive species (such as Red Lark) are deemed to have some probability of collision consistently throughout the year. Furthermore, natural drainage line vegetation represents an important habitat to maintain natural geohydrological processes of the PAOI. A 50 m buffer around these areas must be considered NO-GO where no turbines and associated infrastructure may be located. A 200 m buffer is also applied around seasonally inundated watercourses in the PAOI, as these features attract birds under certain conditions and could be the only locations were certain sensitive species such as the ducks, herons, storks and water birds are likely to occur. Martial Eagle nests (occupied or abandoned) were buffered according to either best practice (5 km) or the application of mitigation measures such as shutdown on demand (4.6 km). These areas must be avoided by the developer where no turbines and associated infrastructure may be located. Due to an interactive process within the client and the specialist team, very few of the proposed turbine positions and associated infrastructure coincide with areas currently demarcated as High sensitivity features as the layout was carefully re-evaluated in order to mitigate against negative interaction with priority species such as Martial Eagle, Red Lark and Ludwig's Bustard.

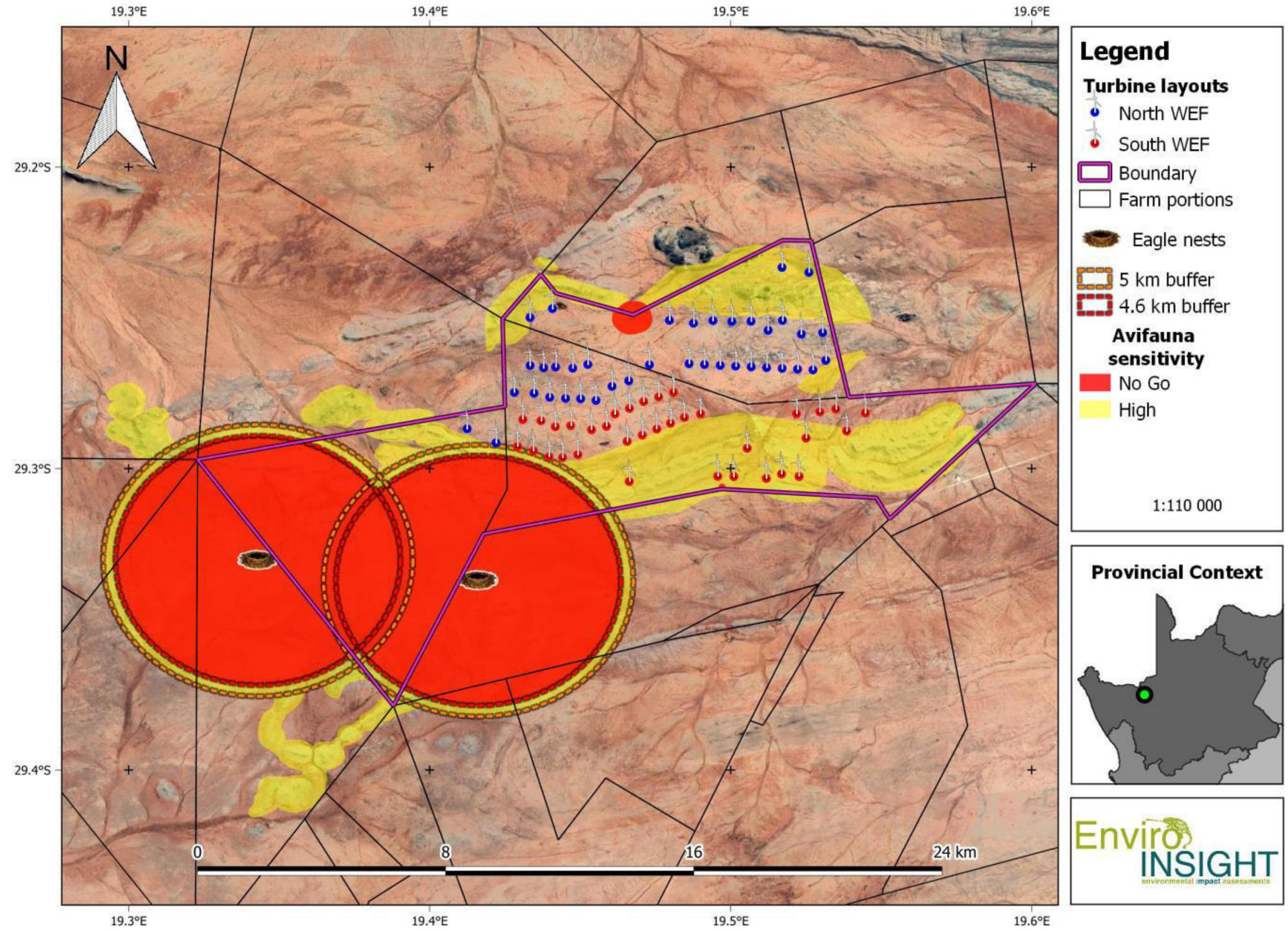


Figure 4-14: Overall Avifauna Sensitivity Buffers with preferred turbine placements overlaid.

5 POTENTIAL IMPACTS

5.1 BACKGROUND TO INTERACTIONS BETWEEN WIND ENERGY FACILITIES, POWER LINES AND BIRDS

The effects of a wind farm on birds are highly variable and depend on a wide range of factors including the design and specification of the development, the topography of the surrounding land, the habitats affected and the number and species of birds present.

Typical potential impacts include (but are not necessarily limited to):

- Habitat loss (including foraging and breeding) and fragmentation due to displacement (avoidance of disturbance);
- Collision mortality with turbines;
- Collision and electrocution with above-ground power transmission lines.
- Disturbance of flight/migratory pathways; and

- Disturbance due to lights, noise, machinery movements and maintenance operations.

These potential impacts are assessed in the Scoping Phase of the project with specific reference to priority species and other non-priority species at high risk of negative impact from the proposed facility.

Table 5-1: Habitat loss and fragmentation impacts during the construction phase.

<table>
<tr><td colspan="4">Impact: Habitat loss and fragmentation
Access roads and turbine or infrastructure construction may necessitate the removal of foraging and roosting habitat, destruction or disturbance of bird breeding habitats, bird roosts and sensitive avifaunal habitats such as migratory routes. This will occur during the construction phase and sensitive areas include tall emergent trees, flight paths to the mountain ranges, the river and associated riparian vegetation, free standing water (impoundments) and drainage lines across the PAOI.</td></tr>
<tr><td>Issue</td><td>Nature of impact</td><td>Extent</td><td>No-Go Areas</td></tr>
<tr><td>Habitat destruction due to construction of infrastructure.</td><td>Negative, especially species utilising watercourses for foraging and breeding, as well as migratory pathways.</td><td>Local</td><td>Watercourses, including the river, wetlands and all drainage lines.</td></tr>
<tr><td colspan="4">Description of expected significance of impact:
The relatively small operational footprint of the development may reduce the overall expected significance of the impact although the impact can potentially be high and long-lasting. However, if no-go areas are avoided and the necessary buffers against infrastructure applied, the impact should be medium to low. As far as possible all roads must utilise and upgrade existing farm roads to avoid further destruction of habitat.</td></tr>
<tr><td colspan="4">Gaps in knowledge and recommendations for further study
Areas that might be important for avifaunal activity, especially migratory pathways may change over time in response to infrastructure establishment and subsequent monitoring.</td></tr>
</table>

Table 5-2: Collision mortality with turbines.

Impact: Avifauna mortalities due to collision with turbines This impact will occur during the operational phase due to avifauna collision with the blades of the turbines or due to barometric trauma suffered by avifauna caused by difference in air pressure created by the turning of wind turbine blades. This will be especially relevant during times of migration when avifauna move through the area between summer and winter breeding sites and there is a higher abundance of avifauna in the area.

Issue	Nature of impact	Extent	No-Go Areas
Mortalities suffered due to collision with turbines.	Negative and highly relevant for migratory species that traverse through the area.	Local, but can be more extensive for species that migrate through the region.	Large emergent trees, water bodies including large rivers, and all drainage lines and areas with heavily vegetated wetlands. Based on observations, the Bergriver seems to act as a migratory pathway and this area must be subject to buffering. Areas shown to have high recorded densities of bird activity.
Description of expected significance of impact: The impact can potentially be highly significant and will persist during the life of project, but if no-go areas are avoided and the necessary buffers applied the impact may be reduced to medium/ low. This impact can be significantly reduced if mitigation measures are followed, which included no development in Very High and High bird sensitivity areas and implementing appropriate buffers in no-go areas.			
Gaps in knowledge and recommendations for further study: This has been well investigated, including from the neighbouring existing regional WEF, although the fatality risks of habitat types will be consistent with monitoring data.			

Table 5-3: Disturbance of flight/migratory pathways.

Impact: Disturbance of flight/migratory pathways Turbines placed along or close to flight pathways used for migration can cause a large number of collision-related mortalities on birds moving through the area during times of small-scale migration and seasonal migration between winter / summer roosts			
Issue	Nature of impact	Extent	No-Go Areas
Disturbance of bird migration pathways.	Negative, but should be low if pathways are avoided.	Regional.	The entire river section must have a 100m buffer around and anywhere in this buffer will be considered a No-Go Area.
Description of expected significance of impact: This impact could be extremely high, but easily reduced if the buffer around the river is strictly enforced.			
Gaps in knowledge and recommendations for further study: Migration in birds are poorly understood, and times of the year when these events occur can be unpredictable. It is also not established whether birds will follow the exact same pathway year after year.			

Table 5-4: Disturbance due to lights, noise, machinery movements and maintenance operations

Impact: Disturbance due to lights, noise, machinery movements and maintenance operations Can have a negative effect on avifauna behaviour by affecting foraging activity and flight paths used. Artificial lights can attract insects which will entice nocturnal species (owls, nightjars etc) to feed in the area leading to a higher chance of mortalities due to collision or barotrauma. High noise levels could disturb breeding birds which could lead to abandonment of eggs or fledglings.			
Issue	Nature of impact	Extent	No-Go Areas
Increased noise, lighting and disturbance during operation	Negative, but can be reduced to acceptable levels	Local	All bodies of water including the river
Description of expected significance of impact: This impact could be high, but easily reduced if high intensity lights are not used and only the compulsory civil aviation lighting is employed, noise levels are within the accepted standards and machinery are fitted with dampers, where required.			
Gaps in knowledge and recommendations for further study: In certain areas the use of artificial lights will be unavoidable, and these include areas where offices or operational and maintenance buildings will be constructed. Placement of these buildings is currently unknown, but it is recommended that these are constructed in areas away from watercourses.			

5.2 CUMULATIVE IMPACTS

There are a number of proposed, approved and implemented renewable energy facilities within the PAOI as shown in Figure 5-1 and any impacts anticipated from the proposed De Rust WEF will add to these existing impacts. As such, the results obtained during this preconstruction survey and from the subsequent impact analysis should be considered in conjunction with the impacts created by the regional developments. There is a large amount of renewable energy development within the region, raises the possibility of significant cumulative impacts concerning collision risk, habitat loss and fragmentation and loss of suitable habitat for threatened species.

The following current impacts will be exacerbated through increased WEF development regionally;

- Habitat loss: The destruction of highly sensitive habitat (for example sandy substrates for Red Lark) will potentially increase. The Red Lark exists within a narrow ecological and distributional belt and loss of its ecologically specific habitat may be highly significant.
- Road-kills: Many birds are commonly killed on roads, especially nocturnal species such as Spotted Eagle-Owl.
- Regional saturation of turbines: This has implications for several priority species, both in terms of collision mortality for some species, especially Bustards and Raptors, and displacement due to transformation of habitats
- Powerlines: Numerous existing and new power lines are significant threats to large terrestrial priority species in the region as powerlines may kill significant numbers of all large terrestrial bird species.

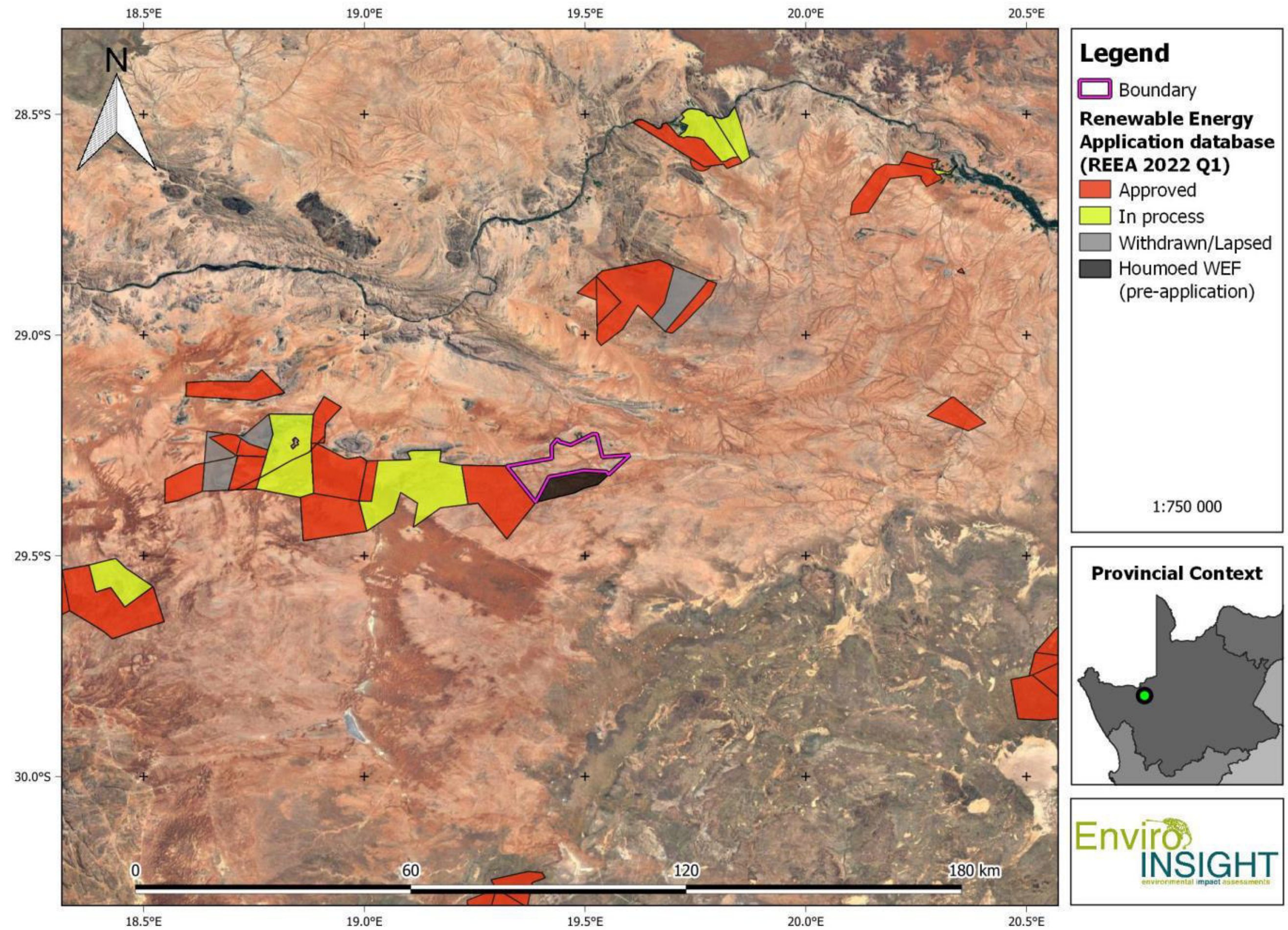


Figure 5-1: Local and regional renewable energy applications and operations

5.3 MITIGATION OF IMPACTS

5.3.1 General

Due to the global demand for renewable energy, a strong research emphasis has been placed on describing and defining mitigation measures to negate or minimise the negative impacts associated with such facilities. In particular, much research is focused on bird-turbine collisions prevention/minimisation at wind energy facilities (see May *et al.*, 2015; Gartman *et al.*, 2016 a & b; May *et al.*, 2020; McClure *et al.*, 2021). New mitigation measures range from simple (e.g., painting one turbine blade black; May *et al.*, 2020) to complex (detecting approaching birds with radar, cameras and artificial intelligence to slow turbines down; McClure *et al.*, 2021). However, by far the best mitigation option remains the first step of the mitigation hierarchy which is "avoidance". Consequently, all attempts will be made to avoid potential impacts arising from the proposed WEF through the application of necessary buffers for sensitive areas, where placement of turbines may not occur. Additional remaining impacts will be minimised through the application of known and previously tested mitigation measures (e.g., May *et al.*, 2015). Finally, there is strong support from the developer to apply experimental minimisation mitigation measures (e.g., painting of one blade) and to utilise the facility to generate important research data.

Alternative additional mitigation measures may include change of the current land use to minimise attraction for priority species. Since development and construction go hand in hand with high ambient and stochastic noise levels (machinery) and habitat loss, it is possible for bird species and bird individuals to be displaced from the surrounding environment. It is essentially true for large species that require extensive home ranges, and those species that are inherently shy or unobtrusive by nature (e.g., raptors). Displacement will be the response of raptors to the disturbance activity, for example when a bird changes its behaviour or takes flight by aborting its activity prior to the disturbance or being unsuccessful in completing its current activity (Ruddock & Whitfield 2007). Reactions are likely to differ between species and between individuals of the same species (Rogers & Smith 1995; Rogers & Schwikert 2002). Reactions are also positively correlated to the magnitude and frequency of a particular disturbance event. For the proposed WEF as well as the cumulative impacts, it cannot be predicted to a 100% confidence to what degree these activities will affect the Priority Species, but it must be stated that many bird species will become accustomed, or have the ability to learn and adapt, to constant occurring disturbance events of low magnitude (e.g. vehicle noise) and turbine operation, unless they are directly affected (e.g. their physical habitat is affected). Collision with turbines and associated infrastructure (including powerlines and fences situated near roads) is the most significant impact for the species in the region.

Set-back areas or buffer zones are allocated to sensitive or important habitat features to alleviate the effect of foraging and roosting habitat in particular which fortunately is considered of low significant in the PAOI. The choice of an appropriate set-back distance is complex since different species and even different taxon groups demand different habitat types or home ranges to maintain a viable population in the long term.

5.3.2 Shutdown on Demand

The specialist conducted extensive research into radar and camera technology currently being applied in Europe. After careful evaluation of the technological capabilities of the automated monitoring systems and given the specific species of high risk, the prevailing topographical conditions and interactions with the client, it has been determined that the implementation of automated radar monitoring be implemented during the operation phase of the project. The following justification is deemed determinate.

- Avoidance measures in adherence to the 5 km recommended buffers is the most preferred option of mitigation.
- If the recommended radar technology is trained to monitor species of 2.8 kg or more (and given the topography), individual birds traveling towards a monitored turbine will be detected at 4000 metres. Topography (increasing effective range and accuracy) will be the most important factor determining radar placement and is illustrated in Figure 5-2.
- Once locked on to a target, Artificial Intelligence (AI) can track the direction, altitude and speed of the individual bird and utilising thresholds, can implement directed shutdown on demand actions.
- For example, if an individual bird is flying toward a turbine at a high speed without deviation, the AI based radar technology will implement a designated action at a greater distance than individuals approaching at a lower speed and/ or at a variable bearing (representative of migration vs foraging behaviour).
- The radar technology by design can detect bird weight (based upon water density) to a 95% accuracy. Therefore, the system must be calibrated to any species above 2.8 kg which will incorporate not only Martial and Verreaux's Eagles (3 to 6.5 kg), but all other SCC including Ludwig's/ Kori Bustard (3 to 18 kg), Secretary Bird (3.4 to 4.3 kg) and Lappet-faced/ Cape Vultures 6.5 to 12 kg). Thus, the application of radar technology will not only protect the nesting Martial Eagle population but other migratory, resident, vagrant and foraging species of concern.
- The threshold of 2.8 kg will prevent unnecessary shutdowns based upon incursions by species that may be classified as Priority but are not listed as a SCC of a status IUCN Vulnerable or above (Endangered, Critically Endangered).
- Careful consideration must be provided regarding the placement of the radar system in conjunction with the nesting Martial Eagles with the subsequent radar buffer options (in relation to radar placement) shown in Figure 5-2.
- Finally, all of the above information is subject to the final data analysis and submission of the EIA. However, it is suggested that shutdown on demand protocols not only be submitted as part of the EMP but updated every 3 years in regards to advancements in the hybridised approach to the technology. For example, diversionary trigger systems (such as sirens which trigger when larger target species breach 1000 metres) may be implemented not only to avoid unnecessary shutdowns but also to maximise the chances of a zero-collision record for the project operation. AI-based technology such as cameras may be implemented on higher risk turbines (determined through the monitoring programs and telemetry-based tracking of local eagles) as the preferred hybridised solution.

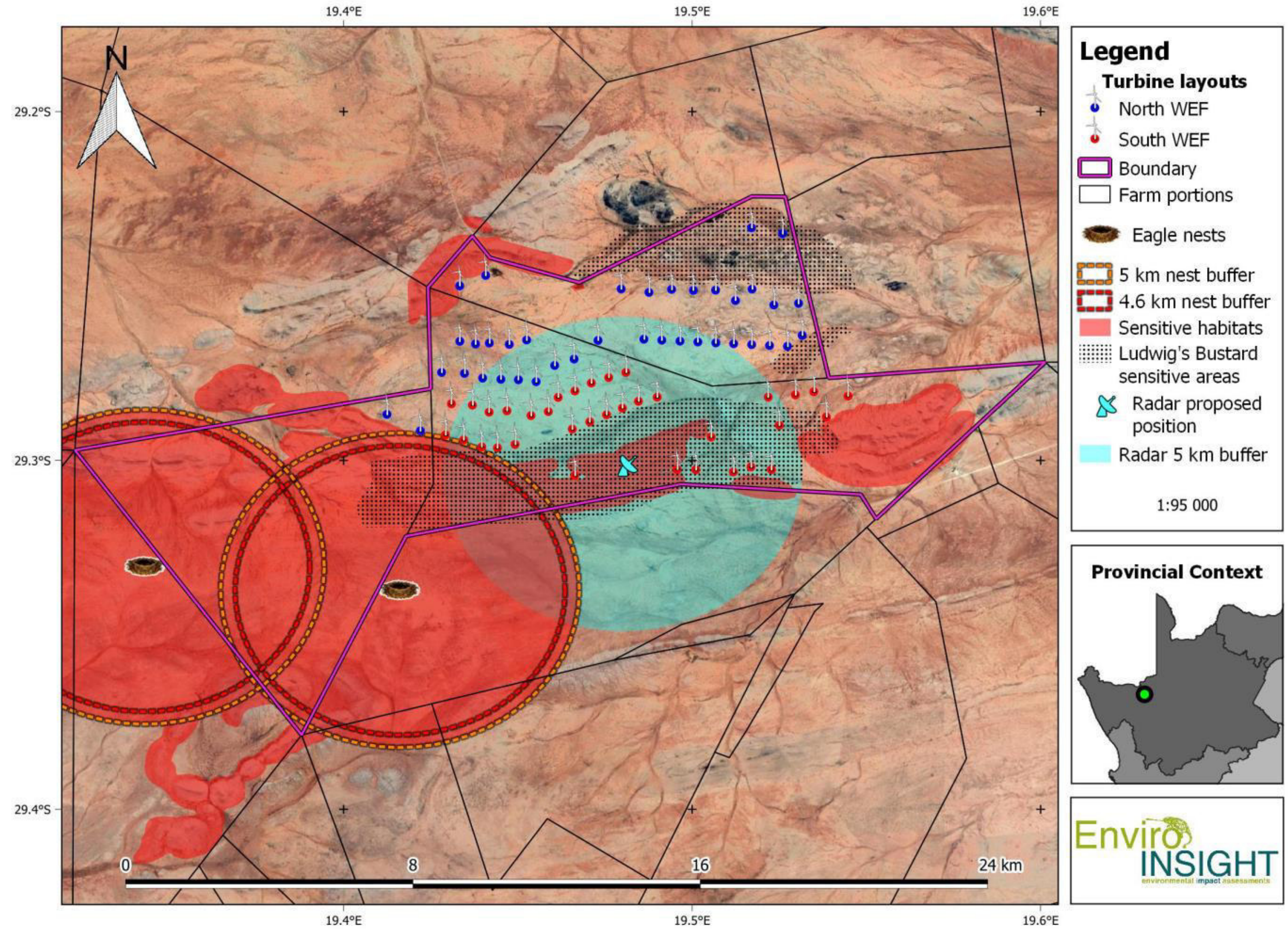


Figure 5-2: Preliminary radar positioning in conjunction with the location of martial eagle nest sites and high sensitivity areas

5.4 SUMMARY OF PROPOSED MITIGATION MEASURES

The following summary of mitigations is dependent on the final confirmation of the turbine layout to be shown in the final EIA. It is deemed possible, through the application of appropriate mitigation measures, to restrict the impact of on priority species through collisions with the turbines to a low level of significance. The following mitigation measures are proposed:

Habitat destruction: Apply necessary buffers for roost and foraging sites and other sensitive bird habitat features, avoiding the construction of turbines and access roads in these areas. Roads must utilise or upgrade existing farm roads as far as possible.

Bird mortality: Avoid placement of turbines near sensitive bird breeding and roosting habitats. The application of adaptive mitigation measures (e.g., shutdown on demand retrofitting), according to post-construction monitoring results (counted strikes of threatened species) must be informed by environmental correlates of avifaunal activity and/or strikes.

Bird collisions with turbines: Increase turbine cut in speed as this has been shown to reduce collisions. The risk is not considered to be high, and the annual collision risk is estimated at less than 5 birds per year. The fatality rates post-construction will provide additional data and the risk model can be adjusted accordingly. Advanced Radar-based shutdown on demand must be applied where turbines transcend recommended buffers in permanent populations of Martial Eagles and Vultures in the PAOI.

Avoidance: It is recommended that limited development (including the full rotor swept zone of wind turbines) takes place in High sensitivity areas. Minimise impacts to natural and artificial wetlands and water bodies by implementing the appropriate buffer areas where no development may take place. This includes a 200 m no-go buffer proposed around water points (500 metres from the largest seasonal impoundment within the Project Footprint) as they serve as focal points for bird activity.

General Mitigation Measures for Wind Energy

- Formal post construction monitoring must be resumed once the turbines have been activated, as per the most recent edition of the best practice guidelines (Jenkins et al. 2015). The exact scope and nature of the post-construction monitoring will be informed on an ongoing basis by the result of the monitoring through a process of an establishment of available new technology and adaptive management. The purpose of this would be to establish if and to what extent displacement of priority species has occurred through the altering of flight patterns post-construction, and to search for and identify carcasses at turbines (mortality).
- High value target species such as Martial Eagle can be tracked using the Shutdown on Demand Radar Technology and/ or telemetry systems in order to more accurately monitor movement patterns, especially in conjunction with turbines. These programs should be implemented during and post construction.
- Post-construction monitoring should be undertaken as per the EMPr. The exact scope, nature and frequency of the post-construction monitoring will be informed on an ongoing basis by the results of the monitoring through a process of adaptive management.
- If turbines are to be lit at night, lighting should be kept to a minimum and should preferably not be white light. Flashing strobe lights should be used where possible (provided this complies with Civil Aviation Authority regulations).
- Lighting of the wind farm (for example security lights) should be kept to a minimum. Lights should be directed downwards (provided this complies with Civil Aviation Authority regulations).

5.5 SPECIES SPECIFIC RISK ANALYSIS AND RECOMMENDED MITIGATIONS

Ultimately, it is suggested that the morphological and behavioural; characteristics of a given bird species traits of birds, especially those related to size, wing beat, manoeuvrability, flight pattern and hunting/ foraging behaviour, are known to influence the relative collision risk with structures such as power lines and wind turbines. Larger bird species often need to use thermal and updrafts to gain altitude, particularly for long distance flights. Thermal updrafts (thermals) and orographic lift (slope updraft) will affect the relative risk per species. The relatively flat nature of the survey area dictates that the overall topography related risks are low, However, some higher risk species have been identified and described below.

5.5.1 Ludwig's Bustard (*Neotis ludwigii*)

Ludwig's Bustards are globally and regionally listed as Endangered (BirdLife International 2012b and Taylor, *et. al.* 2015) which is cause for a significant evaluation of the species in relation to the proposed development. Actual counts were carried out during the pre-construction monitoring process although and monitoring data suggest that a permanent (albeit seasonal) population including breeding pairs persist for prolonged periods within the study area. Multiple and frequent sightings were recorded. The species is highly migratory and localised development may not represent a fatal flaw. However, the fact that sub-adults and juveniles are encountered in the study area provides strong anecdotal evidence of residential breeding behaviour which may have significance ramifications for the Cumulative Impact Assessment.

It must be stated that some local landowners stated that Ludwig's bustards have increased in density over the last ten years within the region (sometimes numbering up to 130 congregated individuals) and within the Project footprint. By all accounts, 2022 showed a particularly high density. There are a number of possible explanations for the observed increase in density in 2022:

- This species, as a nomad, may show localised and temporal increases as part of natural population dynamics due to climatic fluctuations. 2022 experienced a highly unusual amount of rainfall in 2022 over an extended period of time. This caused an activation of the seed bank within the PAOI and subsequently, a large amount of fodder was available for avifaunal species including Ludwig's Bustard.
- The lack of smaller (and less visible) powerlines within much of the study area allowing for localised lower mortality rates; and

This species is almost certainly resident and at risk to the creation of large, turbines in combination with non-marked powerlines may cause collision of birds which could significantly reduce local and regional populations. In addition, large-scale increases in fencing combined with a high volume of large maintenance trucks may cause drastic declines in bustard numbers due to flushing displacements, collisions and entanglements. The presence of this species must form a significant focal point of the mitigation measures.

On a final note, concerning monitoring of the species (and possible mitigations), it is vital to highlight that fact that as an Endangered species, Ludwig's bustard demands higher degrees of auditing and monitoring attention than other Red-Listed birds (a fact supported by multiple publications including Visser *et. al.* 2018 and Scott *et. al.* 2012). It is also vital to highlight that presence or absence over time for a nomadic species is difficult to predict and spatial/ temporal population reductions may or may not be development-induced. For example, another prolonged drought may all but exclude local colonisation which will be immediately reversed with the onset of more unusual heavy rains. Although it is highly feasible that the development may be directly responsible for local population reductions, comprehensive and continuous data collection is required to monitor the situation on site and apply appropriate mitigation measures and far more significant weighting and value should be applied to the Cumulative Impact Assessment. Ludwig's Bustard Specific High Sensitivity Area based upon density of sightings and habitat suitability is shown as Figure 5-3

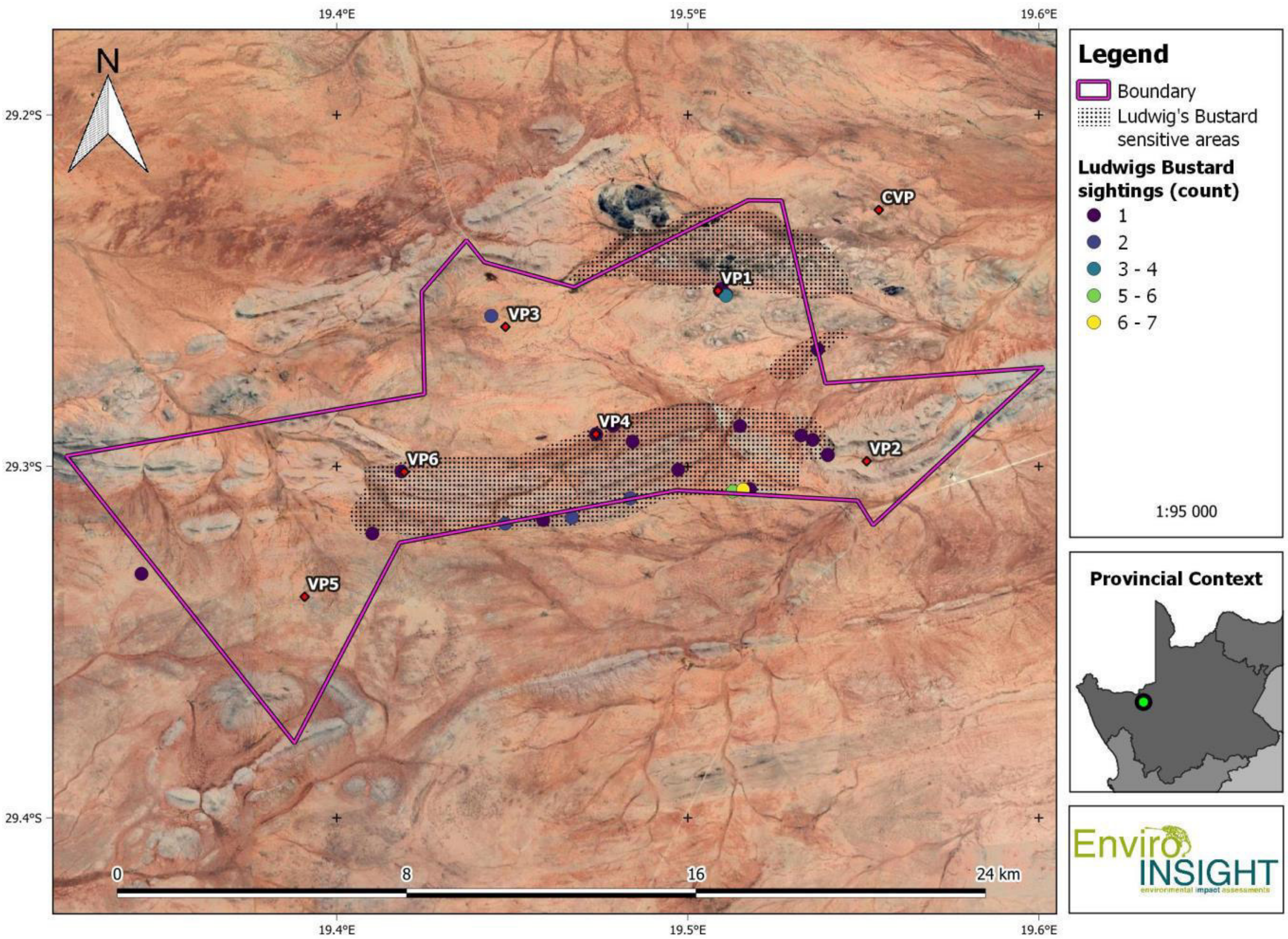


Figure 5-3: Ludwig's Bustard Specific High Sensitivity Area based upon density of sightings and habitat suitability

5.5.1 Martial Eagles and Nest Site

Utilising the interpretations stipulated above and in the absence of any mitigation measures, a preliminary buffer of 5 km is recommended as an exclusion area around the one active and one (recently dormant) Martial Eagle nests adjacent to the footprint, which were confirmed after the completion of the 12-month pre-construction monitoring. There is currently no species-specific guideline for the Martial Eagle, and buffer areas around nest sites (especially nests that have been unused for long periods of time) remains a scientifically contentious topic of discussion in the industry without rigorous scientific studies providing necessary guidance (for example, Murgatroyd, Bouten & Amar 2021). The only published recommended buffer to implement around raptor nests in South Africa is for the Verreauxs' Eagle (Ralston-Paton, 2017), which dictates that a precautionary buffer of 3 km is recommended and may be reduced or increased based on the results of rigorous avifaunal surveys, but nest buffers should never be less than 1.5 km. This buffer is deemed inadequate for Martial Eagles.

A recent paper from Murgatroyd, Bouten & Amar (2021) indicated that by using predictive models to account for habitat use instead of simple buffers around a nest, a greater area of land can be made available for wind energy development without increased mortality risk to raptors. Accordingly, this tool can be used to provide robust guidance on wind turbine placement in a way which minimises the conflict between raptor species and the development of wind energy facilities in South Africa as well as provide the basis for rigorous monitoring programs to be applied. It must be noted that the study species for this research was Verreaux's Eagle which was tracked at only four locations (not including the current habitat or region), and accordingly the interpretation of the results needs to be considered as species- and site-specific, even though the same principle can be extrapolated to other raptor species in various regions. The study recommended that nest buffers should never be <3.7 km radius, but also indicated that additional site-specific specialist input or mitigation methods might allow a limited amount of development for high-risk developments. Based on the preliminary data collected during the pre-construction monitoring, at least one breeding pair of martial eagles appear to be foraging regularly over the proposed De Rust WEF development area.

As a result, it is strongly recommended that mitigation measures (buffering) be coupled with a robust radar/ AI and/ or telemetry-based monitoring program directed by a recognised Martial Eagle specialist (we propose Dr. Gareth Tate of the EWT) be applied in order to investigate the movement patterns of the resident eagles. It is also suggested that the Shutdown on Demand radar system combined with the AI be used in order to more accurately monitor not only Martial Eagle movements, but all species over 3 to 3.5 kg (including Ludwig's Bustard).

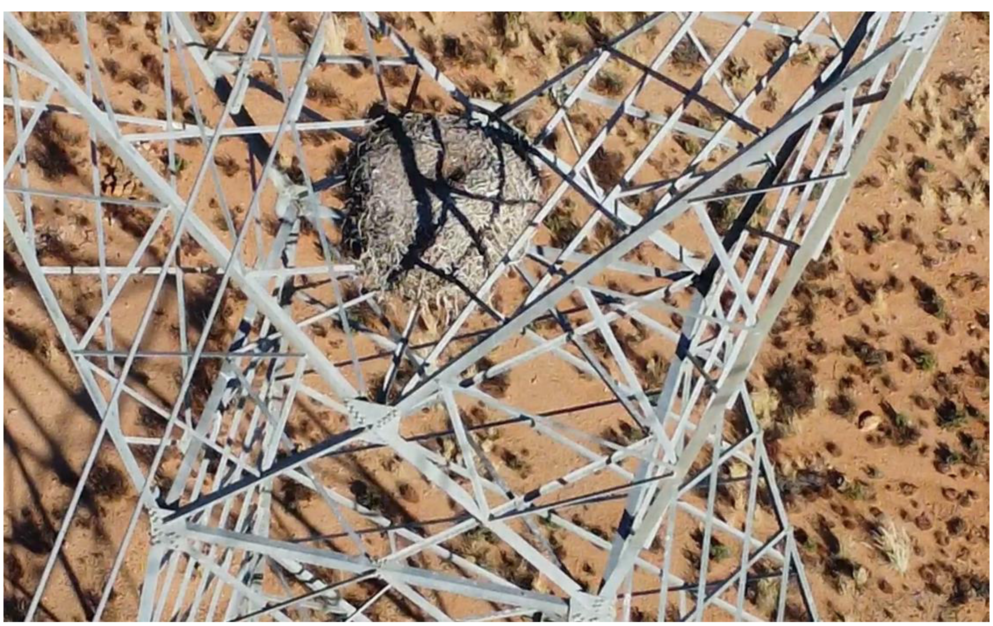


Figure 5-4: Seemingly abandoned Martial Eagle Nest

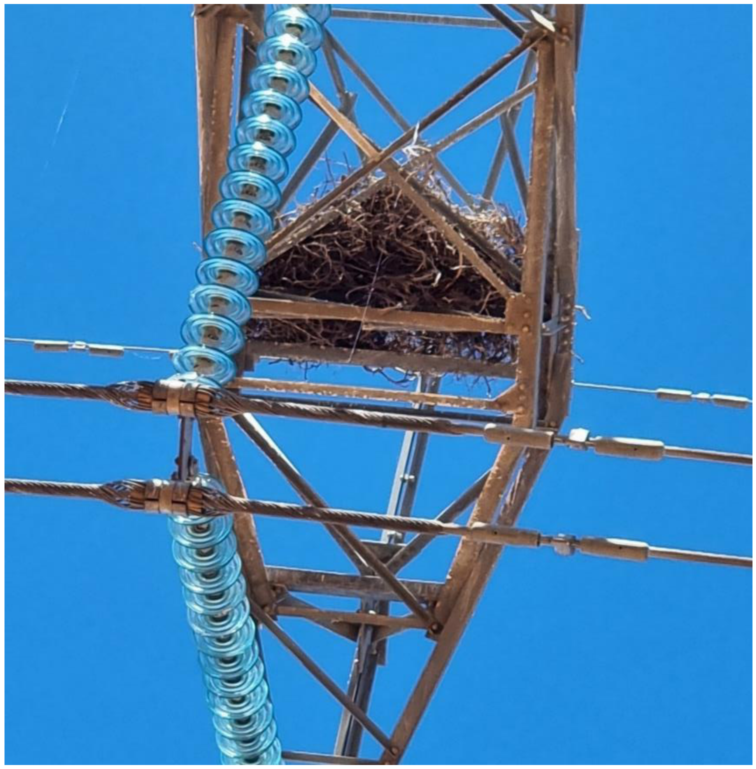


Figure 5-5: Western active Martial Eagle nest.

5.5.2 Red Lark (*Calendulauda burra*)

This species is highly range range-restricted (Figure 5-6) and is listed as IUCN Vulnerable (Taylor *et al.*, 2015). The species was observed frequently during the assessment period albeit within a highly restricted habitat preference. Significant populations (breeding and foraging) within the PAOI have been confirmed. Even though the species exhibits a specific breeding behaviour (display flights of up to 20 metres as described in Hockey *et. al.* 2005), it has been deemed to have a relatively low risk of collision and thus is not considered a fatal flaw to the project. However, care must be taken as some individuals were observed displaying up to 60 metres (wind assisted). The species prefers the open sandy habitats, in particular open sandy karroid dunes and grassland, particularly on dune crests and dune side slopes. The species is considered as a regular, albeit low density breeding resident in the region. Avoidance based mitigation is the primary mitigation measure and must be based upon the aforementioned delineated sensitivity. However as some turbines fall within the delineated high sensitivity area for Red Lark and large-scale avoidance may not be possible, additional small-scale micro sighting may be required. Turbine infrastructure should be placed away from dune crests and side slopes. In addition, and affected turbines, dune habitat should be removed, fenced or artificially vegetated to a prescribed radius of 100 metres in order to ensure no breeding behaviour (and therefore, mating displays leading to potential collision) will not take place within range of the rotor sweep zone.

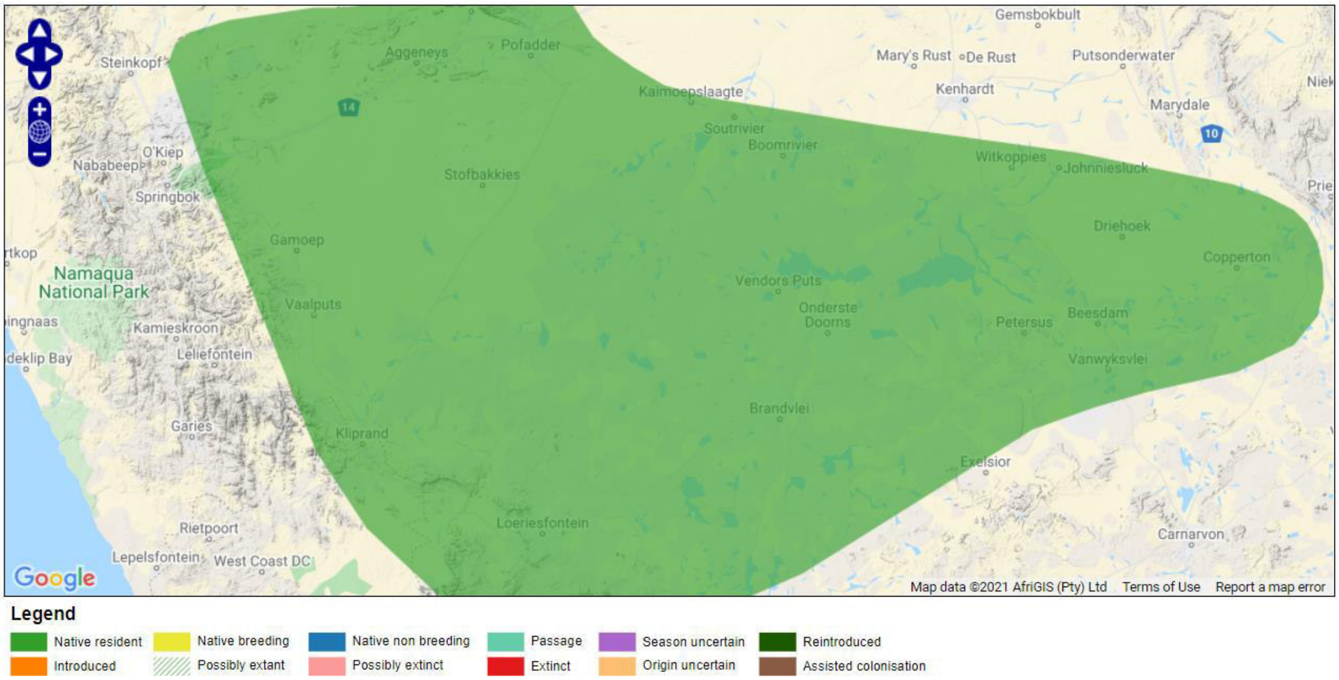


Figure 5-6: Red lark (Calendulauda burra) distribution map (BirdLife International, 2021b).

5.5.3 Raptors and Vultures

For the purposes of the report and given some ecological similarities within the affected groups and specifically for the De Rust WEF project, all raptors and vultures of special conservation concern will be addressed together.

Affected Species, Threatened Status and Habitat Requirements

White-backed Vulture (*Gyps africanus*) and Lappet-faced Vulture (*Torgos tracheliotos*). Due to large-scale drastic declines in recent years, the Vulture species are listed as Globally Critically Endangered and Endangered (IUCN 2021) meaning that the species are in imminent danger of extinction. Within the study area, Lappet-faced Vultures have been classified as locally vagrant but were observed on a single occasion in significant numbers within a seasonal pan by the IUCN (2021). Due to climate change and other factors, it appears that vulture ranges are expanding west and the frequency of occurrence of multiple vulture species may increase over time. Although there exists excellent habitat for these species within the PAOI, insufficient prey exists within the region to support permanent populations of both species.

Methods Applied for Future Species Assessment

Habitat Mapping Verification. Given the predicted low population densities of these species, it is anticipated that individuals may not be observed during a future study period. Therefore, and regardless of observational success, predicted habitats for the species must be mapped using a structural habitat map and this must be carried out prior to the commencement of fieldwork to increase the chances of successful observation through the identification of target areas. In addition, on-site habitat verification must take place to enable supervised classification of potential vulture and raptor habitat (using GIS algorithms) which allows for delineations of areas qualifying as IFC Critical Habitat under Criteria 1.

Random (ad hoc) and periodic visual surveys. Walking and driving transects, periodic horizon and “sky scans” should be undertaken to search for soaring raptor species. In addition, particular attention must be devoted to suitable roosting, foraging and nesting habitat of the target species.

6 CONCLUSIONS

The study area is located in a region dominated by natural and diverse koppies/ ridge, drainage line, karroid and sandy grassland and shrubland karoo vegetation types. Several drainage lines and small farm dams as well as small to large natural pans can be found scattered across the study area with most being mostly dry with some seasonal flow/ inundation. The powerline infrastructure that traverses the PAOI is a significant habitat for Martial Eagles.

Fourteen priority species were recorded during the initial surveys, including Martial Eagle, Karoo Korhaan, Ludwig’s Bustard, Lanner Falcon, Red Lark and Black-winged Kite. Of these, the Martial Eagle and Ludwig’s Bustard was the most concerning large bird species. At the commencement of the survey, the PAOI was characterised by extremely atypical high rainfall in areas normally associated with arid conditions. The onset of a stochastic extreme rainfall event (wet season) may have atypically transformed the PAOI where it is possible that diluted densities (and perhaps diversity) of avifaunal assemblages may have been recorded due to an abundance of high forage value habitat that became temporarily available in the region. This increases the concern regarding large nomadic species such as bustards, large wide foraging raptors such as Martial Eagle and vultures seeking water sources within the PAOI when typical arid conditions return over the next 12 months.

7 PROFESSIONAL OPINION

A final Professional Opinion will be submitted at the conclusion of the EIA submission. However, a preliminary opinion is provided below.

- The addition of the proposed De Rust WEF does indicate potentially significant impacts to the receiving environment via the risk to Priority Species (such as Martial Eagle, Red Lark and Ludwig’s Bustard) as well as the Cumulative Impacts need to be considered and provision made within the EMPr for this development.
- Although previous impact assessments and monitoring programs for existing local WEFs indicated that not all impacts can be mitigated to acceptable levels, medium significance post-mitigation should be interpreted that more can be done to avoid critically important species-specific (especially Red Lark impacts as is the case for the impacts discussed within this statement). This is mainly because impact assessments regarding wind developments have been poorly understood since their inception and the impacts (especially cumulative impacts) of wind developments may have highly significant consequences if mitigation and monitoring is not implemented correctly.
- Overall, it is still the opinion of the consultants that the impacts associated with WEF projects are far preferable (from an environmental impact perspective) to extractive and/ or non-renewable alternatives. It must be related that this report must be considered in context with the greater EIA process.

- In addition, while striving to maintain the highest standards of mitigation and monitoring as well as the commissioning of a highly detailed preconstruction micro sighting assessment, developments such as the De Rust WEF be encouraged within designated areas.
- The presence of nesting and breeding Ludwig's Bustard, Martial Eagles and Red Lark within the PAOI are of particular concern. Avoidance mitigation must be implemented in conjunction with the aforementioned micro sighting as well as technological applications such as Shutdown on Demand. Thus, the author will look to support Environmental Authorisation (EA) based upon the following conditions;

- Shutdown on Demand will be required to mitigate against Ludwig's Bustard and Martial Eagle.
- All recommended buffering be strictly adhered to.
- Micro sighting of turbine placement must occur preconstruction supervised by a specialist zoologist in order to mitigate habitat loss for Red Lark.
- All recommended mitigation measures be applied preconstruction, post construction and operations.
- The EMPr be updated every three years in order to revaluate the potential distributional population changes of species such as Martial Eagles and Vultures. Thus, retrofitted mitigations such as AI, radar and camera technology may have to be applied.

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9 APPENDIX

9.1 APPENDIX 1: EXPECTED AVIFAUNA SPECIES LIST

Avifauna recorded and predicted to potentially occur within the study area according to SABAP1 and SABAP2.

	Common Name	Scientific Name	SABAP2	Observed
1	Acacia Pied Barbet	*Tricholaema leucomelas*	YES	YES
2	African Hoopoe	*Upupa africana*	NO	YES
3	African Palm Swift	*Cypsiurus parvus*	NO	YES
4	African Pipit	*Anthus cinnamomeus*	YES	YES
5	African Red-eyed Bulbul	*Pycnonotus nigricans*	YES	YES
6	Alpine Swift	*Tachymarptis melba*	YES	NO
7	Ant-eating Chat	*Myrmecocichla formicivora*	YES	YES
8	Ashy Tit	*Melaniparus cinerascens*	YES	NO
9	Barn Swallow	*Hirundo rustica*	YES	NO
10	Black Stork	*Ciconia nigra*	YES	NO
11	Black-chested Prinia	*Prinia flavicans*	YES	YES
12	Black-chested Snake Eagle	*Circaetus pectoralis*	YES	YES
13	Black-eared Sparrow-Lark	*Eremopterix australis*	YES	YES
14	Black-headed Canary	*Serinus alario*	YES	NO
15	Blacksmith Lapwing	*Vanellus armatus*	YES	YES
16	Black-throated Canary	*Crithagra atrogularis*	YES	YES

	Common Name	Scientific Name	SABAP2	Observed
17	Black-winged Stilt	*Himantopus himantopus*	YES	YES
18	Bokmakierie	*Telophorus zeylonus*	YES	YES
19	Booted Eagle	*Hieraaetus pennatus*	NO	YES
20	Bradfield's Swift	*Apus bradfieldi*	YES	NO
21	Brown-throated Martin	*Riparia paludicola*	YES	NO
22	Burchell's Courser	*Cursorius rufus*	YES	YES
23	Cape Bunting	*Emberiza capensis*	YES	NO
24	Cape Penduline Tit	*Anthoscopus minutus*	YES	YES
25	Cape Robin-Chat	*Cossypha caffra*	YES	NO
26	Cape Sparrow	*Passer melanurus*	YES	YES
27	Cape Teal	*Anas capensis*	YES	YES
28	Cape Turtle Dove	*Streptopelia capicola*	YES	YES
29	Cape Wagtail	*Motacilla capensis*	YES	NO
30	Capped Wheatear	*Oenanthe pileata*	YES	YES
31	Chat Flycatcher	*Melaenornis infuscatus*	YES	YES
32	Chestnut-vented Warbler	*Curruca subcoerulea*	YES	NO
33	Common Greenshank	*Tringa nebularia*	YES	NO
34	Common Ostrich	*Struthio camelus*	YES	NO
35	Common Quail	*Coturnix coturnix*	NO	YES
36	Common Swift	*Apus apus*	NO	YES
37	Desert Cisticola	*Cisticola aridulus*	YES	YES
38	Double-banded Courser	*Rhinoptilus africanus*	YES	YES
39	Dusky Sunbird	*Cinnyris fuscus*	YES	YES
40	Eastern Clapper Lark	*Mirafra fasciolata*	NO	YES
41	Egyptian Goose	*Alopochen aegyptiaca*	YES	YES
42	Fairy Flycatcher	*Stenostira scita*	YES	YES
43	Familiar Chat	*Oenanthe familiaris*	YES	YES
44	Fawn-colored Lark	*Calendulauda africanoides*	YES	NO
45	Greater Kestrel	*Falco rupicoloides*	YES	YES
46	Greater Striped Swallow	*Cecropis cucullata*	YES	NO
47	Grey Tit	*Melaniparus afer*	YES	NO
48	Grey-backed Cisticola	*Cisticola subruficapilla*	YES	YES
49	Grey-backed Sparrow-Lark	*Eremopterix verticalis*	YES	YES
50	House Sparrow	*Passer domesticus*	YES	YES
51	Jackal Buzzard	*Buteo rufofuscus*	NO	YES
52	Karoo Chat	*Emarginata schlegelii*	YES	YES
53	Karoo Eremomela	*Eremomela gregalis*	YES	YES
54	Karoo Korhaan	*Eupodotis vigorsii*	YES	YES
55	Karoo Long-billed Lark	*Certhilauda subcoronata*	YES	YES
56	Karoo Prinia	*Prinia maculosa*	YES	NO

	Common Name	Scientific Name	SABAP2	Observed
57	Karoo Scrub Robin	*Cercotrichas coryphoeus*	YES	YES
58	Karoo Thrush	*Turdus smithi*	YES	NO
59	Kittlitz's Plover	*Charadrius pecuarius*	YES	NO
60	Lanner Falcon	*Falco biarmicus*	YES	YES
61	Large-billed Lark	*Galerida magnirostris*	YES	YES
62	Lark-like Bunting	*Emberiza impetuani*	YES	YES
63	Laughing Dove	*Spilopelia senegalensis*	YES	YES
64	Layard's Warbler	*Curruca layardi*	YES	YES
65	Little Grebe	*Tachybaptus ruficollis*	YES	NO
66	Little Swift	*Apus affinis*	YES	YES
67	Long-billed Crombec	*Sylvietta rufescens*	YES	NO
68	Ludwig's Bustard	*Neotis ludwigii*	YES	YES
69	Martial Eagle	*Polemaetus bellicosus*	YES	YES
70	Mountain Wheatear	*Myrmecocichla monticola*	YES	YES
71	Namaqua Dove	*Oena capensis*	YES	YES
72	Namaqua Sandgrouse	*Pterocles namaqua*	YES	YES
73	Northern Black Korhaan	*Afrotis afraoides*	YES	YES
74	Pale Chanting Goshawk	*Melierax canorus*	YES	YES
75	Pale-winged Starling	*Onychognathus nabouroup*	YES	YES
76	Peregrine Falcon	*Falco peregrinus*	NO	YES
77	Pied Avocet	*Recurvirostra avosetta*	YES	YES
78	Pied Crow	*Corvus albus*	YES	YES
79	Pririt Batis	*Batis pririt*	YES	NO
80	Pygmy Falcon	*Polihierax semitorquatus*	YES	YES
81	Red Lark	*Calendulauda burra*	YES	YES
82	Red-billed Quelea	*Quelea quelea*	YES	YES
83	Red-billed Teal	*Anas erythrorhyncha*	NO	YES
84	Red-capped Lark	*Calandrella cinerea*	YES	YES
85	Red-faced Mousebird	*Urocolius indicus*	YES	NO
86	Red-headed Finch	*Amadina erythrocephala*	YES	NO
87	Rock Kestrel	*Falco rupicolus*	YES	NO
88	Rock Martin	*Ptyonoprogne fuligula*	YES	YES
89	Rufous-eared Warbler	*Malcorus pectoralis*	YES	YES
90	Sabota Lark	*Calendulauda sabota*	YES	YES
91	Scaly-feathered Weaver	*Sporopipes squamifrons*	YES	YES
92	Sclater's Lark	*Spizocorys sclateri*	YES	NO
93	Short-toed Rock Thrush	*Monticola brevipes*	NO	YES
94	Sickle-winged Chat	*Emarginata sinuata*	YES	YES
95	Sociable Weaver	*Philetairus socius*	YES	YES
96	South African Shelduck	*Tadorna cana*	YES	YES

	Common Name	Scientific Name	SABAP2	Observed
97	Southern Fiscal	*Lanius collaris*	YES	YES
98	Southern Grey-headed Sparrow	*Passer diffusus*	YES	NO
99	Southern Masked Weaver	*Ploceus velatus*	YES	NO
100	Speckled Pigeon	*Columba guinea*	YES	YES
101	Spike-heeled Lark	*Chersomanes albofasciata*	YES	YES
102	Spotted Eagle-Owl	*Bubo africanus*	YES	YES
103	Spotted Thick-knee	*Burhinus capensis*	YES	YES
104	Stark's Lark	*Spizocorys starki*	YES	YES
105	Three-banded Plover	*Charadrius tricollaris*	YES	YES
106	Tractrac Chat	*Emarginata tractrac*	YES	YES
107	Verreaux's Eagle	*Aquila verreauxii*	YES	NO
108	Wattled Starling	*Creatophora cinerea*	NO	YES
109	Western Bar Owl	*Tyto alba*	NO	YES
110	White-backed Mousebird	*Colius colius*	YES	NO
111	White-backed Vulture	*Gyps africanus*	YES	NO
112	White-browed Sparrow-Weaver	*Plocepasser mahali*	YES	NO
113	White-rumped Swift	*Apus caffer*	YES	YES
114	White-throated Canary	*Crithagra albogularis*	YES	NO
115	Yellow Canary	*Crithagra flaviventris*	YES	YES
116	Yellow-bellied Eremomela	*Eremomela icteropygialis*	YES	YES
Total				**83**

9.2 APPENDIX 2: SACNASP QUALIFICATION

SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Samuel David Laurence

Registration number: 400450/13

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule I of the Act)

Zoological Science	**20 November 2013**
Ecological Science	**20 November 2013**

COPY

20 November 2013
Pretoria

President

Executive Director