Appendix C2a:

Avifauna amendment report (Addendum to avifaunal specialist impact assessment)

Holland & Associates
Environmental Consultants

Impact Assessments - Environmental Management Programs - Compliance Monitoring - Process Review

Highlands South Wind Energy Facility (RF) (Pty) Ltd
Per Email: jasper@wkn-windcurrent.com

14 June 2021

Attention: Jasper Dick

Dear Jasper,

PROPOSED HIGHLANDS SOUTH WIND ENERGY FACILITY NEAR SOMERSET EAST, EASTERN CAPE PROVINCE: APPLICATION FOR AMENDMENT OF THE ENVIRONMENTAL AUTHORISATION (14/12/16/3/3/1/1960)

Addendum to the Avifaunal Specialist Impact Assessment

The specialist 'Highlands Wind Farm Pre-construction Bird Monitoring: Impact Assessment Report' prepared by Arcus Consultancy Services (Pty) Ltd on 27 July 2018, and updated on 4 October 2019, on behalf of WKN-Windcurrent South Africa (Pty) Ltd refers (Appendix 1).

1 Background

Highlands South Wind Energy Facility (RF) (Pty) Ltd received environmental authorisation (EA) on 21 January 2020 for the 90 MW Highlands South Wind Energy Facility (WEF) and its associated infrastructure west of the town of Somerset East within the Blue Crane Route Local Municipality in the Eastern Cape Province.

The infrastructure associated with the **90 MW Highlands South WEF**, as described in the Department of Environmental Affairs' (DEA) EA dated 21 January 2020, includes up to 15 turbines with a rotor diameter of up to 150 m, a hub height from ground level up to 135 m and blade length of up to 75 m and associated infrastructure including foundations, transformer hard standing areas, cabling between turbines, transformer substations, permanent and temporary laydown areas, operations & maintenance buildings, internal roads, fencing and lighting system.

The project is located within the Cookhouse Renewable Energy Development Zone (REDZ), therefore Basic Assessment processes were followed in line with GN R.114 in Government Gazette 41445 of 16 February 2018. The Basic Assessment processes for this and two associated projects, the Highlands Central WEF and the Highlands North WEF, as well as their three respective grid connections, was completed by Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus') in 2018/2019 and Environmental Authorisation for the proposed projects was granted by DEA in January and February 2020. An appeal was lodged against the EAs in February 2020. The Minister of Forestry, Fisheries and the Environment issued an appeal decision in April 2020, dismissing the appeal by the appellants and confirming the decision of the DEA to grant the EA to the Applicant.

Highlands South Wind Energy Facility (RF) (Pty) Ltd wishes to increase the maximum dimensions of the Wind Turbine Generators (WTG's) for the Highlands North WEF, in order to align to current international WTG models.

The avifaunal specialist that conducted the pre-construction monitoring and submitted the above-mentioned bird impact assessment report was Andrew Pearson, Senior Avifaunal Specialist for Arcus Consultancy Services South Africa (Pty) Ltd (Arcus). The aforementioned report was independently reviewed by avifaunal specialist Jon Smallie (Wildskies). Andrew Pearson has since left the avifaunal consulting industry and is no longer working as an avifaunal specialist. Ms Anja Albertyn of Holland & Associates has been appointed to undertake the re-assessment of potential impacts on avifauna associated with the proposed amendments. (Note: Ms Anja Albertyn was at the time of the pre-construction monitoring and Scoping & EIA Phase employed at Arcus in the capacity of Avifaunal Specialist and EAP (until March 2019), and worked on the project in both capacities, until leaving Arcus. Ms Albertyn is currently employed at Holland & Associates Environmental Consultants, also in the capacity of Avifaunal Specialist and EAP and is therefore familiar with the project, having been to site on several occasions during the environmental authorisation process, and also conducted a 3 day site visit in August 2020, to confirm avifaunal habitats and nest locations identified in the original bird impact assessment report, in order to inform the re-assessment of avifaunal impacts associated with the proposed amendments. This addendum to the original specialists assessment will be peer- reviewed by Jon Smallie of Wildskies, as per the original Pre-construction Bird Monitoring: Impact Assessment Report.

2 The Proposed Amendments

The Applicant proposes to amend the project description of the Environmental Authorisation (EA) as follows:

Table 1: Highlands South WEF: Proposed amendments to the project description

Component	Approved	Proposed amendment
Number of turbines:	Up to 15 turbines	Up to 12 turbines
Generation capacity of the WEF	Up to 90 MW	No change
Generation capacity per turbine	Up to 6 MW	Remove generation capacity per turbine
Rotor / blade diameters:	Maximum of 150 m	Maximum of 175 m
Hub height	Up to 135 m	Up to 180 m
Tip height	Up to 200 m	Up to 267.5 m
Foundation Size:	up to approximately 25 m x 25 m in total and up to 5 m deep per turbine	up to approximately 35 m x 35 m in total and up to 7 m deep per turbine
Hard Stand area per turbine:	5000 m^2	6000 m^2

Battery Storage	N/A (Not currently included in project description)	Battery energy storage system (BESS) adjacent to the substation on the temporary laydown area (with a footprint of approximately 1 ha, and a height of approximately 8 m).
Length of internal roads	approximately 50 km	approximately 45 km

In addition, the following amendments are proposed:

- Slight adjustments to the turbine positions in the preliminary approved layout are proposed, in order to minimise wake effects, as well as to avoid the proposed new blade length extending into areas identified as highly sensitive for birds and bats.
- The proposed battery storage technology, adjacent to the substation (on the temporary laydown area), would have a footprint of approximately 1 ha, and a height of approximately 8 m, and would include the following:

Type of Battery	:	Battery Storage Facility comprising Lithium-ion, Sodium-sulphur, Vanadium Redox Flow or an alternative battery technology
Life span of BESS	:	Assume the same as duration of facility
Motivation for BESS	:	Battery storage offers a wide range of advantages to South Africa including renewable energy time shift, renewable capacity firming, electricity supply reliability and quality improvement, voltage regulation, electricity reserve capacity improvement, transmission congestion relief, load following and time of use. In essence, this technology allows renewable energy to enter the base load and peak power generation market and therefore can compete directly with fossil fuel sources of power generation and offer a truly sustainable electricity supply option.
Footprint	:	Approximately 1 ha
Connection type	:	AC Connection on Grid
System Power	:	Up to 870 MWh (The larger project option)
No. of batteries used	:	Variable, preferably containerized systems
Inverters used	:	Specific type will be chosen according to performance requirements of use cases
Height of BESS	:	Approximately 8m

- Removal of Condition 17.1 (relating to the requirement of an Electromagnetic Compatibility (EMC) Control Plan for acceptance by the SKA-SA, for inclusion in the Final EMPr).
- Removal of Condition 42 which states that "*The development footprint must exclude the area identified as a potential target for the protected area expansion (NPAES)*.

According to the Applicant, the proposed amendments will not result in an increase in the size of the approved development footprint for the project. The EA currently states the following: "Surface

area to be covered (including associated infrastructure such as roads): Typically in wind energy facilities, the amount of surface area covered by turbines and associated infrastructure such as roads is less than 1% of the total site. The footprint of the facility is estimated at 51.4 ha". The development footprint with the proposed amendments would be approximately 48ha.

3 Terms of Reference

The Terms of Reference for the compilation of this Addendum letter to the existing specialist report are as follows:

- The implications of the proposed amendments, if any, in terms of the potential impacts within your area of expertise;
- A re-assessment of the significance (before and after mitigation) of the identified impact(s) in light of the proposed amendments (as required in terms of the 2014 EIA Regulations, as amended), for the construction, operational and decommissioning (where relevant) phases, including consideration of the following:
    - Cumulative impacts;
    - The nature, significance and consequence of the impact;
    - The extent and duration of the impact;
    - The probability of the impact occurring;
    - The degree to which the impact can be reversed;
    - The degree to which the impact may cause irreplaceable loss of resources;
    - The degree to which the impact can be avoided, managed or mitigated;
- The addendum to the report must include an impact summary table outlining the findings of the re-assessment in terms of the above-mentioned assessment criteria. The addendum report must include the impact summary tables for both the "Authorised project" (which would be from the original specialist report) and the proposed amended project, in the Addendum, for ease of reference and comparison between the two.
- A statement as to whether or not the proposed amendments will result in an increased level or change in the nature of impact, where such level or change in nature of impact was not assessed and included in the initial application for EA, or taken into consideration in the initial EA (within your area of expertise), and if so, how the significance would change.
- An outline of the potential advantages and disadvantages of the proposed amendments in terms of potential impacts (within your area of expertise)
- Provide confirmation as to whether or not the proposed amendments will require any changes or additions to the mitigation measures recommended in the original specialist report. If so, provide a detailed description of the recommended measures to ensure avoidance, management and mitigation of impacts associated with the proposed amendments.

4 Methodology

A three day site visit was conducted on 27 – 29 July 2020 to the project area, in order to identify any changes in land use since the original assessment, confirm avifaunal habitats and priority species nest activity on and surrounding the WEF site.

Potential impacts of the proposed amendments were identified and re-assessed using the same impact assessment methodology (Hacking 2001) that was used during the original assessment.

A review of the originally recommended mitigation measures was also conducted and updated where necessary in line with current best practice.

5 Results

5.1 Site visit

During the site visit the below large stick nest locations within 3 km of the WEF sites were visited and activity determined.

Ref	Species	Latitude / Longitude	Activity status	
			2017 - 2019	2020
N1	Verreauxs' Eagle	-32.678205 / 25.479486	Active	Active Adult pair present
N2	Verreauxs' Eagle	-32.656660 / 25.342739	Inactive	Inactive
N2b	Verreauxs' Eagle	-32.658053 / 25.345113	Active	Likely active. Pair flying above nest.
N5	Verreauxs' Eagle	-32.769651 / 25.325759	Active	Active. Chick on nest. Pair present.
N14	Verreauxs' Eagle	-32.657207 / 25.359364	Unconfirmed	Unconfirmed. No birds or recent signs of activity visible.
N15	Martial Eagle	-32.649960 / 25.381800	Likely active	Active. 2 adults, 1 sub-adult present.

No change in land use or avifaunal habitats was observed from 2019 conditions when traversing the site, and it was assumed that the avifaunal baseline identified from monitoring and site visits from 2017 to 2019, against which potential impacts were assessed in the 2019 bird impact assessment report, is still applicable.

5.2 Identification of potential impacts from the proposed amendments

The following table lists impacts that were identified in the original assessment, and details if the proposed amendments would impact any of these impacts. Any impacts, where a change in any of the ratings is possible, were re-assessed.

Impact assessed 2019	Proposed amendment that could influence impact rating	Re-assessment required
Construction Phase		

Habitat destruction	Adjustments to turbine positions could cause habitat destruction in sensitive areas. Reduction of turbine numbers could decrease overall habitat destruction.	Yes
Disturbance & Displacement	Adjustments to turbine positions could cause disturbance & displacement in sensitive areas. Reduction of turbine numbers could decrease overall disturbance and displacement.	Yes
Operational Phase		
Collisions with wind turbines	Adjustments to turbine positions, a change in the number of turbines, a change in rotor diameter, hub height and tip height, could all influence collision risk.	Yes
Collisions with power lines	Adjustments to turbine positions could result in changes to internal cabling routing into sensitive areas. The addition of battery storage could affect internal cable routing.	Yes
Electrocution	Adjustments to turbine positions could result in changes to internal cabling routing into sensitive areas. The addition of battery storage could increase electrocution risk.	Yes
Disturbance and Displacement	Adjustments to turbine positions could cause disturbance & displacement in sensitive areas.	Yes
Disruption of Local Bird movement patterns	Change in number of turbines, and rotor swept area size and height could change how local bird movement patterns are disrupted.	Yes
Decommissioning Phase		
Disturbance & Displacement	Adjustments to turbine positions could cause disturbance & displacement in sensitive areas.	Yes
Cumulative impacts		
Cumulative impacts	Combined changes to the project descriptions of the three Highlands WEFs (i.e. Highlands North WEF, Highlands central WEF and Highlands South WEG) and existing projects in the area could cause a change in impact significance ratings.	Yes

The addition of battery storage (i.e. Battery Energy Storage System (BESS) could result in potential habitat destruction, disturbance and displacement. However, since the BESS is proposed in an approved temporary laydown area, this has already been assessed, and the addition of a BESS would not lead to a change in the development footprint. The addition of a BESS could lead to an increase in collision with internal powerlines, and electrocutions, which is being re-assessed.

No additional impacts to those already assessed in the original Pre-construction Bird Monitoring: Impact Assessment Report were identified from the proposed amendments.

5.3 Re-assessment of Construction Phase Impacts

5.3.1 *Habitat destruction*

		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Original assessment	Without mitigation	M	L	M	NEG	H	M	M
	With mitigation	L	L	M	NEG	L	L	M
Proposed amendments	Without mitigation	M	L	M	NEG	H	M	M
	With mitigation	L	L	M	NEG	L	L	M
Additional mitigation measures: none All mitigation measures in the original assessment must be implemented								
No changes in the consequence, reversibility, irreplaceable loss of resources and if the impact can be avoided, managed or mitigated would occur with the proposed amendments versus the authorised project description.								

While the magnitude of habitat destruction is likely to be somewhat reduced with a reduction in the number of turbines, particularly for terrestrial species and passerines, this reduction is not of a magnitude that would change the significance rating of the impact, as long as all mitigation measures are implemented.

5.3.2 *Disturbance and displacement*

		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Original assessment	Without mitigation	M	L	L	NEG	M	M	M
	With mitigation	L	L	L	NEG	L	L	M
Proposed amendments	Without mitigation	M	L	L	NEG	M	M	M
	With mitigation	L	L	L	NEG	L	L	M
Additional mitigation measures: none All mitigation measures in the original assessment must be implemented								
No changes in the consequence, reversibility, irreplaceable loss of resources and if the impact can be avoided, managed or mitigated would occur with the proposed amendments versus the authorised project description								

While the magnitude and probability of overall disturbance and displacement is likely to be reduced with a reduction in the number of turbines, particularly for terrestrial species and passerines, this change is not of a magnitude that would change the significance rating of the impact, as long as all recommended mitigation measures are implemented.

5.4 Re-assessment of Operational Phase Impacts

5.4.1 *Collisions with wind turbines*

		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Original assessment	Without mitigation	H	M	M	NEG	H	M	M

	With mitigation	H	M	M	NEG	M	M	M
Proposed amendments	Without mitigation	H	M	M	NEG	H	M	M
	With mitigation	H	M	M	NEG	M	M	M
Additional mitigation measures: none All mitigation measures in the original assessment must be implemented								
No changes in the consequence, reversibility, irreplaceable loss of resources and if the impact can be avoided, managed or mitigated would occur with the proposed amendments versus the authorised project description.								

The original assessment was based on 15 turbines with a rotor diameter (RD) of up to 150 m being built, which equates to a rotor swept area (RSA) of up to 265,071.9 m^2. The proposed amendment to 12 turbines with a RD of 175 m would result in a total RSA for the Highlands South WEF of 288,633.8 m^2. This equates to a 8.9% increase in RSA. While an increase in rotor swept area does increase the collision risk area, it has been demonstrated that this does not necessarily translate into a direct increase in collision risk, and that other, local factors play a greater role in influencing collision risk and mortality rates, and that fewer larger turbines are preferable over more smaller turbines (Everaet 2014). Therefore, a change in 8.9% rotor swept area with a reduction of 20% in turbine numbers, is not expected to lead to a change in collision risk, as long as turbine placement considers avifaunal sensitivity areas, and all other mitigation measures are implemented as recommended.

5.4.2 *Collisions with power lines*

		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Original assessment	Without mitigation	H	L	M	NEG	M	M	M
	With mitigation	M	L	M	NEG	L	L	M
Proposed amendments	Without mitigation	H	L	M	NEG	M	M	M
	With mitigation	M	L	M	NEG	L	L	M
Additional mitigation measures: none All mitigation measures in the original assessment must be implemented								
No changes in the reversibility, irreplaceable loss of resources and if the impact can be avoided, managed or mitigated would occur with the proposed amendments versus the authorised project description.								

A reduction in the number of turbines may also decrease the length of internal cabling required, and thus potentially decrease the risk of collisions. However, this potential reduction would be too small to change the significance rating of the impacts. With the recommended mitigation measures, such as the burying of overhead powerlines wherever practically possible, there would be no change from the original assessment.

5.4.3 *Electrocutions*

		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Original assessment	Without mitigation	M	L	M	NEG	M	M	M

	With mitigation	M	L	M	NEG	L	L	H
Proposed amendments	Without mitigation	M	L	M	NEG	M	M	M
	With mitigation	M	L	M	NEG	L	L	H
Additional mitigation measures: none All mitigation measures in the original assessment must be implemented								
No changes in the consequence, reversibility, irreplaceable loss of resources and if the impact can be avoided, managed or mitigated would occur with the proposed amendments versus the authorised project description.								

A reduction in the number of turbines may also decrease the length of internal cabling required, and thus potentially decrease the risk of electrocutions. However, this potential reduction by three turbines would be too small to change the significance rating of the impacts. With the recommended mitigation measures, such as the insulation of electrical infrastructure and using bird friendly designs wherever burying of cables is not possible, there would be no change from the original assessment.

5.4.4 *Disturbance and displacement*

		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Original assessment	Without mitigation	M	M	M	NEG	M	M	L
	With mitigation	M	L	M	NEG	L	L	L
Proposed amendments	Without mitigation	M	M	M	NEG	M	M	L
	With mitigation	M	L	M	NEG	L	L	L
Additional mitigation measures: none All mitigation measures in the original assessment must be implemented								
No changes in the consequence, reversibility, irreplaceable loss of resources and if the impact can be avoided, managed or mitigated would occur with the proposed amendments versus the authorised project description.								

While the magnitude and probability of overall disturbance and displacement is likely to be reduced with a reduction in the number of turbines, particularly for terrestrial species and passerines, this change is not of a magnitude that would change the significance rating of the impact, as long as all mitigation measures are implemented as recommended.

5.4.5 *Disruption of Local Bird Movement Patterns*

		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Original assessment	Without mitigation	M	M	M	NEG	L	L	L
	With mitigation	M	M	M	NEG	L	L	L
Proposed amendments	Without mitigation	M	M	M	NEG	L	L	L
	With mitigation	M	M	M	NEG	L	L	L

Additional mitigation measures: none All mitigation measures in the original assessment must be implemented
No changes in the consequence, reversibility, irreplaceable loss of resources and if the impact can be avoided, managed or mitigated would occur with the proposed amendments versus the authorised project description.

As the probability of this impact occurring is already low, the reduction of turbine numbers is unlikely to have any effect on the ratings of this impact and the significance is deemed to remain unchanged.

5.5 Re-assessment of Decommissioning Phase Impacts

5.5.1 *Disturbance and Displacement*

		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Original assessment	Without mitigation	M	L	L	NEG	M	M	M
	With mitigation	L	L	L	NEG	L	L	M
Proposed amendments	Without mitigation	M	L	L	NEG	M	M	M
	With mitigation	M	L	L	NEG	L	L	M
Additional mitigation measures: none All mitigation measures in the original assessment must be implemented								
No changes in the consequence, reversibility, irreplaceable loss of resources and if the impact can be avoided, managed or mitigated would occur with the proposed amendments versus the authorised project description.								

While the magnitude and probability of overall disturbance and displacement is likely to be slightly reduced with a reduction in the number of turbines, particularly for terrestrial species and passerines, this change is not of a magnitude that would change the significance rating of the impact.

5.6 Cumulative re-assessment

		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Original assessment	Without mitigation	H	H	M	NEG	M	H	M
	With mitigation	M	H	M	NEG	L	M	M
Proposed amendments	Without mitigation	H	H	M	NEG	M	H	M
	With mitigation	M	H	M	NEG	L	M	M
Additional mitigation measures: none All mitigation measures in the original assessment must be implemented								
No changes in the consequence, reversibility, irreplaceable loss of resources and if the impact can be avoided, managed or mitigated would occur with the proposed amendments versus the authorised project description.								

No further developments have been approved or proposed within a 35 km of the Highlands WEFs since the original cumulative assessment (DEA, Q4 2020). The total rotor swept area (RSA) of the approved Highlands WEFs is 724,529.81 m^2 for a total of 41 turbines. The amendments to

the Highlands WEFs that are currently being proposed would lower the total turbine number by 17% to 34 turbines, and increase the total RSA by 11.4% to 807467.85 m^2. As discussed above, it is preferred for avifauna to have fewer larger turbines, rather than more smaller turbines, at the same RSA. Therefore, the reduction in turbine numbers is likely to balance out or even outweigh the increase in RSA. However, it is not expected that the level of any change would be significant enough to change any of the impact ratings. The significance rating of this impact is therefore not expected to be affected by the proposed amendments.

6 Conclusion

Overall, the proposed amendments have potentially different impacts on birds. The proposed increase in blade length would result in a larger rotor swept area, which increases the collision risk area of a turbine, and would be disadvantageous to avifauna. This is however offset by a decrease in turbine numbers, which is advantageous to avifauna. Any potential changes are not significant enough to change any of the impact assessment ratings. The proposed amendments will not result in an increased level or change in the nature of the impact.

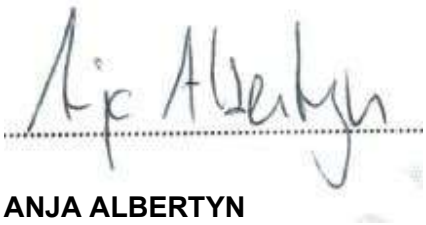
The significance of all identified and re-assessed impacts is therefore expected to be the same as in the original assessment with mitigations.

The mitigation measures as proposed in the original assessment (Arcus 2019) are valid and must be included in the EMPr for the proposed project. No additional mitigation measures are required for the proposed amendments.

Impact	Authorised project description significance rating with mitigation	Proposed amended project description significance rating with mitigation
Construction Phase		
Habitat destruction	Low negative	Low negative
Disturbance & Displacement	Low negative	Low negative
Operational Phase		
Collisions with wind turbines	Medium negative	Medium negative
Collisions with power lines	Low negative	Low negative
Electrocution	Low negative	Low negative
Disturbance and Displacement	Low negative	Low negative
Disruption of Local Bird movement patterns	Low negative	Low negative
Decommissioning Phase		
Disturbance & Displacement	Low negative	Low negative
Cumulative Assessment		
Cumulative impact	Medium negative	Medium negative

There is no reason why the proposed amendments should not be authorised from an avifaunal perspective.

Yours sincerely,



ANJA ALBERTYN

For: Holland & Associates - Environmental Consultants

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APPENDIX 1: 'Highlands Wind Farm Pre-construction Bird Monitoring: Impact Assessment Report' prepared by Arcus Consultancy Services (Pty) Ltd on 27 July 2018, and updated on 4 October 2019

Highlands Wind Farm Pre-construction Bird Monitoring: Impact Assessment Report

On behalf of

WKN Windcurrent SA (Pty) Ltd

27 July 2018
Updated: 04 October 2019

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

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Figure List

SPECIALIST DECLARATION

Andrew Pearson is an Avifauna Specialist at Arcus. Andrew has a four year BSc (hons. equivalent) in Conservation Ecology, certificates in Environmental Law, as well as ten years' experience as an environmental management professional, including over eight years as an Avifaunal Specialist.

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The specialist performed the work required in an objective manner, and declare that there are no circumstances which may compromise the objectivity in performing such work. Arcus has no business, financial or other interests in the proposed project except for financial compensation for specialist work conducted.

The Natural Scientific Professions Act of 2003 aims to "Provide for the establishment of the South African Council of Natural Scientific Professions (SACNSP) and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith." Andrew and Anja are professional members of the SACNSP, as detailed below:

Investigator:	Andrew Pearson (Pri.Sci.Nat)
Qualification:	BSc Conservation Ecology
Affiliation:	South African Council for Natural Scientific Professions
Registration number:	400423/11
Fields of Expertise:	Ecological Science
Registration:	Professional Member

Andrew Pearson

04 October 2019

CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	Page v Appendix II
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix II
(c) an indication of the scope of, and the purpose for which, the report was prepared;	1.1 & 2
(cA) an indication of the quality and age of base data used for the specialist report;	3.1 & 3.3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	7
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	3.3
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	3
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	3, Figures 2 & 11
(g) an identification of any areas to be avoided, including buffers;	Figure 11
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 11
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	3.2
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	5 & 8
(k) any mitigation measures for inclusion in the EMPr;	7, Tables 11-38
(l) any conditions for inclusion in the environmental authorisation;	8
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	7 & 8
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	8
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	1.2, 1.3 and 3.7
(p) any other information requested by the competent authority	1.3
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	NA

1 INTRODUCTION

WKN Windcurrent South Africa (Ltd) Pty ('WKN-WC') are proposing the Highlands Wind Energy Facility (WEF), and associated infrastructure including grid connection infrastructure (the Proposed Development), located near the town of Somerset East in the Eastern Cape Province (Figure 1). The Proposed Development Site is situated within the Cookhouse REDZ and the affected land parcels cover an area of approximately 11 180 hectares. The area of interest for development within these land parcels is approximately 9000 hectares.

WKN-WC appointed Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus') to conduct a pre-screening/feasibility assessment of the project site. Following a site visit and a desktop study a feasibility report was issued to WKN-WC in March 2017. WKN-WC thereafter appointed Arcus to conduct the required pre-construction bird monitoring for the project, the results of which have been used to advise the Environmental Impact Assessment (EIA) processes for the proposed development.

While monitoring covered the whole development site, for the EIA process the applicant has decided to split the project into three phases (North, South and Central) as discussed in more detail in the project description below. Each WEF phase was assessed separately and it was concluded that each phase can be approved (from an avifaunal perspective). This conclusion was made knowing that all 49 proposed turbine locations from all three phases cannot be built, due to capacity constraints on the grid connection lines, and to allow the applicant flexibility when choosing the optimal turbine positions that will ultimately be built. It is understood that the likely number of turbines to be constructed will be less than the potential 49 turbines being cumulatively applied for (depending on the final turbine model), and it is advised that it is preferable that less than 40 are constructed, from an avifaunal perspective.

1.1 Project Description

The proposed development consists of three phases: North, Central and South. For all three phases, turbines with a maximum height to blade tip of 200 m will be considered (a hub height of up to 135 m, and a rotor diameter of up to 150 m).

The proposed **Highlands North WEF** will comprise of 14 turbines with a maximum generation capacity of 6 MW per turbine. Internal roads will connect the turbines. On-site cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground. One on-site substation location (Substation A) will form part of this phase. Two route alternatives are proposed for the Grid Connection for Highlands North WEF. The maximum length will be 4 km with a 31 m wide servitude. A 300 m corridor surrounding the proposed line alternatives is to be assessed (150 m each side). The line will either be a 66 kV line, or a 132 kV line

The proposed **Highlands Central WEF** will comprise of 12 wind turbines, with each turbine having an installed maximum generation capacity of 6 MW per turbine. Internal roads will connect the turbines. On-site cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground. One on-site substation location (Substation B) will form part of this phase. An existing access road may require upgrading as part of this phase. Two route alternatives are proposed to connect Highlands Central WEF to the grid. The maximum length will be 6 km with a 31 m wide servitude. A 300 m corridor surrounding the proposed line alternatives is to be assessed (150 m each side).

The proposed **Highlands South WEF** will comprise of 15 wind turbines, with each turbine having an installed maximum generation capacity of 6 MW per turbine. Internal roads will connect the turbines. On-site cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground. One on-site substation location

(Substation C) will form part of this phase, and two route alternatives are proposed. It will be either a 66 kV line, and /or a 132 kV line. The maximum length of the line will be approximately 13 km with a 31 m wide servitude. A 300 m corridor surrounding the proposed line alternatives is to be assessed (150 m each side).

There are therefore 41 wind turbine positions proposed for approval across all three phases of the proposed development. However, it should be noted that this represents the number of turbines in the final mitigated layout, updated following the additional bird work conducted in 2019 (see section 1.3 below). The first 10 figures (Figure 1 – 10) in this report show an initial proposed layout of 49 turbines (17 in North WEF, 14 in Central WEF and 18 in South WEF). Figure 11 shows the final mitigated layout of 41 proposed turbine locations.

It is noted that a maximum of 140 MW can be bid in the Renewable Energy Independent Power Producer Procurement (REIPPP) programme. Furthermore, there are grid connection constraints on the existing lines in the area, and the REIPPP only allows for one grid connection per project. Therefore, if the projects are successful in obtaining Environmental Authorisation and are to be bid in the REIPPP, turbines from the Highlands Central WEF (Phase 2) will be combined with turbines either from Highlands North (Phase 1) or Highlands South (Phase 3), depending on meteorological data, for bidding as one project in the REIPPP. A second project (to connect to the second existing HV line on the project site) may also be bid, again drawing on turbine locations from one or more of the approved WEF sites.

There are two existing Eskom Transmission lines located within the Proposed Development Site boundary, one a 66 kV and the other a 132 kV. Both have a limited but available capacity, and both will be required to connect the Highlands WEF to the national grid. It is unknown at this stage how many turbines can connect to which line, based on uncertainty surrounding the available capacities on each line and the downstream constraints (for example the Eskom main transmission system (MTS) substations). The technical and financial feasibility for the optimum Project split can only be determined on finalising the ongoing analysis of meteorological data – this will ultimately determine whether the larger of the two projects connecting to the 132 kV line will be located to the north or the south of the smaller project connecting to the 66 kV line.

Pre-construction bird monitoring was conducted across the entire proposed development site (i.e. for all three WEF phases simultaneously) which included the grid connection corridor alternative locations, however separate avifaunal specialist impact assessments are produced for each phase, as well as one combined assessment which considered one WEF of up to a maximum of 40 turbines and 140 MW (but potentially split across two REIPPP project applications).

1.2 Objectors External Peer Review

AVISENSE Consulting, working for a consortium of objectors to the proposed developments, conducted an avifaunal peer review report (Jenkins, 2018[1]) and submitted this to the Department of Environmental Affairs (DEA), after submission of the Final EIA reports for decision making. Following which the DEA suspended the Highlands WEFs and grid connection applications, and asked the EAP and bird specialist to respond to the Avisense peer review. The applicable correspondence, comments and responses between the parties can be seen in the updated comments and responses report in Volume III – Revised Comments and Response Report (Part of the main EIA Application documents). Following this correspondence, the DEA uplifted the suspensions and requested Arcus to conduct additional avifaunal work.

[1] Jenkins, A. 2018. Peer review of the bird impact study for the proposed Highlands Wind Farm developments in Somerset East area of the Eastern Cape Province. AVISENSE Consulting, November 2018.

1.3 Additional 2019 Work

On 18 July 2019 the Department of Environmental Affairs overturned a suspension on the applications for the proposed developments. The lifting of the suspension letter required the applicant) to update the avifaunal specialist report (this document represents this update) following additional fieldwork, survey and modelling. The additional work required was the following:

- The specialist must consider and incorporate the Verreaux's Eagle Risk Model Analysis to augment the identification of impacts on avifauna.
- Scope of Cliff Survey: Figure 1 that was excluded from the avifaunal reports submitted with the final BARs must be considered and included in the reports.
- Further interrogation and strengthening of the approach used to identify no-go areas as well as impacts on site in light of the context of the site in relation to the CBA's and Protected Areas Expansion Strategy Area must be considered.
- Additional nest locations searches for Martial Eagle within 5 km of the site must be conducted.
- Findings of the additional work must be used to further determine/inform the demarcation of no-go areas, the location of turbine positions and all associated infrastructure.
- The avifaunal specialist must recommended practical mitigation measures for inclusion in the EMPr.
- The peer review done by Wildskies must be updated considering the updated Avifaunal report, following completion of all additional work above.

The avifaunal specialist specific comments taken from the DEA suspension uplift letter, and applicable responses are shown in the table below.

DEA Requirement	Specialist Response	Reference
The application must do the following: 1.The avifaunal study for all projects (14/12/16/3/3/1/1955; 14/12/16/3/3/1/1958; 14/12/16/3/3/1/1960) must be revised and strengthened to reflect the following aspects;	The avifaunal study was revised as per the requirements of the letter and additional work completed to strengthen the study.	Throughout this updated Specialist Assessment Report.
i. The specialist must consider and incorporate the Verreaux's Eagle Risk Model Analysis to augment the identification of impacts on avifauna.	The VERA specialist was contacted and ran the model for the proposed development. The results of the model have advised the updated report and the revised final mitigated layout.	Sections 3.6.1; 5.8.8; and 8. Appendix III Figure 11
ii. Scope of Cliff Survey: Figure 1 that was excluded from the avifaunal report must be submitted with the final BARs and must be considered and included in the reports.	The figure has been included in the report. It has also been further enhanced to show additional coverage and cliffs searched in 2019.	Figure 3
iii. Further interrogation and strengthening of the approach used to identify no-go areas as well as impacts on site in light of the context of the site in relation to the CBA's and Protected Areas Expansion Strategy Area must be considered.	The location of the site in context to CBA's and Protected Areas Expansion Strategy Area, specifically as they potentially relate to the avifauna biodiversity of the development site, was considered.	Section 5.7

DEA Requirement	Specialist Response	Reference
iv. Additional nest location searchers for Martial Eagle within 5 km of the site must be conducted.	Additional work to thoroughly search for Martial Eagle nests was conducted.	Section 3.3.4; 5.7.4
v. Findings of 1 (i) and 1 (ii) must be used to further determine/inform the demarcation of no-go areas, the location of turbine positions and all associated infrastructure.	Based on the results of VERA and the Martial Eagle nest search, the no-go areas were revised and an updated avifaunal sensitivity map was produced, to advise the final turbine layout.	Sections 3.3.4; 3.6.1; 5.8.4; 5.8.8; and 8. Figure 11
vi. The avifaunal specialist must recommend practical mitigation measures for inclusion in the EMPr.	These have been recommended in the various impact assessment tables.	Section 7 Tables 11-38 Section 8

1.4 Purpose and Aims

The purpose and aims of this report are to provide:

- A confirmation of the terms of reference adopted for the avifaunal study;
- Description of the monitoring programme as part of the impact assessment;
- Findings of the completed 12 month bird monitoring programme;
- Findings of the additional bird specialist work conducted in 2019;
- A description of the avifaunal status quo (i.e. the avifaunal baseline), including a description of avifaunal microhabitats available on site;
- A description of potential predicted impacts to avifauna;
- An impact assessment and significance rating for each impact and a cumulative impact assessment for all three development phases; and
- Recommendations and required mitigation measures for inclusion in the EMPr.

2 TERMS OF REFERENCE

The following terms of reference were utilised for the preparation of this report:

- Provide summarised results from the full 12 month bird pre-construction monitoring programme;
- Provide results of all additional work conducted in 2019 as requested by the DEA;
- Describe the proposed development site baseline with regard to avifauna for the study area, focussing on the characteristics which may be impacted upon by the proposed development during construction, operation and decommissioning;
- Describe the sensitivity of the baseline environment with regard to avifauna specifically with regard to the conservation status of species;
- Identify the Regional Red Data and priority species present and potentially present on the project site;
- Identify the nature of potential impacts (positive and negative, including cumulative impacts if relevant) of the proposed development on avifauna during construction and operation;
- Conduct a significance rating and impact assessment of identified impacts;
- Identify mitigation or enhancement measures to minimise impacts to avifauna or deliver enhancement from the proposed project; and
- Identify information gaps and limitations;

3 METHODOLOGY

The approach to the monitoring followed the requirements of the Best Practice Guidelines applicable at the time of the surveys (Jenkins *et al.* 2015) ('the guidelines') and those of the National Environment Management Act, 1998 (Act No 107 of 1998), as amended and the EIA Regulations (GNR 326 of 4 December 2014, as amended 7 April 2017). The monitoring approach was also advised by a site feasibility study for the proposed development site. This study (Arcus, 2017[2]), which included a short site visit and thorough desk-based review and was completed in March 2017, found that there were no fatal flaws evident that would exclude development of a WEF, but did highlight the potential for a number of sensitive species to be present as well as the need for the Verreaux's Eagle guidelines to be considered (as detailed in section 3.4).

The following terminology is used:

- **Priority species** = all species occurring on the Birdlife South Africa (BLSA) and Endangered Wildlife Trust (EWT) Avian Sensitivity Map priority species list (Retief *et al.* 2011 updated 2014). This list consists of 107 species with a priority score of 170 or more, and most likely to be affected negatively by WEFs. The priority score was determined by BLSA and EWT after considering various factors including bird families most impacted upon by WEFs, physical size, species behaviour, endemism, range size and conservation status;
- **Red Data species** = species whose regional conservation status is listed as Near-Threatened, Vulnerable, Endangered or Critically Endangered in the Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015);
- **Endemic or Near-endemic** = Endemic or near endemic (i.e. ~70% or more of population in South Africa) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BLSA Checklist of Birds in South Africa, 2014.

3.1 Defining the Baseline

The baseline avifauna environment for the proposed development site was defined utilising a desk-based study and informed by an initial feasibility/screening study (including specialist site visit) (Arcus, 2017), four seasons of thorough pre-construction bird monitoring and a specialist nest survey, as well as additional site work and nest searchers and survey in 2019. This information was examined to determine the potential location and abundance of avifauna which may be sensitive to development, and to understand their conservation status and sensitivity.

3.1.1 Sources of Information

- Bird distribution data of the Southern African Bird Atlas Project (SABAP-1) (Harrison *et al.* 1997) and Southern African Bird Atlas Project 2 (SABAP-2) obtained from the Avian Demography Unit of the University of Cape Town (Brooks 2018);
- Animal Demography unit (ADU) Co-ordinated Water-bird Count (CWAC) project (Taylor *et al.* 1999);
- ADU Co-ordinated Avifaunal Road counts (CAR)[3];
- The Important Bird Areas of southern Africa (IBA) project (Marnewick *et al.* 2015);
- Publically available satellite imagery;
- The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015);

[2] Bird and Bat Feasibility Study for the Proposed Highlands Wind Farm near Somerset East, Eastern Cape Province. Arcus Consultancy Services South Africa (Pty) Ltd on behalf of WKN Windcurrent South Africa (Pty) Ltd. Version 2: 23 March 2017.
[3] http://car.adu.org.za/index.php

- Results of the four seasonal surveys (summer, autumn, winter and spring) and nest survey conducted for the pre-construction avifaunal monitoring programme for the Highlands WEF.
- Results of additional field work including nest searching and survey conducted in 2019;
- Most recent publically available information regarding post-construction results from operational monitoring at wind farms in South Africa (Ralston Paton *et al.* 2017, BLSA 2017a; Sam Ralston Paton & Jon Smallie Pers. Com; BLSA, 2018);
- Nojoli Wind Farm Eastern Cape Operational Phase Bird and Bat Monitoring Programme (Smallie & MacEwan 2018);
- Final Report from the Amakhala Emoyeni Wind Farm Operational phase bird & bat monitoring programme (Smallie & MacEwan 2017);
- Cookhouse Wind Farm Operational Bird and Bat Monitoring Year 1 Final Report (IWS 2016); and
- Publically available peer reviewed literature on the effects of wind energy developments on birds.

3.2 Limitations and Assumptions

- The SABAP-1 data covers the period 1986 – 1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate. (For a full discussion of potential inaccuracies in SABAP data, see Harrison *et al.* 1997);
- 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), as well as information from BirdLife South Africa (BLSA) in the form of a presentation (2017a). Estimates of impacts are therefore also based on knowledge gained internationally, which should be applied with caution to local species and conditions;
- There is no guideline or standard scientifically reviewed method for extrapolating observed bird flight activity to a spatial set of sensitivity classes on a map. Flight sensitivity classes are also qualitatively assigned, and while for example a 'High Flight Sensitivity' area may represent an area where impacts are more likely, collisions are also possible in areas where there is little or no flight sensitivity. This is primarily due to the potential for inter-annual variation in bird activity, the sampling nature of the monitoring (i.e. monitoring is not conducted on site over all 365 days of a year) and the unpredictability of bird flight behaviour and inherent mobility of birds;
- While sampling effort was conducted as recommended in the guidelines, it represents only a small fraction of actual time, and to achieve statistically powerful results it would need to be increased beyond practical possibilities. The data was therefore interpreted using a precautionary approach.

3.3 Pre-Construction Bird Monitoring Survey Design

The monitoring programme was developed by Arcus to be in line with the latest best practice guidelines (Jenkins *et al.* 2015). Use of these guidelines is a requirement of the Department of Environmental Affairs (DEA) for assessment of proposed WEFs. Furthermore, in 2017 BLSA released species specific Verreaux's' Eagle Guidelines (BLSA 2017b). These guidelines become applicable "where a wind farm is proposed within potentially important Verreaux's Eagle habitat". It was the specialist's opinion, based on the results of the feasibility study, that the proposed project site meets this criterion and the guidelines should be followed. Therefore, these were considered in the design of the monitoring programme. The results of a screening study and site visit report (Arcus, 2017) was also considered when designing the surveys.

To obtain data for accurate 'before-after' comparison, the monitoring programme included data collection in a control area, at least 5 km from the nearest proposed turbines, and where there are no future known plans for renewable energy development.

Prior to the first seasonal survey, the avifaunal specialists visited the WEF site, control site, and surrounding areas between 15 and 17 May 2017 for the 'site set up' to confirm survey locations and effort. This visit confirmed that the locations and methods (as described below) were accessible and suitable.

The first seasonal survey was conducted from 18 to 30 May 2017 (autumn). This was followed by a specialist nest survey in winter between 11 and 14 July 2017. The second seasonal survey (winter) was conducted 11 – 25 August 2017, while the third (spring) survey was conducted from 30 October 2017 to 09 November 2017. The final summer seasonal survey was conducted between 16 and 28 January 2018. Additional site work, specifically to conduct more cliff surveys and search for possible Martial Eagle nest sites was conducted over 8 days by the specialist and a highly experienced field surveyor from 12-19 August 2019.

The standard seasonal bird monitoring was conducted by a team of four observers and comprised flight activity surveys from various Vantage Points (VPs), as well as walked transects, driven transects, and focal site surveys (Figure 2). Relevant species were also recorded incidentally in the course of travelling the length of the site and on route to survey locations.

Target species are those particular bird species that are to be recorded by a specific survey method. Target species per survey method:

- Vantage Point (VP) Surveys: all raptors; all large (non-passerine) priority species; all waterfowl (e.g. ducks and geese);
- Walked Transects (WT): all birds;
- Driven Transects (DT): all raptors; all large (non-passerine) priority species;
- Incidental Observations: all raptors; all large (non-passerine) priority species; and
- Focal Sites (FS): all species associated, utilising or interacting at/with the focal site.

The target species per method were recorded using the following methods, as described in more detail below.

3.3.1 Vantage Points

Six vantage points were surveyed on the project site, and one on the control site (CVP) (Figure 2). The location of the VPs was designed to maximise coverage of the inclusion areas identified by WKN-WC, taking into account accessibility.

Observer pairs monitored a viewshed of 360 degrees with a radius of at least 2 km from each VP. These viewsheds were the focus of observation, however if target species were noted beyond these (or if a species being recorded flew out of the viewshed but was still visible), they would also be recorded. For each flight of a target species the flight path was recorded on a large scale map along with data on the number/species of bird(s) and type of flight, flight duration and flight height. Flight heights were recorded through five height bands: 1: 0-20 m; 2: 20-40 m; 3: 40-120 m; 4: 120-200 m and 5: >200 m. In the analysis of flight data, height bands 2, 3 and 4 are considered to be within the potential Rotor Swept Height (RSH) of turbines, and fights within the RSH are considered to be at a higher risk of collision.

VPs on the development and control sites were monitored for 18 hours each per season[4], with a maximum of six hours per observer pair per day. This resulted in 72 hours per VP, and total of 432 hours of VP monitoring on the WEF site and 72 hours on the control site over the 1 year programme. VPs were always surveyed by a pair of observers, to prevent fatigue, increase safety and increase the quality of the data collected.

3.3.2 Walk Transects

To sample abundances and species richness of small terrestrial species, four walked transects of 1 km each in length on the development site and two on the control site, were established (Figure 2). WT1-WT3 were each conducted twice during each of the four seasonal surveys. WT4 was added at the start of the third (spring) survey, to increase the sampling effort in the north, and was conducted twice in spring and twice in summer.

Each time a WT was conducted, two observers walked between the start and end points of the transects whilst recording all birds seen or heard up to 150 m on either side of the transect. Beyond 150 m, only priority species were noted and were recorded as incidental sightings.

3.3.3 Drive Transects

To sample abundances of large terrestrial birds and raptors, three driven transect routes were conducted twice per season within and around the project site (DT1, DT2 and DT3) and one transect was conducted twice per season at the control site (CDT) (Figure 1). The length of each DT was as follows: DT1 = 5.44 km; DT2 = 9.36 km; DT3 = 5.22 km; and CDT = 8 km. Target species were recorded by driving slowly (+- 25 km/h) with all windows open, and stopping occasionally to listen and scan the surrounding environment. When a target species was located, a GPS co-ordinate was recorded along with the distance and direction from the vehicle to the observed bird and additional information such as weather conditions and habitat type.

3.3.4 Nest Searches and Survey

3.3.4.1 Cliff Nesting Birds

Firstly, the most prominent cliffs on the WEF site and bordering the site to the north were inspected by the specialist during the feasibility site visit on 16-17 March 2017. A more thorough and dedicated cliff nest survey was then conducted by an avifaunal specialist and assistant from 11 -14 July 2017. Additional cliffs were surveyed on an ongoing basis by the bird team during the standard seasonal site visits. Between 12-19 August 2019, all known Verreaux's Eagle nest sites were re-visited, some selected cliff lines were searched again, and any outstanding and relevant cliffs were searched. Figure 3 shows the locations of all cliffs and/or cliff lines on and around that have been thoroughly searched for the possible presence of cliff-nesting raptors, and particularly Verreaux's Eagle.

The cliff-nest survey methodology broadly followed the methods recommended in Malan (2009), and involved an initial desk-based screening using satellite imagery, to identify the location of possible cliffs. The specialist also utilised his knowledge of the site from the monitoring set up, prior to the autumn survey, to identify cliffs that required surveying. These areas were then visited (with the largest and most accessible cliff's generally being visited first) using a 4 x 4 and walking where possible. Cliffs were surveyed using a combination of 10 x 42 binoculars as well as a tri-pod mounted 20-60 x 60 Nikon Prostaff

[4] On the WEF site, VP5 was relocated after 15 hours in autumn to a better location (VP5b) which was used for the rest of the autumn season, the winter season and the spring season. For the last season, another location (VP5c) was used instead of VP5b.

5 fieldscope. The aim was to locate Verreaux's' Eagle nests (which are typically large), however the presence of any cliff nest (active or inactive) was noted if observed.

3.3.4.2 Martial Eagle

The Avisense peer review (Jenkins, 2018) revealed the historical location of a Martial Eagle nest and that the surrounding landowner of the proposed development site, confirmed recent sightings of this species in the area. From 12 and 19 August 2019, Arcus conducted a thorough search of suitable nesting substrate (i.e. large trees and power line infrastructure) within 5 km of the proposed WEF site, to try and locate Martial Eagle nests (while also searching for any other nests sites of priority species). The starting point for the search was the abandoned site (Figure 2) on Kamala Game Reserve, pointed out to Arcus by Mr. Clive Clever (who accompanied the specialist whilst on Kamala). The wooded valleys on the south eastern slopes of Bruintjieshoogte Mountain were also searched. The vehicular coverage obtained by the Arcus specialist in August 2019 is shown in Figure 3.

3.3.4.3 Other Priority Species

Nesting sites of all other cliff nesting birds were searched for during the cliff-nest surveys described above, however, the primary aim was to locate Verreaux's Eagle nests. Nest sites (or potential signs thereof) of non-cliff nesting priority species (e.g. Blue Cranes) were also continuously sought on an ongoing basis by the bird team during the standard seasonal site visits and by the specialist whenever traversing on or around the WEF site.

3.3.5 Focal Sites

Focal Sites (FS) may include cliff-lines, quarry faces, power lines, and stands of large trees, nest sites, dams, water points, marshes and wetlands.

Fourteen focal sites on and around the development site were surveyed. These comprised of seven dams (FS1-FS6, and FS8) and seven nest sites (N1-N7) (Figure 2). On the control site, two dams were surveyed as focal sites (CFS1 and CFS2). The amount of times each focal site was surveyed differed per season and per site, depending on importance and access restrictions.

FS1-F3, FS6 and FS8 were each surveyed eight times (i.e. twice per seasonal survey). FS4 and FS5 were each surveyed six times, as they were found to be dry in spring and summer, and were not surveyed in summer.

Each nest site (N1-N9) were surveyed at least once (i.e. during the nest survey in winter). Most nest sites were not surveyed in autumn, as they were only located after the nest survey in winter. N1 was surveyed again in summer. N2 was located prior to the autumn surveys (during feasibility site work) and was surveyed again in on two occasions in autumn, and two occasions in winter. N3 was surveyed twice in winter and once in summer. N4 was surveyed once in each of winter spring and summer, as was N5. N6 was visited twice in winter and once in summer. N7 was surveyed once in winter and once in spring. The Verreaux's Eagle nests N1, N2 and N5 were surveyed again in winter 2019.

When a focal site was visited, it was surveyed for approximately 15 min per visit, in order to record all species associated, utilising or interacting at/with the focal site at that time, and taking care not to record birds more than once. If required, additional time was spent at nest site focal sites to try to determine the status of the nest.

3.3.6 Incidental Observations

All other incidental sightings of priority species on the WEF site, control site and within the broader area were recorded and geo-referenced, along with additional relevant information such as weather and habitat type.

3.4 Identification of Potential Impacts

After collation of the baseline data from the source of information listed above the potential impacts of the project were identified (separately for the WEF and Grid Connection of each proposed phase), for the construction, operational and decommissioning phases.

The key potential impact types on avifauna from WEFs and associated grid connection infrastructure are:

- Collision with turbines;
- Electrocution;
- Collision with power lines;
- Disturbance and displacement;
- Disruption of bird movements; and
- Habitat destruction.

3.5 Impact Assessment Methodology

Each of the potential impacts (identified above and discussed in more detail in Section 6), on the baseline environment presented in Section 5, is assessed in Section 7 using the methodology provided by the Environmental Assessment Practitioner (Hacking 2001). For each impact, the significance was calculated by determining the probability and consequence for each impacts. The consequence considered the severity, duration and spatial scale of each impact. An indication of confidence in the assessment is provided and the status (neutral/positive/negative) of each impacts is indicated. All of the above is done for each impacts in the absence of any mitigation ('without mitigation'). Mitigation measures were identified and the significance was re-rated, assuming the effective implementation of the mitigation ('with mitigation'). The assessment 'without mitigation' assumes the worst case scenario in which the maximum proposed number of turbines for each phase is constructed anywhere in the proposed development site. The assessment 'with mitigation' assumes that all turbines are constructed outside of avifaunal no-go areas identified, and all additional mitigations described in the tables in Section 7 are also adequately implemented.

The assessment included determining the value of the avifaunal receptors. This was done primarily though the compilation of a list of focal species by considering factors such as abundance, behaviour on site, breeding and flight activity (i.e. by considering the survey results) as well as priority species status (as per Retief *et al.* 2014), Regional Red Data status (Taylor *et al.* 2015) and whether the species is endemic or range-restricted or not.

Cumulative impacts were assessed as the incremental impact of the proposed activity on the baseline presented in Section 5, when added to the impacts of other past, present or reasonably foreseeable future relevant activities in a 50 km radius. The following, operational, proposed or approved developments within 50 km were identified for consideration in the cumulative assessments:

- Operational 140 MW Cookhouse Wind Farm
- Operational 88 MW Nojoli Wind Farm
- Operational 134 MW Amakhala Emoyeni Wind Farm
    - Potential 140 MW Msenge Emoyeni Wind Farm (under same EA as Amakhala)
- Proposed Cookhouse II Wind Energy Facility[5]
- Proposed 140 MW Middleton Wind Energy Project

[5] It is our understanding that this project, was previously authorised as two separate wind farms 'the Great Fish River Wind Farm' and the Bedford Wind Farm' and has since been re-named as 'Nxuba Wind Farm' which has been selected as a preferred bidder in bid window 4 of the REIPPP programme.

- Proposed Golden Valley 1 and Golden Valley 2 Wind farms[6]
- 10mw Photovoltaic (PV) Solar Farm In Pearston
- 10 Mw Photovoltaic Solar Farm in Pearston on Erf 468-Portion of the Pearston Municipal Commonage.
- A 55MW PV Solar Farm And Associated Infrastructure On Portion 2 Of The Farm Kraan Vogel Kuil No.50, Pearston

Any publically available specialist, EIA or BA reports were obtained and reviewed in terms of avifaunal impacts, and included in the cumulative assessment.

3.6 Determination of Avian Sensitivity and No-Go Areas

Avifaunal Flight Sensitivity Zones were designated based on observed flight activity during 12 months of avifaunal VP monitoring sessions on the WEF site.

Observed flight sensitivity was determined by creating a Grid Cell Sensitivity Score (GCSS), falling within either a Low, Medium, Medium-High or High classification for a 200 m x 200 m grid covering the WEF site. The GCSS was derived by analysing the following characteristics of all mapped priority species and raptors flight lines passing through each grid cell:

- Priority species score and the number of individuals associated with each flight line;
- Risk height factor, which considered if the flight was within the Rotor Swept Height;
- The duration of the flight; and
- The length of the flight.

These factors were considered in the following equation to determine a Flight Section Sensitivity Score (FSSS), for each section of flight within a grid cell. The GCSS is the sum of these flight sections within the grid cell, giving a sensitivity score specific to the cell.

FSSS = PSS x N x (X/Y x D) x (P+1)
Where:

- PSS is the Priority Species Score (Retief *et al.* 2011, updated 2014).
- N is the number of birds that are associated with the flight line.
- X is the length of the flight line section that is within a particular Grid Square.
- Y is the length of the whole flight line.
- D is the duration of the whole flight.
- P is the proportion of the flight line at Risk Height.

Grid cells within the WEF site boundary without a GCSS did not have any recorded priority species flights passing through from the monitoring survey, either because no species were recorded, or they were beyond the viewsheds covered by VP watches.

The resultant GCSS scores were weighted to account for survey effort (which in this case was 72 hours per VP) and then categorised into Flight Sensitivity Zones as follows: low <500, medium <1250, med-high <2500, high 2,500 to 10,000, and very high >10,0000.

No-Go areas for turbines only (other infrastructure permitted) include nest buffers (dependent on species and as indicated in Table 7, where for example Verreaux's Eagle nests are buffered by 3 km and a Martial Eagle nest by 6 km); steep slopes and steep slopes buffered by 200m; cultivated lands and a 200 m buffer of National Freshwater Ecosystem Priority Areas (NFEPA) rivers and wetlands (including dams). They also include high and very high Flight Sensitivity Zones buffered by 50 m (to allow for some error in observer accuracy), as well as additional no-go areas identified in 2019 by the VERA modelling exercise.

[6] It is our understanding that one of these projects has been selected as a preferred bidder in bid window 4 of the REIPPP programme.

No-Go areas for all infrastructure are 1 km buffers around selected active nest sites and 1.5 km buffers around active Verreaux's Eagle nests sites, in line with applicable guidelines, and primarily intended to reduce disturbance and displacement impacts.

3.6.1 Verreaux's Eagle Risk Assessment (VERA) Model

The VERA model was developed by Dr. Meagan Murgatroyd under the supervision of the Sir Percy Fitzpatrick Institute of African Ornithology. It is intended to provide a prediction of likely use of an area by Verreaux's Eagle in relation to nest sites.

The locations of all known Verreaux's Eagle nests on (n=1) and around the development site (n=7) were provided to Dr. Murgatroyd, who used the most suitable and up-to date version of the model available at the time to run (See appendix III which gives details of the model).

3.7 Stakeholder Consultation

Birdlife SA has been consulted and is aware of the preconstruction monitoring methodologies. The Endangered Wildlife Trust and Vulpro were consulted during the bird feasibility study, particularly to request data. Vulpro provided the most up to date available Cape Vulture data for roost sites in the broader area. The specialist also had discussions with local birdwatchers, Greg Brown and Allan Collet, as well as various farmers and landowners to obtain local information. Additional stakeholders will be consulted and engaged accordingly, as part of the public participation process of the EIA, as and when required.

4 POLICY AND LEGISLATIVE CONTEXT

The legislation relevant to this specialist field and the proposed project is as follows:

4.1 National Environmental Management Act, No 107 of 1998 (NEMA).

South Africa's framework environmental act was established to provide for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.

Through the Environmental Impact Assessment (EIA) Regulations (2014, as amended), the act requires certain activities and developments to undergo an EIA process. Certain specialist studies are required, depending on the development type, scale and location. In the case of a WEF development, and avifaunal specialist study is required.

4.2 The Convention on Biological Diversity (CBD), 1993

A multilateral treaty for the international conservation of biodiversity, the sustainable use of its components and fair and equitable sharing of benefits arising from natural resources. The CBD is based on the precautionary principle which states that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat and that in the absence of scientific consensus the burden of proof that the action or policy is not harmful falls on those proposing or taking the action.

4.3 The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention), 1983

An intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale.

The fundamental principles listed in Article II of this treaty state that signatories acknowledge the importance of migratory species being conserved and agree to take action to this end "whenever possible and appropriate", "paying special attention to migratory species the conservation status of which is unfavourable and taking individually or in cooperation appropriate and necessary steps to conserve such species and their habitat".

4.4 The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 1999

An intergovernmental treaty developed under the framework of the Convention on Migratory Species (CMS), concerned the coordinated conservation and management of migratory waterbirds throughout their entire migratory range. Signatories of the Agreement have expressed their commitment to work towards the conservation and sustainable management of migratory waterbirds, paying special attention to endangered species as well as to those with an unfavourable conservation status.

4.5 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – Threatened or Protected Species List (TOPS)

Amendments to the TOPS Regulations and species list were published on 31 March 2015 in Government Gazette No. 38600 and Notice 256 of 2015. The amended species list excluded all species threatened by habitat destruction and which are not affected by other restricted activities, but included the following potentially relevant target species for this study:

Endangered – Martial Eagle, Ludwig's Bustard, Cape Vulture; *Vulnerable* – Denham's Bustard; *Protected* – Kori Bustard, Blue Crane.

4.6 Nature and Environmental Conservation Ordinance (No. 19 of 1974)

Developed to protect both animal and plant species within the province which warrant protection. These may be species which are under threat or which are already considered to be endangered. Is applicable in the Eastern Cape and lists birds which are protected.

4.7 The Civil Aviation Authority Regulations, 2011

These are relevant to the issue of lighting of wind energy facilities, and to painting turbine blades, both of which are relevant to bird collisions with turbine blades.

4.8 The Equator Principles (Eps) III, 2013

The principles applicable to the project are likely to include:

- Principle 2: Environmental and Social Assessment;
- Principle 3: Applicable Environmental and Social Standards;
- Principle 4: Environmental and Social Management System and Equator Principles Action Plan;
- Principle 8: Covenants.

These principles, among various requirements, include a requirement for an assessment process (e.g. EIA process), an Environmental and Social Management Plan (ESMP) to be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards, and the appointment of an independent environmental expert to verify monitoring information.

5 BASELINE AVIFAUNAL ENVIRONMENT

The baseline avifauna environment was determined for the proposed development site as a whole (i.e. the area covering all three WEF phases) by considering a number of data sources. The primary data source, upon which most emphasis was placed was the recent pre-construction bird monitoring programme.

5.1 Southern African Bird Atlas Project 1

The SABAP1 data was collected between 1986 and 1997 and is one of the best long term data sets on bird distribution and abundance available in South Africa at present[7]. This data was collected in quarter degree squares, with the proposed development covering the following squares: 3225CB and 3225CD. Table 1 indicates the reporting rate for all raptors and priority species as well frequently recorded aerial foragers and waterbirds within these squares.

Table 1: All Priority Species and Raptors, as well as frequently recorded Aerial Foragers and Waterbirds recorded in the SABAP1 Quarter Degree Squares covering the Proposed Development Site

Species	Regional Red Data Status (Taylor *et al.* 2015)	Priority Species Score	QDGS Report rate (%) **	
			3225CB	3225CD
Total species			*162*	*135*
Number of cards submitted			*26*	*8*
Wind Farm priority species or raptors				
Stork, White		220	19	-
Stork, Black	VU	330	4	-
Secretarybird	VU	320	4	50
Kite, Black-shouldered		174	31	63
Eagle, Verreaux's	VU	360	15	13
Eagle, Booted		230	-	25
Eagle, Martial	EN	350	4	38
Buzzard, Steppe		210	31	38
Buzzard, Jackal		250	23	25
Goshawk, Pale Chanting		200	35	88
Harrier, Black	EN	345	-	25
Harrier-Hawk, African		190	4	-
Falcon, Peregrine		240	4	-
Kestrel, Rock			58	75
Kestrel, Lesser		214	8	25
Francolin, Grey-winged		190	-	13
Crane, Blue	NT	320	4	50
Bustard, Denham's	VU	300	4	-

[7] Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1: Non-passerines. BirdLife South Africa, Johannesburg.

Species	Regional Red Data Status (Taylor *et al.* 2015)	Priority Species Score	QDGS Report rate (%) **	
			3225CB	3225CD
Bustard, Kori	NT	260	-	13
Bustard, Ludwig's	EN	320	4	38
Korhaan, Karoo	NT	240	4	-
Korhaan, Black (Southern)	VU	270	4	50
Owl, Spotted-Eagle		170	8	-
Kite, Yellow-billed			8	-
Owl, Western Barn			-	13
Frequently recorded aerial foragers				
Swallow, Greater-striped			62	63
Swallow, Barn			27	38
Swift, Little			15	38
Swift, Alpine			12	13
Martin, Rock			27	88
Frequently recorded waterbirds				
Duck, African Black			35	25
Duck, Yellow-billed			15	25
Hamerkop			31	50
Goose, Egyptian			19	63
Shelduck, South African			54	63
Cormorant, Reed			31	-
Heron, Black-headed			42	38

* Report rates are percentages of the number of times a species was recorded in a square, divided by the number of times that square was counted. It is important to note that these species were recorded in the entire two quarter degree squares of which only a portion covers the proposed development site.

Important priority species with relatively high reporting rates are: Blue Crane, Ludwig's Bustard, Southern Black Korhaan, Martial Eagle, and Secretarybird. It is worth noting that three bustard species have been recorded in the area.

5.2 Southern African Bird Atlas Project 2

The Southern African Bird Atlas Project 2 is part of an on-going study by the Animal Demography Unit, a research unit based at the University of Cape Town. SABAP2 data was examined for the pentads (which are roughly 8 km x 8 km squares, and are smaller than the squares used in SABAP1) extending over any part of, or bordering the site for which data exist. These are pentads 3235_2515 (2 cards), 3235_2525 (1), 3240_2515 (3), 3240_2520 (5), 3240_2525 (4), 3245_2515 (1), 3245_2520 (5), 3245_2525 (8), and 3250_2520 (1 card) (Figure 1). A total of 30 full protocol cards[8] have been submitted for these pentads. The SABAP 2 data recorded a total of 193 species across these pentads including 20 priority species (Table 2).

[8] The number of 'cards' indicates the number of times a particular pentad has been counted by a citizen scientist, for a at least a total of 2 hours, and a list of the birds recorded has been produced, submitted to the ADU and verified.

Table 2: SABAP2 recorded Priority Species and Raptors, as well as frequently recorded Aerial Foragers and Waterbirds in 9 Pentads in and around the Proposed Development Site

Species	Regional Red Data Status	Endemic / Near-Endemic	Priority Score	Reporting Rate (%) (from 30 cards in 9 pentads)
Priority species or raptors				
Bustard, Kori	NT		260	10.0
Bustard, Ludwig's	EN		320	26.7
Buzzard, Steppe			210	10.0
Buzzard, Jackal		X	250	30.0
Crane, Blue	NT		320	50.0
Eagle, African Fish			290	13.3
Eagle, Booted			230	10.0
Eagle, Martial	EN		350	3.3
Eagle, Verreaux's	VU		360	23.3
Falcon, Lanner	VU		300	6.7
Francolin, Grey-winged			190	3.3
Goshawk, Gabar			-	3.3
Goshawk, Pale Chanting			200	40.0
Harrier, Black	EN	X	345	3.3
Harrier-Hawk, African			190	13.3
Kestrel, Greater			174	Ad hoc
Kestrel, Rock			-	60.0
Kite, Black-shouldered			174	10.0
Korhaan, Karoo	NT		240	3.3
Korhaan, Southern Black	VU	X	270	26.7
Owl, Spotted Eagle-			170	3.3
Secretarybird	VU		320	30.0
Frequently recorded aerial foragers				
Martin, Brown-throated				13.3
Martin, Rock				56.7
Swallow, Barn				20.0
Swallow, Greater Striped				26.7
Swallow, Pearl-breasted				13.3
Swallow, White-throated				20.0
Swift, African Black				10.0
Swift, Alpine				13.3
Swift, White-rumped				20.0

Species	Regional Red Data Status	Endemic / Near-Endemic	Priority Score	Reporting Rate (%) (from 30 cards in 9 pentads)
Frequently recorded waterbirds				
Cormorant, Reed				10.0
Duck, African Black				10.0
Duck, Yellow-billed				36.7
Goose, Egyptian				73.3
Grebe, Little				16.7
Heron, Black-headed				10.0
Heron, Grey				33.3
Lapwing, Blacksmith				36.7
Plover, Three-banded				43.3
Shelduck, South African				20.0
Spoonbill, African				13.3
Stilt, Black-winged				13.3

The pentad with the highest number of cards (Pentad 3240_2535 with 25 cards) in the broader area was also consulted (Figure 1). Priority species recorded in this pentad but not listed above are Buff-streaked Chat (18.18%), Crowned Eagle (40.91%), Black Sparrowhawk (45.45%) and White Stork (18.18%) and Cape Vulture (4.55%). Verreaux's Eagle has a reporting rate of 36.36% in this pentad and Martial Eagle 22.73%. As this pentad covers similar habitat as the proposed development site and is less than 20 km from the site boundary, it is possible that these species may also occur there.

5.3 Important Bird Areas (IBA) Project

The proposed development site does not fall within a BLSA Important Bird and Biodiversity Area (IBA). The Camdeboo National Park IBA lies approximately 75 km to the North West of the development site and is the closest IBA, while the Amatola-Katberg Mountain IBA is approximately 100 km east north east of the project site. While some larger species may move between the general project area and these IBA's, this is unlikely, and data from these IBA's will not provide any further information to advise the study, and is therefore not considered further in this study.

5.4 Coordinated Avifaunal Roadcounts (CAR)

CAR counts comprise a census of birds (focussed on large terrestrial species) performed twice annually (in winter and summer) by volunteer birdwatchers. The purpose is to provide population data for use in science, especially conservation biology, by determining findings about the natural habitats and the birds that use them.

There are three car count routes (ES03, ES07 and ES11) within 15 km of the proposed development site.

Table 3 shows summarised results for priority species from the last 10 years of surveys (2008-2017) across all three routes. Generally, each route was conducted twice per year (in winter and in summer), with a total of 2147.5 km having been driven. An indication of the average Index of Kilometric Abundance (IKA) is given, which shows that the average

IKA for priority species on these routes was ~0.32 birds/km, which represents a relatively moderate to low density in the specialists experience.

Table 3: Total Numbers of Birds of Priority Species Recorded in Winter and Summer across three CAR Routes between 2008 and 2017

	Summer				Winter				Total Birds	Total IKA
Row Labels	**ES03**	**ES07**	**ES11**	***Total***	**ES03**	**ES07**	**ES11**	***Total***		
Black Harrier							1	*1*	**1**	0.0005
Black Stork	1			*1*				-	**1**	0.0005
Blue Crane	26	44	60	*130*	97	18	126	*241*	**371**	0.1728
Denham's Bustard					7	2	1	*10*	**10**	0.0047
Karoo Korhaan	24			*24*	49	1		*50*	**74**	0.0345
Kori Bustard	3	5		*8*	5	2		*7*	**15**	0.0070
Ludwig's Bustard	16	2	11	*29*	37	18	4	*59*	**88**	0.0410
Northern Black Korhaan					2			*2*	**2**	0.0009
Secretary Bird	2	6	1	*9*	5	1	1	*7*	**16**	0.0075
Southern Black Korhaan	15	9	31	*55*	11	5	6	*22*	**77**	0.0359
White Stork	12	1	11	*24*				-	**24**	0.0112
Grand Total	**99**	**67**	**114**	***280***	**213**	**47**	**139**	***399***	**679**	**0.3162**

Generally, more priority species bird were recorded in winter. This is not overly surprising, as one of the most conspicuous (and easy to spot) larger terrestrial bird, the Blue Crane, gathers in large flocks in winter, and much higher numbers of this species were recorded in winter. Blue Crane had the highest IKA (0.17 birds/km), followed by Ludwig's Bustard (0.04 birds/km) and Southern Black Korhaan (0.036 birds/km). It is noted that White Stork and Black Stork were only recorded in summer, while Denham's Bustard was only recorded in winter.

5.5 Coordinated Waterbird count (CWAC) data

Coordinated Waterbird Counts (CWAC) consist of a programme of mid-summer and midwinter censuses at a large number of South African wetlands. The counts are conducted by citizen scientists at more than 400 wetlands around the country and provide a useful source of information on wetland bird species in South Africa. There are no CWAC sites within 60 km of the proposed development site, and therefore this data set is not deemed relevant, and is therefore not considered further in this study.

5.6 Bird Microhabitats

In order to determine which bird species are more likely to occur on the proposed development site, it is important to understand the habitats available to birds at a smaller spatial scale, i.e. micro habitats. Micro-habitats are shaped by factors other than vegetation, such as topography, land use, food sources and man-made factors.

Aerial photographs, satellite imagery, a vegetation type layer[9], supplemented by three different site visits by the bird specialist and four seasonal site surveys by the observer

[9] Mucina and Rutherford, 2012.

team, has been used to identify the following micro-habitats[10] on the proposed development site:

5.6.1.1 Open Grasslands

The majority of the proposed site falls within the 'Bedford Dry Grassland' Vegetation type. Open grasslands (whether disturbed or natural, depending on land use practises), are a dominant avifaunal micro-habitat on the site. These areas may be important for various priority species including Blue Crane, Denham's Bustard, Ludwig's Bustard, Secretarybird, Southern Black Korhaan, Lanner Falcon, Martial Eagle, Black Harrier, Black-shouldered Kite, Jackal Buzzard, as well as numerous passerines such as larks, pipits and cisticolas.

5.6.1.2 Thicket and Scrub

Thicket vegetation is prevalent on the site, particularly associated with slopes and valleys to the west of the proposed development site. These areas generally coincide with the 'Camdeboo Escarpment Thicket' vegetation type. Thicket and Scrub is utilised by smaller passerine birds such as larks, chats, eremomelas, prinias, robin-chats and shrikes. A variety of raptors may also forage over these areas, such as Southern Pale Chanting Goshawk, Jackal Buzzard, Martial Eagle and Verreaux's Eagle.

5.6.1.3 Cultivated Fields and Pastures

Limited areas of irrigated agricultural land and pastures occur around farmhouses or associated with watercourses and rivers. These areas may provide a feeding ground for many species of birds, as land preparation makes insects, seeds, bulbs and other food sources readily available. This habitat type may be used by cranes, ibises, herons, storks, egrets, geese, francolins and a variety of passerine species. Most importantly, flocks of Blue Crane and White Stork may congregate in cultivated fields.

5.6.1.4 Rivers and Drainage Lines

There are no major rivers on or near the proposed development site. Smaller rivers, streams and drainage lines in the area may not always carry water, these features are dominated by denser and taller riparian scrub and generally have a higher abundance of bird life than the surrounding vegetation. Drainage lines, streams and rivers may form flyways for amongst others, ibises, ducks, cormorants, geese and storks, while riparian scrub will host a number of smaller passerine species. Rivers responsible for eroding cliff faces into the landscape may also therefore indirectly provide roosting and nesting habitat for geese, ibises, herons, storks, Hamerkop and raptor species such as Rock Kestrel, Verreaux's Eagle, African Harrier Hawk and Jackal Buzzard.

5.6.1.5 Farm Dams

Dams are important attractions for various bird species in the South African landscape, and are often the only source of water during the dry season in the area. A number of dams are present on the proposed development site and were found to attract various waterfowl, such as shelduck, geese and ducks. Storks, African Spoonbill, herons and egrets may also frequent these water bodies, as well as fish-eating raptors such as African Fish Eagle. Blue Cranes are known to use farm dams as roost sites.

5.6.1.6 Ridges and/or Cliffs

Long ridges run north to south along the western boundary of the proposed development site. An escarpment running north east to south west borders the development site to the

[10] Except for Natural Forest, which is only present in the broader area and not on the proposed development site.

north. The central and eastern area of the site has less hills and ridges, and is more open and flat.

The hills and ridges are important for various raptors, e.g. Rock Kestrel, African Harrier Hawk, Jackal Buzzard and Verreaux's Eagle, that may use the slopes for soaring and to gain lift. Rocky outcrops and cliffs may be important nesting habitat for various raptors, including Verreaux's Eagle, which is likely to spend time hunting along rocky outcrops and ridges. Black Stork may also nest on suitable cliffs. Rocky ridges are also home to Rock Hyrax ('Dassie') an important prey species of Verreaux's Eagle, which may hunt regularly in these areas. While most of the extensive, and large cliff faces are north of the site, there are some rocky areas and cliffs on the site itself. Dassies will frequent these areas, which are may attract foraging Verreaux's Eagles.

5.6.1.7 Farmsteads and Feeding Kraals

Farmsteads are disturbed areas surrounding farm houses or areas of human activity, while feeding kraals are areas where livestock gather for food, shelter and water provided by the farmers. These habitats are frequented by small passerine birds such as sparrows, starlings, doves, weavers and larks but also by egrets, ibis, crows and guineafowl. Farmsteads are utilised by a variety of raptors such as Black-shouldered Kite and Barn Owl, which prey on various rodent species that occur in these areas.

5.6.1.8 Stands of Alien Trees

Stands of alien trees such as poplars and blue gums occur scattered around the site, mainly near farmsteads, rivers and drainage lines. These may be utilised as roosts and/or perches by raptors such as Verreaux's Eagle, Martial Eagle and Jackal Buzzard, and also frequented by a variety of passerines such as doves, starlings and weavers.

5.6.1.9 Natural Forest

While forest habitat was not observed on site, it is present in the broader area, particularly on the slopes of the large mountain ranges to the north and north east (e.g. Bruintjieshoogte and Boschberg). Forests may hold breeding raptors such as Martial Eagle, Crowned Eagle and sparrow-hawks, while forest associated species such as Fork-tailed Drongo, Olive Bush-shrike, Terrestrial Brownbul, Klaas's' Cuckoo, Tambourine Dove, Forest Canary and Grey Cuckoo-shrike are likely to be present. In similar forest (approximately 22 km east north east from the proposed site), a Martial Eagle nest and a Crowned Eagle nest (respective approximate locations: -32.695167°S; 25.622992°E and -32.692940°S; 25.630563°E) have been located on the farm Glen Avon (pers. comm. Greg Brown).

5.7 Critical Biodiversity Area (CBA) and National Protected Areas Expansion Strategy (NPAES) Area

A large portion of the WEF site, particularly in the central and north area, overlaps with a tier 2 CBA which is aimed at maintaining the broad-scale connectivity of the landscape. According to the ecology specialist report the CBA is designated for the maintenance of ecosystem processes and not to protect biodiversity patterns as the area does not have any features of known high significance in this regard (i.e. rare habitats or an abundance of localized or endangered species). This is also true for bird biodiversity in the area, and our data collection has shown that the WEF site (including that falling within the CBA), does not have a significantly high abundance of localised or endangered bird species. There are no rare bird habitats on the WEF site, that are restricted to the site, and the majority of the available bird habitats are well represented beyond the site in the broader area.

Indeed the ecology specialist noted 'Although the development would result in some habitat loss within the CBA within the Highlands North and Highlands Central WEF, this is not likely

to compromise the overall functioning of the CBA as it is very large and the development occupies a very small proportion of the CBA'.

It is also noted that the majority of the development lies within a NPAES focus area. However, the extent of the proposed Highlands development would not, according to the ecology specialist, significantly impact ability to meet conservation targets elsewhere within the focus area which is large in comparison with the development site.

The presence of the CBA and NPAES focus area, does not have an influence on the significance of potential impacts to avifauna, as previously assessed. These areas also do not have any influence on the avifaunal no-go areas as described elsewhere in this report.

5.8 Pre-construction Monitoring Results

5.8.1 Vantage Points

During VP watches on the WEF site in the final summer season survey, 321 flights of target species were recorded totalling 841 birds, and this equates to an average of 3 target bird flights and 7.8 target birds per hour over the 108 hours of observation. If only priority species are considered, there were 258 flights (2.4 flights/hour) and 739 birds (6.8 birds/hour) recorded in summer. This is a substantially higher passage rate than what was observed in the previous three seasons. In autumn 116 target species flights were recorded (totalling 152 birds) during observations on the WEF site (an average of 1.4 target birds per hour). In winter 213 target species flights were recorded (totalling 261 birds) during observations on the WEF site (an average of 2.4 target birds per hour), while in spring 179 flights totalling 246 birds were recorded at an average 2.3 target birds per hour of observations.

The higher activity observed in summer was primarily due to the presence of summer migrants e.g. Lesser Kestrel, Amur Falcon and Steppe Buzzard.

Across all four seasonal surveys a total of 809 flight paths from 32 positively identified target species have been recorded on the proposed development site, totalling 1475 individual birds[11]. This equates to approximately 3.41 target species birds per hour of observation. Recorded flights paths are presented in Figures 3 – 7.

For priority species only (including unidentified raptors which are likely priority species), the overall passage rate on the WEF is calculated as 2.75 birds/hour of observation. Considering that the data is heavily skewed by the influx of summer migrants, if one removes Amur Falcon and Lesser Kestrel for the calculation, the resultant passage rate for the remaining priority species is calculated at 1.60 birds/hour on the WEF site.

Generally, these figures discussed above represent a moderate to high level of flight activity compared to other sites in South Africa in the specialists' experience. Compared with sites in the Eastern Cape, the activity is also moderate to high in general, with some sites reporting lower activity and other similar or even higher levels of flight activity. For example, at a site in the Coega IDZ 1.15 target species birds/hour were recorded, while at a site south of Middleton, 1.17 birds/hour were recorded. At another proposed WEF in the Coega IDZ Arcus recorded an average of 1.2 birds/hour. At Jeffrey's bay wind farm flight activity pre-construction was 4.69 birds/hour, a figure that was inflated by the presence of Amur Falcons, but is higher than what has been recorded at the proposed Highlands WEF. Caution must be taken when interpreting passage rates of birds/hour as it is greatly influenced by large flocks, especially flocks of Blue Crane and Ludwig's Bustard which usually flew low, and in lower valleys away from turbine locations, as well as flocks of Lesser Kestrel and Amur Falcon, which were only present in summer. The 32 VP target

[11] A flock of birds flying together is recorded as a single flight path. However, the majority of flight paths to date were of a single bird, with two flights (both by Southern black Korhaan) recording 2 birds each.

species recorded included 11 Red Data species, four of which are *Endangered* (Cape Vulture, Martial Eagle, Ludwig's Bustard and Black Harrier). A total of 23 priority species were recorded from VPs, which is a relatively high number in the specialist's experience, compared to other South African sites, but a moderate number when compared to Eastern Cape sites. At a proposed WEF in the Coega IDZ we recorded 17 priority species after three seasonal surveys. At a site near Riebeek East, 28 priority species were recorded after five site visits. A site near Murraysburg (although not in the eastern cape) recorded 24 priority species during 1 year of surveys, while surveys on a site near Elliot recorded 25 priority species after only two seasonal surveys Table 4 shows a summary of the VP flights recorded for each target species on the WEF site, as well as an indication of the flights potentially at Rotor Swept Height (RSH).

Analyses of flight paths indicate that while target species utilised various height categories, 76% of target species flights included at least some time at RSH. This is a moderate amount of flights in the potential risk zone, and may be indicative of the species recorded, as raptors (the group of birds most recorded) do tend to fly at risk height while soaring, hovering, and gliding and change heights regularly.

While data was collected on the control site, it is not analysed and presented here as it is not required for purposes of assessing the proposed development site. This data is kept and will be analysed to compare with operational phase data for before /after comparisons. In general, a similar suite of priority species were recorded at the control site, and similar levels of flight activity were recorded.

Table 4: Flight Path Target Species

Species	Species Priority Score	Red List Status (Taylor *et al.* 2015)	Total no. of Flight paths	Total no. of birds recorded*	Max. Flock Count	Flights with a portion at RSH (% at RSH)	Flights per hour of observation	Birds per hour of observation
African Fish Eagle	290	-	3	3	1	2 (67%)	0.007	0.007
African Spoonbill	-	-	5	7	2	3 (60%)	0.012	0.016
African Harrier Hawk	190	-	5	6	2	4 (80%)	0.012	0.014
Amur Falcon	210	-	79	348	30	49 (62%)	0.183	0.806
African Sacred Ibis	-	-	3	14	8	2 (67%)	0.007	0.032
Black-chested Snake Eagle	230	-	10	10	1	8 (80%)	0.023	0.023
Black Harrier	345	EN	4	4	1	2 (50%)	0.009	0.009
Blue Crane	320	NT	56	144	18	30 (53%)	0.130	0.333
Black Stork	330	VU	5	6	2	4 (80%)	0.012	0.014
Booted Eagle	230	-	9	9	1	7 (78%)	0.021	0.021
Brown Snake-Eagle	180	-	1	1	1	1 (100%)	0.002	0.002
Cape Vulture	405	EN	11	40	8	9 (82%)	0.025	0.093
Denham's Bustard	300	VU	4	6	3	2 (50%)	0.009	0.014
Egyptian Goose	-	-	19	44	6	8 (42%)	0.044	0.102
Grey Heron	-	-	1	1	1	1 (100%)	0.002	0.002
Grey-winged Francolin	190	-	1	2	2	0	0.002	0.005
Hamerkop	-	-	2	2	1	2 (100%)	0.005	0.005
Jackal Buzzard	250	-	155	180	3	144 (93%)	0.359	0.417
Kori Bustard	260	NT	1	1	1	0	0.002	0.002
Lanner Falcon	300	VU	1	1	1	1 (100%)	0.002	0.002
Lesser Kestrel	214	-	43	144	9	27 (63%)	0.100	0.333
Ludwig's Bustard	320	EN	18	23	3	12 (67%)	0.042	0.053

Martial Eagle	350	EN	3	4	2	3 (100%)	0.007	0.009
Pale Chanting Goshawk	200	-	26	29	2	12 (46%)	0.060	0.067
Rock Kestrel	-	-	181	199	3	140 (77%)	0.419	0.461
South African Shelduck	-	-	4	8	2	4 (100%)	0.009	0.019
Secretarybird	320	VU	2	2	1	2 (100%)	0.005	0.005
Spur-winged Goose	-	-	2	7	4	2 (100%)	0.005	0.016
Steppe Buzzard	210	-	31	34	2	25 (81%)	0.072	0.079
Unidentified kestrel	-	-	2	3	2	2 (100%)	0.005	0.007
Unidentified raptor	-	-	22	33	5	18 (82%)	0.051	0.076
Verreaux's' Eagle	360	VU	98	143	3	85 (87%)	0.227	0.331
White Stork	220	-	1	13	13	0	0.002	0.030
Yellow-billed Duck	-	-	1	4	4	1 (100%)	0.002	0.009
Total	**809**	**1475**	**NA**	**NA**	**NA**	**612 (76%)**	**1.873**	**3.414**

**Some flight paths (recorded as a single flight) may have included multiple birds i.e. a flock. As separate flights may have included the same individual bird/s, this figure should not be seen as an indication of abundance or population size, but rather an indication of activity of a particular species.*

5.8.2 Walk Transects

Across the four seasonal surveys on all four transects on the WEF site (n =30) 666 observations recorded 1532 individual birds representing a total WT IKA of 51 birds/km. This represents a relatively high abundance of birds recorded by the walked transects compared to the specialists experience of other WEF sites in South Africa, and a moderate abundance in general compared to other sites in the Eastern Cape

Table 5 shows a summary of the total (i.e. across all four seasonal surveys) observations and numbers of birds recorded on each walk transect. Even though it had fewer repetitions (n=6), WT4 had the most observations (204) and recorded the highest number of birds (509 individuals), resulting in an average of 84.8 birds recorded per kilometre. This high IKA is largely attributable to two observations of flocks of 30 and 40 Amur Falcon respectively. WT3 had the lowest IKA, recording on average 39 birds/km. Red Data species recorded during the WTs included Blue Crane, Southern Black Korhaan, African Rock Pipit, Verreaux's Eagle, Kori Bustard and Ludwig's Bustard.

Common passerine species that were frequently recorded and abundant across most transects were: African Pipit; Cape Turtle Dove; Grey-backed Cisticola; Eastern Clapper Lark; Neddicky; Pied Starling; African Stonechat; Cape Longclaw; Large-billed Lark; Spike-heeled Lark; and Bokmakierie. Corvids (i.e. crows and ravens) were abundant as was Hadeda Ibis.

Table 5: Walked Transect Results

Transect Name (n=replications)	Total Observations (Number of Individual Birds)	Priority Species (P), Red Data Species (Status), Important (I)	Frequently Recorded and/or Abundant.	IKA (birds/km)
WT1 (n=8)	159 (362)	Blue Crane (P, NT); Southern Black Korhaan (P, VU); African Rock Pipit (P, NT) and Pale Chanting Goshawk (P).	African Pipit, Cape Crow, Cape Turtle Dove, Chinspot Batis, Grey-backed Cisticola, Grey-backed Sparrow-lark, Pied Crow, Eastern Clapper Lark, Hadeda Ibis, Neddicky, Plain-backed Pipit, Pied Starling.	45.25
WT2 (n=8)	147 (349)	Jackal Buzzard (P); Rock Kestrel (I); Verreaux's Eagle (P, VU); Amur Falcon (P); African Rock Pipit (P, NT); and Blue Crane (P, NT); Grey-winged Francolin (P);	African Pipit, African Stonechat, Acacia Pied Barbet, Bokmakierie, Eastern Clapper Lark, Cape Crow, Cape Turtle Dove, Cape Longclaw, Grey-backed Cisticola, Pied Crow, Hadeda Ibis, Large-billed Lark, Neddicky, Speckled Pigeon, Pied Starling, Wattled Starling.	43.63
WT3 (n=8)	156 (312)	Blue Crane (P, NT); Kori Bustard (P, VU); Ludwig's Bustard (P, EN); and Pale Chanting Goshawk (P).	African Pipit, Blue Crane, Ludwig's Bustard, Cape Crow, Cape Turtle Dove, Cloud Cisticola, Common Fiscal, Eastern Clapper Lark, Grey-backed Cisticola, Hadeda Ibis, Large-billed Lark, Spike-heeled Lark, Neddicky, Pied Starling, Southern Masked Weaver.	39.00

Transect Name (n=replications)	Total Observations (Number of Individual Birds)	Priority Species (P), Red Data Species (Status), Important (I)	Frequently Recorded and/or Abundant.	IKA (birds/km)
WT4 (n=6)	204 (509)	Blue Crane (P, NT); Ludwig's Bustard (P, EN); Gabar Goshawk (I); African Fish Eagle (P); Jackal Buzzard (P); Amur Falcon (P); and Pale Chanting Goshawk (P).	Amur Falcon, Acacia Pied Barbet, Ant-eating Chat, Barn Swallow, Chinspot Batis, Bar-throated Apalis, Bokmakierie, Cape Turtle Dove, Familiar Chat, Eastern Clapper Lark, Grey-backed Cisticola, Hadeda Ibis, Karoo Prinia, Karoo Scrub Robin, Neddicky, Red-faced Mousebird, Pied Starling, Rufous-eared Warbler, Rufous-naped Lark, White-necked Raven.	84.8

EN=Endangered; VU=Vulnerable; NT=Near-Threatened. I=Important, noteworthy, or uncommon species deemed relevant to highlight by the specialist.

5.8.3 Drive Transects

The driven transects resulted in a relatively moderate to high number of records of target species, with a total of 86 records across the three WEF site transects after four seasonal surveys. A total of 160.16 km of transects were driven on the WEF site across the four seasonal surveys, recording a total of 201 target species birds from 16 positively identified species and unidentified raptors and kestrels (Table 6). The overall IKA for the WEF site of 1.255 target species birds recorded per kilometre was moderate, while the IKA of priority species only was calculated as 1.180 birds/km which is also considered a moderate level of abundance in the specialist's experience of other proposed WEF sites in South Africa.

The most numerous and regularly encountered target species during driven transects was Blue Crane with 54 birds observed in 23 records (IKA ~0.337 individuals per km) followed by Ludwig's Bustard with 36 birds observed from 11 records (IKA ~0.225 individuals per km) and Amur Falcon with 32 birds from 8 records (IKA ~0.2 individuals per km). All the Amur Falcon records were from summer, and if one considers that this species was not present (and therefore could not be recorded) during the other surveys, its actual IKA should be calculated using the length of transects driven in summer only (i.e. 40.4 km), which would result in a DT IKA for this species of ~0.792.

Table 6: Summary of Driven Transect Results

Species	Total Individuals Recorded	Maximum Flock Count	No. Records			IKA (WEF Site)
			DT1	DT2	DT3	
African Harrier-Hawk*	3	1	-	1	2	0.019
Amur Falcon*	32	10	4	4	-	0.200
Black Headed Heron	1	1	-	1	-	0.006
Blue Crane*	54	11	13	7	3	0.337
Gabar Goshawk	1	1	-	1	-	0.006
Grey-winged Francolin*	4	4	-	1	-	0.025
Jackal Buzzard*	5	2	3	1	-	0.031
Kori Bustard*	3	2	-	2	-	0.019
Lesser Kestrel*	19	9	1	5	-	0.119

Species	Total Individuals Recorded	Maximum Flock Count	No. Records			IKA (WEF Site)
			DT1	DT2	DT3	
Ludwig's Bustard*	36	9	1	5	5	0.225
Pale-chanting Goshawk*	5	1	1	4	-	0.031
Rock Kestrel	8	3	1	2	3	0.050
Southern Black Korhaan*	1	1	1	-	-	0.006
Steppe Buzzard*	6	1	3	3	-	0.037
Unidentified Kestrel*	14	11	-	3	-	0.087
Unidentified Raptor*	4	4	1	-	-	0.025
Verreaux's Eagle*	3	1	1	1	1	0.019
White-breasted Cormorant	2	2	1	-	-	0.012
Total	**201**	**NA**	**31**	**41**	**14**	**1.255**
					Priority Species	***1.180***

**Priority Species*

5.8.4 Nest Searches and Survey

The results from the nest searches and surveys conducted on and around the project site are shown in Table 7 below, with the locations of known nest sites given in Figure 2. A total of 21 confirmed nest structures are known to date (N1, N2, N2b and N3-N20).

Eight Verreaux's Eagle nest sites are known (N1, N2, N2b, N5, N14, N16, N17 and N18). One of these (N5) is on the proposed development site, while three (N2, N2b and N14) are within 4 km of the WEF site boundary. Four of the eight nests are over 7.5 km away from the proposed development site. Five Verreaux's Eagle nests (N1, N2b, N16, N17 and N18) were active with confirmed breeding and chicks observed on nest in August 2019. N5 is likely active, although breeding could not be confirmed in 2019. The activity of N14, could not be confirmed, and there remains the possibility that this nest site is an alternate nest of the pair confirmed breeding 1.3 km away at N2b. An active Martial Eagle nest (N15) was located approximately 4.6 km north of the proposed development site (see section 5.8.4.1 below).

Standard best practise (locally and internationally) is to design protective no-go buffers around nest sites of key species. These buffers are intended not only to limit possible disturbance during the breeding season, but to also protect what is assumed to be the core activity/use area of the territory, and thus reduce the risk of collision. Another intention of nest buffers are to protect fledged birds from collision risk during the first few months after fledging. Table 7 also shows the recommended No-Go (for turbine placement) buffers around each nest site. These recommended buffers have all been adhered to in the latest proposed turbine layouts for all three WEF phases. The current Verreaux's Eagle Guidelines state "*BirdLife South Africa recommends a 3 km buffer around nest sites (including alternate nests). This figure is the radius of the mean 90% utilisation distributions, based on data from eagles tracked using GPS during the pre-breeding season in the Cederberg and Sandveld (Murgatroyd pers comm.). It is also roughly half the mean inter-nest distance averaged across sites in South Africa (excluding the Gaap plateau).* Furthermore the guidelines state that the *"3 km buffer is intended to reduce the risk of collisions and disturbance. This is a precautionary buffer and may be reduced (or increased) based on the results of rigorous avifaunal surveys*".

The recommended Jackal Buzzard and unidentified raptor nest buffers are based on our specialist experience to date of other projects worked on and recommendations given in South Africa by other specialists. Certain nests listed below were (after being found during

the nest survey in July 2017) designated as focal sites and monitored during the remaining seasonal surveys.

Table 7: Highlands Wind Farm – Cliff Nest Survey Results and Nest Focal Site Results

Nest	Co-ords.		Species	Comment/Observations from Specialist Nest Survey (July 2017)	Additional Observations / Updated comments following monitoring as focal sites in 2017/2018.	2019 Comments/Observations	Latest Activity Status	Recommended No-Go Buffer (for WTGs)	Approx. Distance to nearest turbine*
	South	East							
N1	-32.678205°	25.479486°	Verreaux's Eagle	Long distance view of a large stick nest on large prominent cliff. Some white-wash evident. No birds observed.	No Verreaux's Eagle seen. Three Rock Kestrels observed near cliff in summer. Landowner confirmed they occasionally see Verreaux's Eagle, but not recently near the nest.	Accessed a higher, closer and better view point (-32.676181° / 25.464037°). Adult pair observed, one flying above and one on cliff. Chick observed on nest.	Active. Successful breeding.	3 km	9.5 km (9 km)
N2	-32.656660°	25.342739°	Verreaux's Eagle	Large stick nest on 'left side' cliff (i.e. south west facing cliff). Pair of adult bird observed in vicinity. Adult bird observed landing on nest.	Pair of Verreaux's Eagle observed in a 'courting display' above nest in autumn. Pair seen flying above a ridge 1 km from nest in winter. Other species recorded at/near the site were Pale-chanting Goshawk, Jackal Buzzard and White-necked Raven.	Nest still in place on cliff. No birds seen on or near nest. Pair was observed flying above and one adult landed on another nest structure +-250m to the east (designated now as N2b below)	Inactive. Likely alternative nest for N2b.	3 km	4.5 km (4.2 km)
N2b	-32.658053°	25.345113°	Verreaux's Eagle	-	-	Med-Large stick nest, low down on SW facing and protruding 'pillar'. Adult pair observed flying above. Adult observed tending to a medium size chick on nest	Active. Successful breeding	3 km	4.3 km (4 km)
N3	-32.738573°	25.324521°	Jackal Buzzard	One adult flushed from cliff perch near to nest site. Adult pair observed flying overhead. Relatively long distance view. No clear evidence of use.	No Jackal Buzzards recorded. Nest status remains unconfirmed. Rock Kestrel and White-necked Raven observed in vicinity.	No raptors observed. Possibly a raven nest site.	Unconfirmed	500 m	1.3 km (600 m)
N4	-32.764181°	25.333358°	Unidentified raptor	Medium stick nest behind small bush/tree on cliff. Suspect Booted Eagle or possibly Jackal Buzzard nest. No clear evidence of use. No birds observed.	Status and species unconfirmed. In spring, baboon dropping seen next to and above nest. In summer, there was no evidence of recent use and no white-wash.	No birds observed. Nest in place but no evidence of recent use.	Unconfirmed	1 km	2.7 km (2.1 km)

Nest	Co-ords.		Species	Comment/Observations from Specialist Nest Survey (July 2017)	Additional Observations / Updated comments following monitoring as focal sites in 2017/2018.	2019 Comments/Observations	Latest Activity Status	Recommended No-Go Buffer (for WTGs)	Approx. Distance to nearest turbine*
	South	East							
N5	-32.769651°	25.325759°	Verreaux's Eagle	Large stick nest, relatively low down on cliff face. Adult bird observed on nest with a small chick. Extensive white-wash and evidence of recently added green foliage on nest.	Breeding success unclear, but it is likely the juvenile had fledged and left the nest site. In spring (early November) only one adult bird seen flying above nest. No Verreaux's Eagles recorded at the site in summer.	Nest in place, and signs (e.g. whitewash) of recent use. Adult pair flushed from cliff near nest.	Active. Successful breeding unconfirmed	3 km	3.5 km (3.1 km)
N6	-32.781130°	25.323837°	Unidentified raptor	Small/medium stick nest. No clear evidence of use.	Activity and species unconfirmed. No birds observed on or near nest. Booted Eagle and Rock Kestrel observed in vicinity flying above the gorge.	-	Unconfirmed	1 km	3.9 km (2.8 km)
N7	-32.782973°	25.303377°	Unidentified bird	Small/medium stick nest. Suspect small/medium raptor, but possibly a White-necked Raven nest.	Activity and species unconfirmed. No priority species or raptors recorded.	-	Unconfirmed	1 km	5.4 km (4.8 km)
N8	-32.795636°	25.307968°	White-necked Raven	Evidence of animal fur/wool and orange rope used on small nest. White-necked Rave observed flying overhead.	Not surveyed as focal site	White-necked Raven flushed from site.	Active	NA	4.2 km (4.2 km)

Nest	Co-ords. South	Co-ords. East	Species	Comment/Observations from Specialist Nest Survey (July 2017)	Additional Observations / Updated comments following monitoring as focal sites in 2017/2018.	2019 Comments/Observations	Latest Activity Status	Recommended No-Go Buffer (for WTGs)	Approx. Distance to nearest turbine*
N9	-32.849262°	25.348887°	Unidentified raptor	Nest pointed out by Land-owner who says it is a Verreaux's Eagle nest. No birds seen in vicinity and/or on nest and no evidence of recent nest preparation (e.g. green twigs/leaves etc.) Some white wash on cliffs. Nest appears too small for Verreaux's Eagle, however, the possibility can't be ruled out that it may be a Verreaux's Eagle nest site.	Not surveyed as focal site (Access denied by landowner)	Nest in place. No evidence of recent preparation for breeding. Some evidence of 'orange string'. Site is most likely in use by White-necked Raven. As a precaution (and considering the small possibility that is a historical Verreaux's Eagle site), 3 km buffer is kept.	Unconfirmed.	3 km	3.6 km (3.6 km)
N10	-32.851732°	25.348003°	Jackal Buzzard	-	-	Adult flushed from cliff. Adult pair observed flying above site. No clear nest observed, but is strongly suspected ad some whitewash observed.	Likely active	500 m	3.8 km (3.8 km)
N11	-32.840492°	25.332744°	White-necked Raven	-	-	Medium nest, lots of white-wash, ravens above, wool and string.	Active	NA	2.9 km (2.9 km)
N12	-32.718593°	25.260418°	White-necked Raven	-	-	Small / medium nest on low cliff in corner of river. Wool and string evident. White-necked Raven pair flying overhead.	Active	NA	5.5 km (5.5 km)
N13	-32.701353°	25.305742°	White-necked Raven	-	-	Small stick nest in ravine on low cliff. 'Wool' and 'string' observed and White-necked Raven pair flying above.	Active	NA	2.3 km (2.3 km)

Nest	Co-ords. South	Co-ords. East	Species	Comment/Observations from Specialist Nest Survey (July 2017)	Additional Observations / Updated comments following monitoring as focal sites in 2017/2018.	2019 Comments/Observations	Latest Activity Status	Recommended No-Go Buffer (for WTGs)	Approx. Distance to nearest turbine*
N14	-32.657207°	25.359364°	Verreaux's Eagle	Beyond initial search focus area.	-	Nest site located by Avisense (XX). Poor visibility and no clear signs of use could be established. Possibly alternate nest site of pair breeding at N2b.	Unconfirmed	3 km	4.5 km (4 km)
N15	-32.649960°	25.381800°	Martial Eagle	Beyond initial search focus area.	-	Large stick nest in indigenous tree in a 'kloof'. No clear evidence of recent use. Adult bird flushed from tree at/near nest site. Adult bird and a sub-adult bird seen flying together above.	Likely active.	6 km	6.05 km (5.3 km)
N16	-32.596057°	25.319926°	Verreaux's Eagle	Beyond initial search focus area.	-	Adult bird perched on cliff, and other adult flying overhead. Chick observed on nest.	Active	3 km	11.6 km (11.3 km)
N17	-32.623109°	25.396759°	Verreaux's Eagle	Beyond initial search focus area.	-	Chick on nest and adult pair flying above.	Active	3 km	9.2 km (8.4 km)
N18	-32.619251°	25.445702°	Verreaux's Eagle	Beyond initial search focus area.	-	Chick on nest and adult pair flying above.	Active	3 km	11.7 km (10.8 km)
N19	-32.853118°	25.321407°	Hamerkop	-	-	Large enclosed nest on low cliff over river with entrances hole. No birds seen.	Unconfirmed	NA	4.6 km (4.6 km)

Nest	Co-ords. South	Co-ords. East	Species	Comment/Observations from Specialist Nest Survey (July 2017)	Additional Observations / Updated comments following monitoring as focal sites in 2017/2018.	2019 Comments/Observations	Latest Activity Status	Recommended No-Go Buffer (for WTGs)	Approx. Distance to nearest turbine*
N20	-32.875815°	25.386518°	Unidentified	Beyond initial search focus area.	-	Small-medium stick nest. Appears old and un-used. Pied crows observed in area, and possibly have used this site historically.	Inactive	Na	6.7 km (6.7 km)

** The first figure is in relation to the updated and final 41 turbine layout. The figure in parentheses is in relation to the original 2018 layout.*

5.8.4.1 Martial Eagle Nest

A Martial Eagle Nest was located in an indigenous tree (unknown species), in a 'kloof' approximately 1 km north of the historical site at the abandoned farm house 'Bergvliet' on Kamala Game Reserve. The nest is a large stick nest, approximately 1.1-1.3m wide with a 40-60 cm depth. While there was no clear evidence of recent use, or successful breeding in the 2019 season, an adult bird was flushed from a tree at/near the nest site, and was seen on at least two separate days in the vicinity of the nest site. A sub-adult bird was also recorded flying above the nest site with an adult. While the presence of two adults could not be confirmed, it is possible (because of the separate sightings of a single adult on different days) there may have been two separate adult birds.

5.8.5 Focal Sites

Relatively low numbers of waterbirds (and/or water related species) have been recorded at the seven focal sites that are dams (i.e. FS1-FS6 and FS8), and the project site in general does not appear to be important for any large numbers of waterbirds or waterfowl (Table 8). Many dams were dry, and a number of species recorded were smaller common passerines in vegetation around the dams. Various aerial foraging species (e.g. swallows), that are summer migrants arrived in spring and were foraging above the dam sites in spring and summer.

Table 8: Focal Site Summary Records (Dams)

Focal Site	Site Description	Numerous / Abundant Water Associated Species	Priority Species (P), Red Data Species (Status), Important (I)	Notes
FS1	Two small dams.	Blue Crane; Egyptian Goose; and Three-banded Plover	Amur Falcon (P); Blue Crane (P, NT); Pale Chanting Goshawk (P); and Steppe Buzzard (P).	One dam was mostly dry, and most species were observed around dam and overhead, including aerial foragers. Small flock of 7 Blue Crane observed near dam in spring.
FS2	Small/medium dam.	Egyptian Goose; Blacksmith Lapwing; and Three-banded Plover.	Blue Crane (P, NT)	Two groups of Blue Crane (one of 2 birds, and one of 3 seen on separate days. Other species were common passerines and aerial foragers.
FS3	Two small dams.	Egyptian Goose; and Brown-throated Martin.	Amur Falcon (P); Lesser Kestrel (P); and Steppe Buzzard.	The three priority species recorded were hunting over the side or near the two dams. Other species were aerial foragers e.g. Greater-striped Swallow and passerines e.g. doves, pipits, larks, sunbirds and chats recorded around the dams.
FS4	Small dam.	None recorded	Blue Crane (P, NT)	No water in dam in winter and spring. Not surveyed in summer. Most species observed around dam and overhead, including aerial foragers.
FS5	Medium dam.	Blacksmith Lapwing; and Three-banded Plover	None recorded	No water in dam in winter and spring. Not surveyed in summer. Birds recorded in

Focal Site	Site Description	Numerous / Abundant Water Associated Species	Priority Species (P), Red Data Species (Status), Important (I)	Notes
				vicinity included doves, starlings, cisticolas and crows.
FS6	Medium-large dam ('Rietfontein dam').	Egyptian Goose; Brown-throated Martin; Cape Wagtail; Three-banded Plover; and Yellow-billed Duck.	None recorded	Birds observed in vegetation around the dam included pipits; hoopoes; barbets; starlings; doves, canaries, sparrows, chats and mousebirds. Various aerial foragers included Barn Swallow, Pearl-breasted Swallow, Greater Striped Swallow, Rock Martin and White-throated Swallow.
FS8	Medium-large dam.	African Spoonbill; Egyptian Goose; Common Greenshank; Pied Avocet; South African Shelduck; Three-banded Plover; and Yellow-billed Duck.	Blue Crane (P, NT), Pale Chanting Goshawk (P), Rock Kestrel (I).	Moderate numbers of water associated birds including a flock of over 50 Egyptian Geese in spring.

Seven nest sites (N1-N7) were surveyed as 'focal sites', and the results of these additional visits to these sites are shown in Table 7 in the nest survey results section.

5.8.6 Incidental Observations

A total of 260 incidental records were made of 25 target species (including 20 priority species), comprising 665 birds (Table 9) across the entire study area traversed by the observers (i.e. within the proposed development site and beyond the site extending to the control site). While this is a relatively high amount of incidental records in the specialists experience, it must be noted that many records may have been repeat observations (of the same birds but at different times), and that two observer teams in two vehicles were used over a long period of time, resulting in a very high amount of observer effort/time within which to make incidental observations. Of the 25 species recorded incidentally, nine are Red Data species including two classified as Endangered (Martial Eagle, Ludwig's Bustard) and four as Vulnerable (Verreaux's Eagle, Denham's Bustard, Secretarybird and Southern Black Korhaan). The geographical locations of the observers while recording the priority species incidental observations (as well as priority species observed during driven transect surveys) are indicated in Figure 8, giving an indication of the general location of the various species on and around the WEF site.

The species most regularly recorded incidentally was Blue Crane, followed by Ludwig's Bustard, Pale Chanting Goshawk, Rock Kestrel and Amur Falcon. Blue Crane was observed throughout the site and was occasionally recorded in large flocks of up to 42 birds, and therefore had the highest total number of individuals recorded of all incidental species. Most Ludwig's Bustard records were from the central and southern areas of the development site. The majority of incidental Verreaux's Eagle records were from the north of the proposed development site, while only one of the Martial Eagle records was on the site (in the south of the site).

Table 9: Number of Incidental Records of Target Species

Species	Number of records	Total Birds**	Maximum flock count
African Rock Pipit*(NT)	3	7	3
African Spoonbill	1	1	1
African Harrier Hawk*	5	5	5
Amur Falcon*	13	37	15
Black-chested Snake Eagle*	1	1	1
Blue Crane*(NT)	73	348	42
Black-shouldered Kite*	1	1	1
Denham's Bustard*(VU)	2	4	3
Egyptian Goose	1	7	7
Gabar Goshawk	2	2	1
Grey-winged Francolin*	3	4	2
Hamerkop	3	3	1
Jackal Buzzard*	7	8	2
Kori Bustard*(NT)	5	7	2
Lesser Kestrel*	11	59	15
Ludwig's Bustard*(EN)	32	59	5
Martial Eagle*(EN)	4	4	1
Pale Chanting Goshawk*	26	27	2
Rock Kestrel	23	25	2
Southern Black Korhaan*(VU)	12	14	2
Secretarybird*(VU)	3	4	2
Spotted Eagle-Owl*	1	1	1
Steppe Buzzard*	17	19	2
Unidentified korhaan*	1	1	1
Unidentified raptor	1	3	3
Verreaux's Eagle*(VU)	8	12	2
White Stork*	1	2	2
TOTAL	**260**	**665**	**NA**

**Priority species. **Where more than one bird recorded, the same individual bird may have been recorded more than once. The figures in this column therefore do not necessarily indicate the number of individuals of this species present or the population size. EN = Endangered; VU = Vulnerable; NT = Near-Threatened.*

5.8.7 Species Summary and Discussion

A total of 167 positively identified species have been recorded across both the WEF site and the control site after four seasonal surveys (Appendix I). No new or additional species were recorded on the WEF site during the additional work in 2019.

Twenty-six priority species including 13 regional Red Data species (Taylor *et al.* 2015) have been recorded (Table 10). Four species are classified as *Endangered* (Black Harrier, Ludwig's Bustard, Cape Vulture and Martial Eagle), six as *Vulnerable* (Secretarybird, Black stork, Denham's Bustard, Verreaux's' Eagle, Lanner Falcon and Southern Black Korhaan), and three as Near-Threatened (Blue Crane, African Rock Pipit, and Kori Bustard). Of these, Blue Crane, Ludwig's Bustard, Verreaux's Eagle and African Rock Pipit were regularly recorded, while generally there were only occasional sightings of the others.

A total of 164 species were observed on the WEF site, with only three species (Klaas' Cuckoo, Long-billed Pipit and Karoo Thrush) being recorded on the control site only. 121 species were recorded at the control site. This lower number can be attributed to less time spent at the control site versus the WEF site, and is not necessarily a reflection of local diversity.

These results represent a relatively moderate to high diversity of species, and a relatively high number of Red Data and priority species in the specialists' experience of other WEF sites worked on in South Africa, and generally in the Eastern Cape, although some sites in the Eastern Cape have recorded similar numbers of Red data and priority species.

Table 10: Priority Species and Regional Red Data Species Recorded During the Surveys on the Control and WEF Sites

Alphabetical Name	Red Data Status	Priority Score	Autumn		Winter		Spring		Summer		Winter 2019
			WEF	Control	WEF	Control	WEF	Control	WEF	Control	
Bustard, Denham's	VU	300							x		
Bustard, Kori	NT	260	x	x	x	x		x	x		x
Bustard, Ludwig's	EN	320	x	x	x	x	x	x	x	x	
Buzzard, Jackal		250	x		x	x	x	x	x		x
Buzzard, Steppe		210					x	x	x	x	
Crane, Blue	NT	320	x	x	x	x	x	x	x	x	x
Eagle, African Fish		290	x		x		x		x		x
Eagle, Black-chested Snake		230			x				x		
Eagle, Booted		230			x		x		x	x	
Eagle, Brown Snake		180							x		
Eagle, Martial	EN	350	x	x	x	x					x
Eagle, Verreaux's'	VU	360	x	x	x		x	x	x		x
Falcon, Amur		210							x	x	
Falcon, Lanner	VU	300							x		x
Francolin, Grey-winged		190	x				x		x		
Goshawk, Pale Chanting		200	x	x	x	x	x	x	x	x	x
Harrier, Black	EN	345	x		x						
Hawk, African Harrier-		190	x		x	x	x		x		x
Kestrel, Lesser		214							x		
Korhaan, Southern Black	VU	270	x		x	x	x	x	x		x
Owl, Spotted Eagle-		170	x								
Pipit, African Rock	NT	200			x		x		x		
Secretarybird	VU	320	x		x		x	x	x	x	

Alphabetical Name	Red Data Status	Priority Score	Autumn		Winter		Spring		Summer		Winter 2019
			WEF	Control	WEF	Control	WEF	Control	WEF	Control	
Stork, Black	VU	330			x						
Stork, White		220							x		
Vulture, Cape	EN	405							x		

The full species list (of positively identified species) indicating their conservation status and endemism are provided in Appendix I. This table shows that 23 endemic or near-endemic species[12] have been recorded, and one (Knysna Turaco) is a restricted-range species. Endemic or near-endemic species that were relatively abundant or frequently recorded, and for which the proposed development site represents important habitat are: Cape Bulbul, Jackal Buzzard, Sickle-winged Chat, Fiscal Flycatcher, Grey-winged Francolin, African Rock Pipit, Large-billed Lark, Pied Starling, Southern Double-collared Sunbird, Grey Tit and Ground Woodpecker. Priority species recorded that are also endemic or near-endemic were Jackal Buzzard, African Rock Pipit, Black Harrier, Grey-winged Francolin and Southern Black Korhaan.

Generally the diversity and abundance of small passerine species was moderate to high with most WTs recording high IKAs. Possibly of most concern regarding these species is the Near-threatened African Rock Pipit, which is also a priority species.

Following the conclusion of the monitoring work, and considering all the other desk-based data sources, the following species were identified as being key for the assessment of impacts of the WEFs and grid connections proposed on the development site. These 'focal species' are discussed in more detail below and are: Ludwig's Bustard; Blue Crane; Secretarybird; Cape Vulture; Verreaux's Eagle; Black Harrier; Amur Falcon; Lesser Kestrel; Jackal Buzzard; and African Rock Pipit.

Ludwig's Bustard were relatively widespread and recorded across all seasons on both the WEF and control site. They were usually recorded in small groups of up to five birds. Generally, they spent more time on the ground, but were occasionally observed flying (especially when flushed). Ludwig's Bustard was occasionally seen flying from VPs, with a low recorded passage rate of 0.053 bird/hour. Most flights were recorded over flat open grasslands (Figure 4), particularly in the south east of the proposed development site near VP6. Ludwig's Bustard is known to be nomadic and to have seasonal movements in line with rainfall patterns, and considering it was recorded in all seasons, shows the good suitability of the area for this species. While the species is well known to be very vulnerable to power line collisions, no mortalities have been recorded from turbine collisions in South Africa to date. The species may be susceptible to displacement impacts, however post-construction monitoring at one wind farm in South Africa concluded that the similar Denham's Bustard has not been affected and there was no displacement with 0.35 birds/km recorded pre-construction and 0.51 birds/km during the first year of operation.

Blue Crane is regionally classified as *Near-threatened* and was one of the most abundant and regularly recorded priority species on the WEF site. While no nest locations could be found, the species is likely to be breeding on the proposed WEF site, as on a few occasions, pairs of adult birds were seen with juveniles. Nesting sites of Blue Crane were searched for in spring during the monitoring programme on the site. Most often recorded walking and foraging on the ground, a number of flights were also recorded over the year for this species (Figure 4), particularly in valleys near agriculture (which was not extensive) and over more flat open grassland areas. Blue Crane has suffered some mortality from turbines in South Africa, but not nearly at the level initially feared prior to the commencement of operation of a number of WEFs within the range of this species. It also does not seem to be overly impacted upon by disturbance and displacement effects, with a number of known cases were birds have continued to breed successfully in close proximity to operational turbines. Blue Cranes have been found to be extremely tolerant of human disturbance, and have been recorded successfully breeding on number of wind farms (Pers. Obs; Pers. Com Sam Ralston-Paton; Pers. Com Jon Smallie). The greatest impact on this species is likely to

[12] Endemic or near-endemic (i.e. ~70% or more of population in RSA) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BirdLife South Africa Checklist of Birds in South Africa, 2014.

come from collisions with overhead power lines and disturbance during construction, both of which can be well mitigated against.

Secretarybird were occasionally recorded, usually on the ground as incidental or DT records, and only two flights (both in the far north of the WEF site) were recorded (Figure 4). With one collision mortality recorded for this species to date in South Africa, it is prone to collisions, especially when it flies at height during elaborate courtship displays. A male and female pair was observed in the area, and this coupled with the fact that the habitat on site appears very suitable for this species, lead to the possibility that there is at least one breeding pair resident and possibly nesting on the proposed development site. Nest sites of this species were sought as part of the day to day activities of the monitoring staff during the standard monitoring but no nest could be found. There has been no available information that the specialist is aware of this species being displaced or disturbed by WEF development.

Cape Vulture was only recorded during the final summer season, and only from VP watches when 11 flights were recoded for this species (mostly conducted by birds from one flock of 8 birds) (Figure 6). The recorded passage rate of 0.093 birds/hour is low, there are no breeding colonies within 175 km and the closest known active roost site is at Agieskloof[13], 60 km away. New breeding colonies and roosts were searched for by field workers and extensive consultation with landowners, local birders (pers. comm. Allan Collet and Greg Brown) and Vulpro, and none were located. Considering the above, Cape Vulture is only likely to be an occasional visitor to the Highlands WEF, and should mortalities occur for this species, they could be mitigated (or prevented in future) by implementing mitigation such as carcass management strategies and/or shut down on demand strategies. BLSA (2017) reported six Cape Vulture fatalities, all from the Cookhouse/Bedford area, although a review of more recent operational monitoring reports (Smallie and MacEwan, 2017; Smallie and MacEwan, 2018) and a discussion with the specialist (per. Com Jon Smallie) shows that this number is now at least ten fatalities.

Verreaux's Eagle were confirmed as breeding on the proposed development site (at N5 in winter 2017, and possibly breeding in 2019). A second active nest site (N2) was located in 2017 off the development site. Both of these nest sites are more than 3 km from proposed turbine locations. Additional nest search work in 2019, beyond the initial search area which was on the site and within 3 km thereof, revealed a number of additional active Verreaux's Eagle territories in the mountainous areas. Many of these new nest sites are more than 8 km from proposed turbine locations. VP monitoring has shown that Verreaux's Eagle do not necessarily remain within the 3 km buffer of nests sites, and flights were recorded across the proposed development site, some of which may have also been by non-territory holding birds or 'floaters'. Beyond the 3 km buffer, areas associated with higher levels of flight activity have been excluded from the development through the application of the VERA model results and a detailed sensitivity mapping process, while other areas potentially with higher risk (e.g. steep slopes) but not necessarily where more flights were recorded, have also been excluded. These actions are likely to reduce the potential collision risk to this species. Recorded Verreaux's Eagle flight activity was relatively high compared with other priority species recorded on the Highlands WEF site (particularly in the north and north west and central west areas around the edge of the escarpment), although when compared with the activity of this species on other WEFs in SA, the activity levels are moderate. Verreaux's Eagle are predominantly found in mountainous, rocky habitat (Davies & Allan 1997), and the regional population (i.e. for South Africa, Lesotho and Swaziland) has been estimated to be between 3 500 and 3 750 mature individuals, but confidence in these figures is low (Taylor *et al.* 2015). Verreaux's Eagle are territorial and their territories surround their nest sites, but their nests are not necessarily in the centre of their territory

[13] This roost is approximately 15 km from the operational Cookhouse WEF.

(Gargett 1990). Nests are usually built on cliffs and ledges (Gargett 1990), although they have been recorded nesting on power lines and occasionally in trees or on telephone poles (pers. obs.). The rough density (approximately 1 pair/75 km^2)[14] of Verreaux's Eagle on the proposed development site and it's immediate surrounds (i.e. within 3 km) is low when compared to other relatively high density populations of this species studied in other parts of the region (e.g. Nuweveld escarpment, Beaufort West: mean density 1 pair/24 km^2 (Davies 1997); Cederberg, W Cape: mean inter-pair distance 4.7 km (n = 22, range 3.4-7.2 km); Sandveld, W Cape: mean inter-pair distance 5.8 km (n = 24, range 1.6-15.2 km) – Jenkins 2014: Pers. Comm.; proposed Umsinde Emoyeni WEF, Murraysburg : approximately 1 pair/57 km^2 (Arcus 2015). Nonetheless, this population (of approximately two breeding pairs, one or two single floating adults, and one or two juveniles), represents an important biodiversity asset of the site, and are likely to be important components of the local ecology. The additional search work found more active territories in the mountains as one moves further north away from the site, and the density of pairs in this population is likely higher than on the proposed site.

Verreaux's Eagle is an apex predator which plays an important ecological role. Single birds recorded on the WEF, may be a young adult/s without an established territory (territorial adults are usually observed in pairs), termed a 'floater' that is searching for a territory. The species has been recorded as a turbine collision fatality, and at least ten fatalities have been recorded on WEFs in South Africa to date (Ralston Paton *et al.* 2017; BLSA, 2018; pers. comm BARESG & Sam Ralston Paton). It is likely that this species will suffer turbine collision mortality at some stage during operations of the proposed WEF, however the amount and frequency of collisions are not expected to reach a level that would be unsustainable for the regional population, and if they do, mitigation options such as habitat management, deterrent devices and shut down on demand would need to be implemented and would bring the level of impact back within sustainable levels in our opinion.

Five fatalities of the *Endangered* Black Harrier have been recorded on WEFs in South Africa to date (Ralston Paton *et al.* 2017; pers. comm. BARESG). However, activity of this species was very low over the year of monitoring, and it was only recorded in autumn and winter. There was no evidence obtained during monitoring to indicate that this species is breeding on the WEF site. All four recorded flights over the one year programme, were in the north of the WEF site (Figure 5) and the majority of the time flying was at low heights below rotor swept height. Impacts on this species by the proposed development are unlikely to be significant.

Martial Eagle is an important species as it is *Endangered* and is scarce outside of protected areas with the population in the Eastern, Western and Northern Cape approximately 100-150 birds (< 1 bird / 5000 km^2) (Hockey et al., 2005[15]). It's average breeding territory in north-east South Africa is 130-150 km^2 and at least 280 km^2 in the Nama Karoo and Namibia (Hockey et al., 2005) while inter-nest distances in the central Karoo average about 15 km (Boshoff, 1993[16]; Machange et al., 2005[17]). These large territories show that this is a wide ranging species. It's also important to note that this species is monogamous and

[14] This figure is approximate, and should be used with caution, as it is based on 2 pairs of eagles (and two active nests) being located within an area of approximately 150 km^2, within which additional nests may be located.

[15] Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (eds) 2005. Roberts Birds of Southern Africa, VII edition. The trustees of the John Voelcker Bird Book Fund, Cape Town.

[16] Boshoff, A.F. 1993. Density, active performance and stability of Martial Eagles Polemaetus bellicosus active on electricity pylons in the Nama-Karoo, South Africa. In: Wilson, R.T. (Ed.). Proceedings of the Eighth Pan-African Ornithological Congress. Musee Royal de 1'Afrique Centrale, Tervuren. pp 95-104.

[17] Machange, R.W., Jenkins, A.R. & Navarro, R.A. 2005. Eagles as indicators of ecosystem health: Is the distribution of Martial Eagle nests in the Karoo, South Africa, influenced by variations in land-use and rangeland quality? Journal of Arid Environments 63: 223-243.

the pair bond is often maintained over several seasons, regularly re-using and breeding at the same nest site.

To protect large eagles from impacts (both disturbance and collision), international best practise is to place restrictive buffers around nest sites. Buffers to reduce disturbance are typically smaller, but would exclude all infrastructure and development while buffers to reduce collision impacts are generally larger, and would exclude placement of turbines and/or overhead powerlines, but allow other infrastructure e.g. roads and buildings. Buffers sizes are usually a function of the measured or estimated core foraging ranges of the affected birds (Martinéz et al. 2010). There is no standard guideline or minimum buffer distance for Martial Eagle nests in South Africa currently, and specialists have given various recommendations on projects to date. On a project near Sutherland, Jenkins and du Plessis (2016) recommended a 4 km protective no-go turbine buffer around Martial Eagle nests. At the proposed Inyanda Roodeplaat site near Uitenhage, Eastern Cape, Jenkins (2014a[18]) recommended a 5 km buffer around a Martial Eagle nest site. At the Umsinde Emoyeni WEF, both Jenkins and Du Plessis (2014b[19]) and Arcus (2017[20]) recommended a 5 km buffer around a Martial Eagle nest. Jenkins and Du Plessis (2014) suggested that in the absence of more detailed, site-specific information (e.g. tracking data), one simple but defensible approach is to buffer nest sites by half the mean inter-nest distance of the local population, in line with the approach adopted by the U.S. Fish & Wildlife Service (2013).

More recently, a buffer of 6 km has been recommended on a site in the Karoo near Beaufort West (Pers. Com Jon Smallie). This recommendation was based on tracking data from a recent study (van Eeden et al., 2017[21]) that fitted eight Martial Eagles with GPS tags in the Kruger National Park (KNP) and found that territorial eagles (n=6) held home ranges averaging ca. 108 km2, while two individuals did not appear to hold territories and ranged widely (ca. 44, 0000 km2) beyond the park boundaries. Based on a simple circular area, the findings by van Eeden et al (2017) represent territories of ca 6 km radius. It is important to note that the species inter-nest distances (and likely home ranges) differ varies considerably in different landscapes with larger inter-nest distances (ca. 19 km) in the drier regions of the Nama Karoo and Namibia. While not classified as Nama Karoo, or an extremely arid area, the area of the Highlands project is likely to support pairs of Martial Eagle holding larger territories than in the KNP. Considering though that birds are not likely to use all of their territory all the time, and buffer sizes previously recommended, we proposed a 6 km no-go buffer around the nest site at Kamala.

Lesser Kestrel and Amur Falcon were absent during the autumn, winter and spring surveys, and this had an effect on the overall priority species flight activity and abundance which was generally lower in these seasons than in summer. The two species were observed often together, across the WEF site (Figure 5), seemingly favouring open flat grass areas over which they hunted. Lesser Kestrel breed in Europe and Asia, migrating to southern Africa over the northern winter, arriving in the Karoo in late October or early November and staying to late March. It is estimated that approximately 50,000 birds spend the southern spring and summer in South Africa, although numbers do vary from year to year. They roost communally (often with Amur Falcon), and usually in large alien trees in nearby towns. The specialist is aware of a roost site in Graaff Reinet, approximately 85 km north west of the proposed development, but it is likely that there are other roost sites closer to

[18] Survey of Verreaux's Eagle and other cliff-nesting birds in the vicinity of the proposed Inyanda-Roodeplaat wind farm site near Uitenhage, Eastern Cape Andrew R. Jenkins & Johan du Plessis AVISENSE Consulting August 2014

[19] Jenkins, A.R. and Du Plessis, J. 2014. Survey of Cliff-nesting Birds in relation to the Umsinde Emoyeni Wind Energy Facility near Murraysburg, Western Cape. Avisense Consulting. November 2014.

[20] Arcus, 2017. Umsinde Emoyeni Wind Energy Facility (WEF) Additional 1 Year Avifaunal Monitoring Programme Final Report On behalf of Emoyeni Wind Farm Project (Pty) Ltd Version 2: 10 August 2017

[21] Van Eeden, R., Whitfield, D.P., Botha, A., and Amar, A. 2017. Ranging behaviour and habitat preferences of the Martial Eagle: Implications for the conservation of a declining apex predator. PLoS ONE 12(3): e0173956

the site. At the time of writing, Lesser Kestrel had not suffered from turbine collision mortality in South Africa, while Amur Falcon had suffered high levels with 32 mortalities recorded, making it the third most affected species to date (BLSA 2017a). Given that the population of this migratory species is large (a national census on 2009 recorded approximately 111 000 individuals in South Africa (Symes & Woodborne 2010) and the species is not currently threatened (BirdLife International 2018), the impact on the species' population is unlikely to be significant at this stage. However, Amur Falcon is listed under the Convention of Migratory Species and its flocking behaviour may present a risk of multiple fatalities in a short space of time. The species may also provide valuable ecosystem services and impacts should therefore be monitored, and where possible mitigated (Ralston Paton *et al.* 2017).

Jackal Buzzard was abundant and had very high levels of flight activity on the site. It was recorded at all VPS as well as other survey methods across the site, and one suspected nest site was located. The species is highly susceptible to wind turbine collisions, and with 63 mortalities reported on WEFs in South Africa as of September 2017 (BLSA, 2017), it is the bird species that has been most impacted upon. High fatality rates have been reported for other *Buteo* species including Common Buzzard (*B. buteo*) in Europe (Hötker *et al.* 2006), White-tailed Hawk (*B. albicaudatus*) in Latin America (Ledec *et al.* 2011) and Red-tailed Hawks (*B. jamaicensis*) in the United States (Smallwood & Thelander 2008). Collisions of Jackal Buzzard are likely at the proposed development, however, it is noted that this species is a common and widespread species in South Africa, and if all mitigations are followed the potential impacts are likely to be sustainable.

The Near-threatened African Rock Pipit was recorded often on the proposed development site and is primarily associated with rock strewn slopes and ridges; areas that are likely to be avoided for infrastructure placement in the proposed development. It mainly forages on the ground and is unlikely to suffer collision impacts.

5.8.7.1 Verreaux's Eagle Risk Assessment (VERA) Model Results

The detailed VERA report conducted by Dr. Meagan Murgatroyd is attached as Appendix III. Areas predicted by the model to be of high risk, and therefore not recommended for turbine development are shown in Figure 11.

5.8.8 Avifaunal Site Sensitivity

The pre-construction monitoring results were used to calculate the flight sensitivity of the site (Figure 10).

Landscape features were also buffered accordingly and a combined Avifaunal Sensitivity Map (Figure 11) was created which shows areas of varying sensitivity as well as Avifaunal No-Go Areas (for either turbines only, or turbines and other infrastructure).

The VERA model (discussed above) was also used to advise high risk areas in relation to the locations of known Verreaux's Eagle Nest Sites. All turbines that are within these updated high risk areas identified by VERA, have been removed from these areas by the applicant.

6 IDENTIFICATION OF IMPACTS

The possible impacts arising from the construction, operation and decommissioning of each of the three WEF phases and each of the grid connection phases have been identified below. The impacts described in sections 6.1 to 6.4 can occur on either WEF phase while those described in sections 6.5 to 6.7 can occur on either grid site phase.

6.1 Background to Interactions between Wind Energy Facilities, Power Lines and Birds

South Africa has experienced an increase in the number of wind energy developments (both in terms of applications and those that have been built) in the past seven years, but still lacks some information about the effects that these developments have on certain aspects of the environment. In South Africa, while post-construction monitoring is being conducted on the majority of operational sites, publically available data and information of operational results is limited and restricted to information supplied to BirdLife SA and made available by them to the public in the form of a report (Ralston Paton *et al*. 2017), and a public presentation (BLSA 2017a).

International experience, and results from South Africa have shown that birds can be impacted negatively by wind farms and that the severity of these impacts can differ drastically from site to site (Bose *et al.* 2018; Grünkorn *et al.* 2017; Ralston-Paton *et al.* 2017; Thaxter *et al*. 2017). Overall, it appears that severe impacts, such as the high mortality numbers of Golden Eagle observed at Altamont Pass in California (Hunt *et al.* 1998; Orloff & Flannery 1992) seem to be the exception rather than the rule, with the majority of facilities recording relatively low mortalities (Strickland *et al.* 2011; de Lucas *et al.* 2008; Erickson *et al.* 2001). The effects of one poorly placed facility, or some poorly sited turbines within a facility, can however affect the population of certain species at a regional, national or even global level (Bellebaum *et al*. 2013; Dahl *et al.* 2012; Carrete 2009). Hence, it is important to assess the impacts of wind energy facilities, and to base this assessment on a thorough investigation of the local avifauna prior to construction, which is being done for the proposed development.

The main impacts of wind energy facilities and their associated infrastructure on birds have been identified as (a) displacement through disturbance and habitat destruction and (b) mortality through collisions with turbines and/or powerlines and (c) mortality through electrocution on live power infrastructure (Rydell *et al.* 2017; Drewitt & Langston 2006; Hötker *et al.* 2006; Percival 2005; van Rooyen 2004).

6.2 WEF Impacts Construction Phase

6.2.1 Habitat Destruction

During the construction of the WEFs, some habitat destruction and alteration will take place. This happens with the construction of access roads, the clearing of servitudes and areas for turbine placements, and the levelling of substation yards, development of laydown areas and turbine bases. The removal of vegetation which provides habitat for avifauna and food sources may have an impact on birds breeding, foraging and roosting (Dwyer *et al.* 2018; Tarr *et al.* 2016). This habitat destruction is a direct impact that is restricted to the site. If no mitigation (rehabilitation) occurs the impact can be permanent.

The scale of direct habitat loss resulting from the construction of a wind farm and associated infrastructure depends on the size of the project but, generally speaking, is likely to be small per turbine base. Typically, actual habitat loss amounts to 2 – 5 % of the total development area (Drewitt & Langston 2006) of a WEF although it is likely less in the case of the proposed Highlands WEF phases.

6.2.2 Disturbance and Displacement

Disturbances and noise from staff and construction activities can impact on certain sensitive species particularly whilst feeding and breeding, resulting in effective habitat loss through a perceived increase in predation risk (Dwyer *et al.* 2018; Percival 2005; Frid & Dill 2002). There are various potentially sensitive species occurring on the proposed development site including African Rock Pipit, Southern Black Korhaan, Black Harrier, Ludwig's Bustard, Blue

Crane, Secretarybird and Verreaux's' Eagle. Disturbance can cause these (or other) species to be displaced, either temporarily (i.e. for some period during the construction activity) or permanently (i.e. they do not return), into less suitable habitat which may reduce their ability to survive and reproduce.

6.3 WEF Impacts Operational Phase

6.3.1 Collisions with Wind Turbines

WEFs can cause bird mortalities through the collision of birds with moving turbine blades (Bose *et al.* 2018; Dwyer *et al.* 2018; Thaxter *et al.* 2017; Vasiliakis *et al.* 2017, Marques *et al.* 2014; Ralston Paton *et al*. 2017). A number of factors influence the number of birds impacted by collision, including:

- Number of birds in the vicinity of the WEF;
- The species of birds present and their flying patterns and behaviour (which is often influenced by topographical, environmental and climatic conditions); and
- The design of the development including the turbine layout, height and size of the rotor swept area.

It is important to understand that not all birds that fly through the WEF at heights swept by rotors automatically collide with blades. In fact avoidance rates for certain species have proven to be extremely high internationally, while avoidance rates have not been determined for South African species. In a radar study of the movement of ducks and geese in the vicinity of an off-shore wind facility in Denmark, less than 1% of bird flights were close enough to the turbines to be at risk, and it was clear that the birds avoided the turbines effectively (Desholm and Kahlert 2005). Whilst avoidance rates for SA species are currently unknown due to the lack of data, comparisons can be drawn between functionally similar species, for example Verreaux's' Eagle with Golden Eagle, in order to inform an assessment. Whitfield (2009) reviewed the avoidance rates for Golden Eagle and reported estimates varying between 98.64% and 99.89%.

The majority of studies on collisions caused by wind turbines have recorded relatively low mortality levels (Madders & Whitfield 2006). This is perhaps largely a reflection of the fact that many of the studied wind farms are located away from large concentrations of birds. It is also important to note that many records are based only on finding carcasses, with no correction for carcasses that were overlooked or removed by scavengers (Marquez *et al.* 2014; Drewitt & Langston 2006). Relatively high collision mortality rates have been recorded at several large, poorly-sited wind farms in areas where large concentrations of birds are present (including IBAs), especially among migrating birds, large raptors or other large soaring species, e.g. in the Altamont Pass in California, USA (Thelander *et al.* 2003), and in Tarifa and Navarra in Spain (Barrios and Rodrigues 2004).

In northern Germany one study estimated an annual mortality of 8500 common Buzzards, 11 300 Wood Pigeons and 13 000 Mallards from wind turbine collisions (Grunkorn *et al.* 2017). They also concluded that for the majority of wind farms studied, the numbers of collision victims predicted by collision risk modelling (CRM) using the BAND model, were clearly below the number of collision victims estimated from carcass searches and that the suitability of the BAND-Model for the evaluation of an anticipated collision risk at an 'average' onshore site is limited. Although large birds with poor manoeuvrability (such as cranes, korhaans, and bustards) are generally at greater risk of collision with structures (Jenkins *et al*. 2015), it is noted that these classes of birds (unlike raptors) do not feature prominently in literature as wind turbine collision victims. It may be that they avoid wind farms, resulting in lower collision risks, or that they are not distracted and focussed on hunting and searching the ground while flying, as is the case for raptors.

Eagle mortalities at wind farms are not unexpected. Fatalities at wind farms have been reported for Golden Eagle (e.g. Smallwood 2013), White-tailed Sea Eagle (e.g. Hötker *et al.* 2006), Bald Eagle (Pagel *et al.* 2013) and White-bellied Sea Eagle (Smales & Muir 2005). Verreaux's Eagle has recently been up-listed to *Vulnerable* and rough estimates of the population size are between 3 500 and 3 750 mature individuals (Taylor *et al.,* 2015).

The most effective mitigation for collision impacts currently available is wind farm placement, as well as specific turbine placement within a WEF to avoid high use areas. Such recommendations have been made. While not yet tested in South Africa, deterrent devices and shut-down on demand strategies have been implemented internationally. Foss *et al.* (2017) found monochromatic LEDs that specifically target avian photoreceptors could provide a useful tool to divert raptors from hazardous situations, while in Scotland trials are underway by Scottish Natural Heritage (SNH) using laser beams to deter Sea Eagles from feeding on lambs[22]. Tome *et al.* (2017) found that a Radar Assisted Shutdown on Demand (RASOD) system at the Barão de São João wind farm in Portugal's Sagres region resulted in zero mortality of soaring birds over five consecutive autumn migratory seasons. While such strategy should not be relied upon completely (also considering that they are used internationally during migration events), they should not be discounted and may well hold valuable application in South Africa.

A minimum of 636 birds have been killed by turbines in South Africa to date (BLSA 2017a). Ralston Paton *et al.* (2017) found that mortality estimates for eight studied wind farms in South Africa ranged from 2.1 to 8.6 birds per turbine per year, which is within range of average estimates from Europe (6.5) and North America (1.6) (Rydell *et al.* 2012). Raptors and passerines are the groups most affected by collisions in South Africa to date. Eleven Red Data species (Taylor *et al.* 2015) have been affected, including fatalities of six Blue Crane (Near Threatened), six Verreaux's' Eagle (Vulnerable), six Cape Vulture (Endangered), five Black Harrier (Endangered), four Lanner Falcon (Vulnerable), three Southern Black Korhaan (Vulnerable) and two Martial Eagle (Endangered). Notably, a large number of the not red listed but endemic Jackal Buzzard (63) have been killed (Ralston Paton *et al.* 2017), as well as a number of Rock Kestrel (33) and passerines such as Bokmakierie (21), White-rumped Swift (21) and Red-capped Lark (24).

Verreaux's Eagle is ranked third on the South African Birds and Renewable Energy Specialist Group's priority list and has been confirmed as vulnerable to collisions. During the first year of monitoring at operational wind farms in South Africa, one wind farm recorded four Verreaux's Eagle fatalities in the first year of operation (Ralston-Paton *et al.* 2017). The fatalities occurred a considerable distance (at least 3.5 km) from suitable Verreaux's Eagle breeding habitat and on relatively flat ground (Smallie 2015). A single adult fatality occurred at another wind farm in August, again some distance from a nest 3.8 km away (Ralston-Paton *et al.* 2017). As of 28 September 2017, 6 mortalities of Verreaux's Eagle had been recorded at wind farms in South Africa (BLSA 2017a). Some of these fatalities were unexpected as they occurred in areas not identified as sensitive during pre-construction monitoring. Therefore it is important to consider that collisions may not necessarily occur where predicted, and that they can occur away from areas perceived to be preferred use areas. On the other hand, no fatalities have been reported to date for several species predicted to be susceptible to collisions. Due to these uncertainties a pre-cautionary approach was adapted in the assessment of the impact of collisions with turbines, and the VERA model was adopted as an additional tool to advise placement of turbines to reduce risk. The updated mitigated layout resulted in a reduction in the number of turbines on each WEF phase, as well as turbines being located further from known nest sites (Table 7), further reducing risk of collision.

[22] http://www.bbc.com/news/uk-scotland-highlands-islands-42578354

6.3.2 Collisions with Power Lines

Collisions with power lines are a well-documented threat to birds in southern Africa (van Rooyen 2004), and smaller lines pose a higher threat of electrocution but can still be responsible for collisions. Wind energy facilities may have overhead lines between turbine strings and substations that pose a collision threat, although this is not often the case as internal power is usually transferred between turbines and the on-site substation via underground cabling. Collisions with overhead power lines occur when a flying bird does not see the cables, or is unable to take effective evasive action, and is killed by the impact or impact with the ground. Especially heavy-bodied birds such as bustards, cranes and waterbirds, with limited manoeuvrability are susceptible to this impact (van Rooyen 2004). Many of the collision and electrocution sensitive species are also considered threatened in southern Africa. The Red Data (Taylor *et al.* 2015) species vulnerable to power line collisions are generally long-living, slow-reproducing species. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Species that may be affected on the proposed development site include Blue Crane, Ludwig's Bustard, Secretarybird, and Southern Black Korhaan. Ludwig's Bustard and Blue Crane are known to be particularly prone to collision (pers. comm. R. Simmons, J. Smallie, M. Martins and BARESG) (Shaw *et al.* 2010).

6.3.3 Electrocution

Electrocution of birds from electrical infrastructure including overhead lines and substation components is an important and well documented cause of bird mortality, especially for raptors and storks (van Rooyen and Ledger 1999; APLIC 1994). Electrocution may also occur within newly constructed substations. Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Electrocutions are generally more likely for larger species whose wingspan is able to bridge the gap such as vultures, eagles or storks. A few large birds susceptible to electrocution (particularly in the absence of safe and mitigated structures) occur in the area and may occasionally be present on the proposed development site namely: Cape Vulture, Verreaux's' Eagle and Martial Eagle. Electrocution is also possible on electrical infrastructure within the substation particularly for species such as crows and owls.

6.3.4 Disturbance and Displacement

Disturbance and displacement by operational activities such as power line and turbine maintenance, fencing, and noise can lead to birds avoiding the area for feeding or breeding, and effectively leading to habitat loss and a potential reduction in breeding success (Tarr et al. 2016; Ledec et al. 2011; Percival 2005; Larsen & Madsen 2000). Small songbirds have been known to have been displaced from operational turbines which cause disturbance through noise, vibrations and shadow-flicker (Rydell *et al.* 2017). Disturbance distances (the distance from wind farms up to which birds are absent or less abundant than expected) can vary between species and also within species with alternative habitat availability (Drewitt & Langston 2006). Some international studies of various species have recorded disturbance distances of 80 m, 100 m, 200 m and 300 m (Shaffer & Buhl 2015; Larsen & Madsen 2000) from turbine positions, but distances of 400 m (Reichenbach & Steinborn 2006), 600 m (Kruckenberg & Jaehne 1999) and up to 800 m have been recorded (Drewitt & Langston 2006).

Leddy *et al.* (1999) found increased densities of breeding grassland passerines with increased distance from wind turbines, and higher densities in the reference area than within 80 m of the turbines, indicating that displacement did occur, at least in this case. A comparative study of nine wind farms in Scotland (Pearce-Higgins *et al.* 2009) found seven of the 12 species studied exhibited significantly lower frequencies of occurrence close to the turbines, after accounting for habitat variation, with evidence of turbine avoidance in a further two. No species were more likely to occur close to the turbines. Raptors are generally fairly tolerant of wind farms, and continue to use the area for foraging (Ralston Paton *et al.* 2017; Thelander *et al.* 2003, Madders & Whitfield 2006), and may not be affected by displacement, however this increases their collision risk.

In South Africa the results available thus far have shown little evidence that displacement and disturbance of priority species has occurred (Ralston Paton *et al.* 2017). However, due to the limited number of operational wind farms in South Africa and short monitoring efforts, the precautionary principle should be applied, and disturbance and displacement must still be regarded as a potential impact.

It is expected that some species potentially occurring on the WEF site will be susceptible to disturbance and displacement, for example smaller passerines such as larks, warblers, flycatchers and chats, as well as large terrestrial Red Data species such as Secretarybird, Southern Black Korhaan and Ludwig's Bustard. Priority species nesting on the project site (including on new infrastructure e.g. powerline pylons) may be disturbed during routine maintenance.

6.3.5 Disruption of Local Bird Movement Patterns

Wind energy facilities may form a physical barrier to movement of birds across the landscape, this may alter migration routes and increase distances travelled and energy expenditure or block movement to important areas such as ephemeral wetlands or prey sources altogether. Turbines can also be disruptive to bird flight paths, with some species altering their routes to avoid them (Pettersson & Stalin 2003; Tulp *et al.* 1999; Dirksen *et al.* 1998). While this reduces the chance of collisions it can also create a displacement or barrier effect, for example between roosting and feeding grounds and result in an increased energy expenditure and lower breeding success (Percival 2005). This potential impact is not yet well understood, is likely to be more significant as a cumulative impact with surrounding developments, is difficult to measure and assess, and therefore mitigation measures are difficult to identify. Some mitigation may be possible by avoiding turbine placement in obvious flyways and making turbines more visible through lighting, but this will not change the significance of this impact.

6.4 WEF Impacts-Decommissioning Phase

6.4.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the facility can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons).

6.5 Grid Connection Impacts- Construction Phase

6.5.1 Habitat Destruction

During the construction of the grid connection infrastructure, some habitat destruction and alteration will take place. This happens with the construction of access roads, the clearing of servitudes and areas for pylon placements, and the development of laydown areas. The

removal of vegetation which provides habitat for avifauna and food sources may have an impact on birds breeding, foraging and roosting.

6.5.2 Disturbance and Displacement

Disturbances and noise from staff and construction activities can impact on certain sensitive species particularly whilst feeding and breeding, resulting in effective habitat loss through a perceived increase in predation risk (Percival 2005; Frid & Dill 2002). There are various potentially sensitive species occurring on the Grid Connection route alternatives including Verreaux's Eagle, Martial Eagle, Secretarybird, Blue Crane, Black Harrier and Ludwig's Bustard. Disturbance can cause these species to be displaced, either temporarily (i.e. for some period during the construction activity) or permanently (i.e. they do not return), into less suitable habitat which may reduce their ability to survive and reproduce.

6.6 Grid Connection Impacts - Operational Phase

6.6.1 Collisions with Power Lines

Collisions with large (132 kV or above) power lines is a well-documented threat to birds in southern Africa (van Rooyen 2004). Collisions with overhead power lines occur when a flying bird does not see the cables, or is unable to take effective evasive action, and is killed by the impact or impact with the ground. Especially heavy-bodied birds such as bustards, cranes and waterbirds, with limited manoeuvrability are susceptible to this impact (van Rooyen 2004). Many of the collision sensitive species are also considered threatened in southern Africa. The Red Data (Taylor *et al.* 2015) species vulnerable to power line collisions are generally long living, slow reproducing species. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Species that may be affected on the Grid Connection route alternatives include Blue Crane, Ludwig's Bustard, Kori Bustard, Secretarybird, White Stork, African Spoonbill and Southern Black Korhaan. Ludwig's Bustard and Blue Crane are known to be particularly prone to collision (pers. Com R. Simmons, J. Smallie, M. Martins and BARESG) (Shaw *et al.* 2010).

6.6.2 Electrocution

Electrocution of birds from electrical infrastructure including overhead lines is an important and well documented cause of bird mortality, especially for raptors and storks (van Rooyen and Ledger 1999; APLIC 1994). With regard to the grid connection infrastructure, overhead power line infrastructure with a capacity of 132 kV or more does not generally pose a risk of electrocution due to the large size of the clearances between the electrical infrastructure components. Electrocutions are therefore more likely for larger species whose wingspan is able to bridge the gap such as eagles or storks. A few large species (such as Cape Vulture, Verreaux's' Eagle and Martial Eagle), susceptible to electrocution (particularly in the absence of safe and mitigated structures) may occur in the area.

6.6.3 Disturbance and Displacement

Disturbance and displacement by operational activities such as power line maintenance, can lead to birds avoiding the area for feeding or breeding, and effectively leading to habitat loss and a potential reduction in breeding success (Percival 2005; Larsen & Madsen 2000;). During operation of the grid connection, servitudes for the power line will have to be cleared of excess vegetation at regular intervals. This is done to allow access to the power line for maintenance, to prevent vegetation from intruding into the prescribed clearance gap

between the ground and the conductors, and to minimize the risk of fire under the line which can result in electrical flashovers. These and other maintenance activities can disturb sensitive species occurring on site.

It is expected that some species potentially occurring on the Grid Connection route alternatives will be susceptible to disturbance and displacement, for example smaller passerines such as larks, warblers, flycatchers and chats, as well as large terrestrial Red Data species such as Southern Black Korhaan and Ludwig's Bustard. Priority species nesting on the project site (including on new infrastructure e.g. powerline pylons) may be disturbed during routine maintenance. Potential species at risk of this are Lanner Falcon, Martial Eagle, Verreaux's Eagle and Greater Kestrel.

6.7 Grid Connection Impacts - Decommissioning Phase

6.7.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the Grid Connection can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons). Particularly Martial Eagle (*Endangered*) is known to utilise pylons for nesting and could be susceptible to disturbance, and experience a resulting reduced breeding success. Martial Eagle has been recorded by monitoring at the development site. Lanner Falcon and Verreaux's Eagle as well as Greater Kestrel are three other priority species that may nest on pylons.

7 IMPACT ASSESSMENT

7.1 Highlands North (Phase 1) WEF or Highlands Central (Phase 2) WEF or Highlands South (Phase 3) WEF - Construction Phase

The following potential construction impacts on birds have been identified, and may occur on either of the WEF phases. As the resultant impact significances are the same for all three of the WEF phases, only one table for each impact is given. Each table and the significance of the rated impact is therefore applicable to any one of the three WEFs (North, South or Central) assessed separately.

7.1.1 Habitat Destruction

The extent of this impact is local and confined to the development site. Habitat destruction can be temporary in the case of, for example construction offices and laydown areas, or will last for the duration of the project, in the case of turbine foundations and substation compounds. The impact can be permanent if no rehabilitation takes place, following the decommissioning of the development, although it is assumed that rehabilitation will occur and therefore the duration will be for the life of the WEF. The severity of this impact is considered to be medium negative as a partial loss of habitat and resources will occur. As habitat destruction will definitely occur during construction the probability of this impact is high. The resulting significance of the impact is medium with a high confidence.

Mitigation can reduce the duration and probability of the impact to low, and decrease the significance to low negative (Table 11).

Table 11: Impact Rating Table for Habitat Destruction for the Phase1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Construction							
Potential impact description: Destruction of habitat used by birds							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	H	M	M
With Mitigation	L	L	M	Negative	L	L	M
Can the impact be reversed?			YES – Areas disturbed during construction can be rehabilitated after construction and after decommissioning				
Will impact cause irreplaceable loss or resources?			NO – rehabilitation of habitat is possible. There is extensive avifaunal habitat on the project site and beyond that will remain intact and be available for use.				
Can impact be avoided, managed or mitigated?			YES –The total area of impact (and thus the severity rating) can be minimised.				
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat; - Environmental Control Officers to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced; - High traffic areas and buildings such as offices, batching plants, storage areas etc. should where possible be situated in areas that are already disturbed; - Existing roads and farm tracks should be used where possible; - The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths; - No turbines should be constructed in no-go areas, while associated infrastructure should be avoided where possible in these areas; - Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes as well as the final turbine positions, to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded; Should priority species nests be located, a protective buffer may be applied, within which construction activities may need to be restricted during the breeding season for that species; - Any clearing of large trees (>5m in height), especially stands of large alien trees (e.g. Blue Gum or Pine) on site should be approved first by an avifaunal specialist. Before, clearing, the location and description of the trees should be provided to the specialist, who may request the ECO to inspect the trees for any nests prior to clearing. . - The construction Phase ECO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) are to be trained to identify Red Data and priority bird species, as well as their nests. If any nests or breeding locations for this species are located, an avifaunal specialist is to be contacted for further instruction; and - Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP.							

7.1.2 Disturbance and Displacement

Disturbances and noise from staff and construction activities can impact on certain sensitive species particularly whilst feeding and breeding. This may result in these species being displaced from the WEF site into other areas. The extent of this impact will be restricted to

the immediate WEF site (local). It is expected that the majority of displacement will occur for the duration of the construction phase. The impact is considered to be of moderate severity and negative. The probability of some displacement occurring is considered moderate with a high confidence during the busy construction period, resulting in a medium significance of this impact prior to mitigation. The severity and probability of the impact can be reduced with mitigation, resulting in a Low impact significance after mitigation.

Table 12: Impact Rating Table for Disturbance and Displacement for the Phase1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Construction							
Potential impact description: Disturbance and Displacement of Birds							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	L	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?	PARTIALLY – In some areas of the operational WEF, birds disturbed during construction may return to their activities after completion of construction.						
Will impact cause irreplaceable loss or resources?	POSSIBLE – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.						
Can impact be avoided, managed or mitigated?	PARTIALLY– Some disturbance is inevitable with the activities associated with construction.						
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. Environmental Control Officers to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced; - Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final infrastructure (e.g. road, substation, offices, turbine positions etc.) to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise. Following the specialist site walkthrough, any additional sensitive zones and no-go areas (e.g. nesting sites of Red Data species) are to be designated by the specialist who should advise on an appropriate buffer, within which construction activities may not occur during key breeding times; - The construction Phase ECO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed; - During the construction phase, an avifaunal specialist must conduct a nest survey/exploration of the WEF site. This should be done during and after, the breeding season (i.e. approximately in July and again in September) of large Eagles (e.g. Martial and Verreaux's Eagle). The aim will be to locate any nest sites not yet found, so that these may continue to be monitored during the construction and operation phases, along with the monitoring of already identified nest sites (see point below); and - Appoint a specialist to design and conduct monitoring of the breeding of raptors at the various nests identified to date as well as any additionally located nests (see point above). This monitoring can be combined with the exploration described above, and should be conducted on two occasions (i.e.							

approximately in July and again in September) across each calendar year, during construction. The aim will be to monitor any disturbance to or displacement of the breeding birds during construction.

7.2 Highlands North (Phase 1) WEF or Highlands Central (Phase 2) WEF or Highlands South (Phase 3) WEF - Operational Phase

The following potential operational impacts on birds have been identified, and may occur on either of the WEF phases. As the resultant impact significances are the same for all three of the WEF phases, only one table for each impact is given. Each table and the significance of the rated impact is therefore applicable to any one of the three WEFs (North, South or Central) assessed separately.

7.2.1 Collisions with Wind Turbines

The duration of the impact will be at least for the operational phase of the facility, but could impact populations more permanently through local/regional extinctions. The severity of the impact is high, as it results in mortality. The resulting significance of the impact prior to mitigation is moderate negative.

If mitigation measures are implemented, especially turbine placement is informed by the avifaunal sensitivity map and No-go Areas, then the probability of the impacts could be reduced. This is even more relevant with the further reduction in turbines and increase in no-go areas following the additional 2019 work. The resulting significance with mitigation would be lower, although it would still fall in the medium category because of the criteria used.

Table 13: Impact Rating Table for Collisions with Wind Turbines for the Phase1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Operation							
Potential impact description: Bird mortality caused by collision with wind turbine blades and/or towers							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	M	M	Negative	H	M	M
With Mitigation	H	M	M	Negative	M	M	M
Can the impact be reversed?			PARTIALLY – Bird fatalities caused by collisions with turbines are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			POSSIBLY – Collisions with turbines cause bird fatalities, which could significantly impact local and/or regional populations of certain species.				
Can impact be avoided, managed or mitigated?			PARTIALLY – The probability of the impact can potentially be reduced through informed placement of turbines.				
Mitigation measures to reduce residual risk or enhance opportunities: - The minimum number of turbines should be constructed to achieve the required MW output. It is preferable to have smaller number of turbines with larger rotor, compared with more turbines with smaller rotor. - Turbines must not be constructed within any designated No-Go Areas. The turbine blade should not protrude into these areas, and therefore the bases should be constructed suitably far from these areas to prevent this; - The hierarchy of sensitivity zones identified should be considered where possible with preferential placement of turbines in areas with no sensitivity score, followed by low sensitivity, medium sensitivity and medium-high sensitivity;							

- Develop and implement a carcass search programme for birds as a minimum during the first three years of operation followed by year 5, 10, 15, 20 and 25, in line with the applicable South African monitoring guidelines;
- Develop and implement a minimum 12 month post-construction bird activity monitoring program that mirrors the pre-construction monitoring surveys completed by Arcus and is in line with the applicable South African post-construction monitoring guidelines. This program must include thorough and ongoing nest searches and nest monitoring. The results of this monitoring and the carcass searchers should advise the need for any additional ongoing activity monitoring or nest surveys beyond the 12 month period;
- Conduct frequent and regular review of operational phase monitoring data (activity and carcass) and results by an avifaunal specialist. This review should also establish the requirement for continued monitoring studies (activity and carcass) throughout the operational and decommissioning phases of the development;
- The above reviews should strive to identify sensitive locations at the development including turbines and areas of increased collisions with power lines that may require additional mitigation. If unacceptable impacts are observed (in the opinion of the bird specialist after consultation with BLSA, relevant stakeholders and an independent review), the specialist should conduct a literature review specific to the impact (e.g. collision and/or electrocution) and provide updated and relevant mitigation options to be implemented. Mitigations that may need to be implemented (and should be considered in the project's financial planning) include:
    - Onsite and off-site habitat management. A habitat management plan which aims to prevent an influx/increase in preferred prey items in the turbine area due to the construction and operation activities, while improving raptor habitat and promoting prey availability away from the site.
    - Painting one of the three blades on relevant/selected turbines.
    - Implementing a carcass management plan on the WEF site, to remove any dead livestock as soon as possible, to reduce the likelihood of attracting vultures to the WEF site.
    - Using deterrent devices (e.g. visual and noise deterrents) and/or shutdown systems e.g. Automatic bird detectors (e.g. automated camera based monitoring systems – McClure et. al. 2018) if commercially available; or Radar Assisted Shutdown on Demand (RASOD) to reduce collision risk.
    - Identify options to modify turbine operation (e.g. temporary curtailment or shut-down on demand) to reduce collision risk if absolutely necessary and other methods have not had the desired results.
    - Possibly offset programmes if no suitable mitigation measures can be implemented to reduced impacts sufficiently.

7.2.2 Collisions with Internal WEF Power Lines

The extent of this impact is restricted to constructed powerlines within the WEF, but can occur for the duration of the projects lifespan. The impact potentially has a high severity, depending on the number and species killed, and the resultant significance before mitigation is Medium. If mitigation are adhered to the severity and probability of the impact can be reduced, resulting in a low significance rating.

Table 14: Impact Rating Table for Collisions with Power Lines for the Phase 1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Operation							
Potential impact description: Bird mortality caused by collision overhead powerlines on the WEF site.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M

Can the impact be reversed?	POSSIBLY – Bird fatalities caused by collisions with overhead power lines are irreversible. However local populations may recover if the occurrence of deaths is low.
Will impact cause irreplaceable loss or resources?	UNLIKELY – Collisions with overhead power lines causes bird fatalities which may significantly impact populations of certain species.
Can impact be avoided, managed or mitigated?	YES – Reducing the total distance of overhead power lines and increasing their visibility by fitting bird flight diverters (BFD's) can reduce the number of collisions.
Mitigation measures to reduce residual risk or enhance opportunities: - All new internal power lines linking the wind turbine generators to each other on site must be placed underground where technically and environmentally feasible. Certain spans can only be above ground if it is impossible and completely unfeasible to bury them or if there is a reasonable other environmental aspect present which prevents them being buried (e.g. a sensitive wetland area); - Placement of electrical infrastructure should consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; - If some spans are to be above ground, where possible place new overhead power lines adjacent to existing power line or linear infrastructure (e.g. roads and fence lines); - Attach appropriate marking devices (BFDs) on all new overhead power lines on the WEF to increase visibility. The advice of a specialist should be sought regarding the type, placement and spacing of the BFDs to be used and the type of pylon structure to be used; and - Develop and implement a carcass search program for birds during the first two years of operation, in line with the South African monitoring guidelines (Jenkins et al. 2015). This program must include monitoring of overhead power lines.	

7.2.3 Electrocution

The impact occurs locally and is restricted to powerlines within the WEF site, but can occur throughout the lifespan of the project. As the result of the impact is mortality it could affect the breeding success of species and their populations, therefore the intensity is considered potentially moderate. As electrocution is known to affect many species in South Africa the impact is medium probability of it occurring in the absence of mitigation.

If all powerlines are either underground or of a bird-friendly design as detailed in the table below the probability of electrocution occurring can be reduced to low, resulting in an impact of low significance.

Table 15: Impact Rating Table for Electrocution for the Phase 1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Operation							
Potential impact description: Bird mortality caused by electrocution on the WEF site.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	H
Can the impact be reversed?			POSSIBLY – Bird fatalities caused by electrocution are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			POSSIBLY – Electrocution from overhead power lines causes bird fatalities which could significantly impact populations of certain species.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total length of overhead power lines and using a safe pylon design can reduce the risk of electrocution.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Placement of electrical infrastructure should consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- All new internal power lines linking the wind turbine generators to each other on site must be placed underground where technically and environmentally feasible. Certain spans can only be above ground if it is impossible and completely unfeasible to bury them or if there is a reasonable other environmental aspect present which prevents them being buried (e.g. a sensitive wetland area);
- Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components and possible bird perches (e.g. cross arms) of 1.8 m or greater. Each pylon should be fitted with a safe bird perch; and
- Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines (Jenkins et al. 2015). This program must include monitoring of overhead power lines.

7.2.4 Disturbance and Displacement

It is expected that some species potentially occurring on the WEF site will be susceptible to displacement during the operational phase, for example smaller passerines such as larks and pipits, and large terrestrial Red Data species such as Ludwig's Bustard, Secretarybird and Southern Black Korhaan. The extent of the impact may extend beyond the WEF site and the duration of the impact will last for the duration of operations. The severity is considered moderate and probable to occur, resulting in a medium significance. Mitigation can restrict the extent of the impact to the site and reduce the probability, resulting in a low significance after mitigation.

Table 16: Impact Rating Table for Disturbance and Displacement for the Phase 1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	L
With Mitigation	M	L	M	Negative	L	L	L
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation displaced species will possibly return.				
Will impact cause irreplaceable loss or resources?			POSSIBLE – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the operational activities				
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations; - The on-site WEF manager (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Wind Farm, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction;							

- Operational phase bird monitoring, in line with applicable guidelines, must be implemented and must include monitoring of all raptor nest sites for breeding success; and
- No turbines should be placed in no-go areas to be identified through pre-construction monitoring, while associated infrastructure should be avoided where possible in these areas.

7.2.5 Disruption of Local Bird Movement Patterns

The extent of this impact would affect bird populations travelling through the area and therefore extend beyond the boundaries of the wind farm and is thus classified as medium. The duration would be for the lifespan of the project (medium). The severity would be moderate, although the probability is predicted to be low and the resulting significance low as well.

The impact is not well understood, and while some mitigation may be possible by avoiding turbine placement in obvious flyways, and by making turbines more visible through lighting, this will not change the significance of this impact.

Table 17: Impact Rating Table for Disruption of Local Bird Movement Patterns for the Phase 1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Operation							
Potential impact description: Disruption of Local Bird Movement Patterns (e.g. barrier effects).							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	L	L	L
With Mitigation	M	M	M	Negative	L	L	L
Can the impact be reversed?			POSSIBLY				
Will impact cause irreplaceable loss or resources?			POSSIBLY – Impact is not well understood.				
Can impact be avoided, managed or mitigated?			POSSIBLY				
Mitigation measures to reduce residual risk or enhance opportunities: - The lowest feasible number of turbines should be constructed for the required MW output. Therefore, fewer larger (i.e. with a higher MW output) turbine models should be favoured where possible; - Lighting on turbines to be of an intermittent and coloured nature rather than constant white light to reduce the possible impact on the movement patterns of nocturnal migratory species; and - Turbines must not be constructed within any No-Go areas.							

7.3 Highlands North (Phase 1) WEF or Highlands Central (Phase 2) WEF or Highlands South (Phase 3) WEF - Decommissioning Phase

The following potential decommissioning impact may occur on either of the WEF phases. As the resultant impact significance is the same for all three of the WEF phases, only one table is given. The significance of the rated impact is therefore applicable to any one of the three WEFs (North, South or Central) assessed separately.

7.3.1 Disturbance and Displacement

Disturbances and noise from staff and decommissioning activities can impact on certain sensitive species particularly whilst feeding and breeding. This may result in these species being displaced. It may also result in failed breeding attempts if nest sites are disturbed.

The extent of this impact will be restricted to the immediate WEF site (local), and may occur for the duration of the decommissioning phase. The impact is considered to be of

moderate severity with a medium probability of occurring in the absence of mitigation, resulting in a medium significance. The severity and probability of the impact can be reduced with mitigation, resulting in a Low impact significance after mitigation.

Table 18: Impact Rating Table for Disturbance and Displacement during Decommissioning for the Phase1 WEF or Phase 2 WEF or Phase 3 WEF

Impact Phase: Decommissioning							
Potential impact description: Disturbance and Displacement of Birds							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	L	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?			UNKNOWN				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the activities associated with decommissioning.				
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Environmental Management Plan must be implemented, for the decommissioning phase. - Environmental Control Officers to oversee activities and ensure that the site specific EMP is implemented and enforced; - The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.							

7.4 An up to 140 MW WEF consisting of turbines from Highlands Central (Phase 2) WEF and Highlands North (Phase 1) or Highlands South (Phase 3).

As previously discussed, the proposed Highlands development consists of three WEF phases. However, ultimately due to grid connection conditions the proponent may be required to bid two projects into the REIPPP process, with a combined maximum capacity of up to 140 MW.

If the three phases are successful in (separately) obtaining Environmental Authorisation, turbines from the Highlands Central WEF (Phase 2) will be combined with turbines either from Highlands North (Phase 1) **or** Highlands South (Phase 3), depending on meteorological data, for bidding as one project in the REIPPP. A second project (to connect to the second existing HV line on the project site) may also bid, again drawing on turbine locations from one or more of the approved WEF sites.

Therefore, Table 19 shows an assessment of a WEF up to a maximum of 140 MW and utilising turbine positions (outside of no-go areas) from all three phases, which is likely to result in less than 40 turbines being constructed. The same impacts as identified and discussed above may occur, and the same mitigations measures are recommended, and therefore separate assessment tables are not given. Instead a summary table of the resultant significance ratings is given.

Table 19: Significance Ratings of Impacts for a Single 140 MW WEF Comprising of 40 or Less Turbines from Locations from either the Central WEF and North WEF or the Central WEF and South WEF.

Impact Description	Significance (Without Mitigation)	Significance (With Mitigation)	Confidence
Construction Phase			
Habitat Destruction	Medium	Low	Medium
Disturbance and Displacement	Medium	Low	Medium
Operational Phase			
Collision with wind turbines	High	Medium	Medium
Collision with power lines	Medium	Low	Medium
Electrocution	Medium	Low	High
Disturbance and Displacement	Medium	Low	Low
Disruption of Local Bird Movement Patterns	Low	Low	Low
Decommissioning Phase			
Disturbance and Displacement	Medium	Low	Medium

7.5 Grid Connection for Highlands North (Phase 1) WEF – Construction Phase

7.5.1 Habitat Destruction

Habitat destruction will be limited to the grid connection area (low extent). And the intensity of habitat destruction is considered to be medium, resulting in an impact of potentially medium negative significance. With appropriate mitigation measures applied the intensity and probability of the impact can be reduced to low, changing the significance to low.

Table 20: Impact Rating Table for Habitat Destruction during Construction for Grid Connection for Highlands North

Impact Phase: Construction							
Potential impact description: Destruction of habitat used by birds							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	H	M	M
With Mitigation	L	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	H	M	M

With Mitigation	L	L	M	Negative	L	L	M
Can the impact be reversed?			YES – Areas disturbed during construction can be rehabilitated after construction and after decommissioning				
Will impact cause irreplaceable loss or resources?			NO – rehabilitation of habitat is possible				
Can impact be avoided, managed or mitigated?			YES –The total area of impact (and thus the intensity rating) can be minimised. The servitude can be rehabilitated after project close.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Existing roads and farm tracks should be used where possible;
- The minimum footprint areas of infrastructure should be used wherever possible, including access road widths and lengths;
- A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat. ECOs to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line routes to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded;
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP;
- Construction of grid infrastructure (within the WEF site) must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Any clearing of stands of alien trees on site should be approved first by an avifaunal specialist;
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the Construction Environmental Management Plan (CEMP); and
- The Grid Connection route should, where possible, follow existing linear infrastructure such as roads and power lines, and should be constructed as close as practically possible to the existing infrastructure.

7.5.2 Disturbance and Displacement

The duration of disturbance is expected to last for the duration of the construction phase (medium-term) and will be restricted to the grid connection area. Disturbance during the breeding season and close to nesting sites can potentially impact the breeding success of various sensitive species. Therefore this impact is considered of medium severity resulting in a medium negative significance. With mitigation measures applied, the extent and probability of the impact is reduced and the residual impact is expected to be low negative.

Table 21: Impact Rating Table for Disturbance and Displacement during Construction for Grid Connection for Highlands North

Impact Phase: Construction							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			PARTIALLY – In some areas, birds disturbed during construction may return to their activities after completion of construction.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the activities associated with construction.				
Mitigation measures to reduce residual risk or enhance opportunities: - A CEMP must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. ECOs to oversee activities and ensure that the site specific CEMP is implemented and enforced; - Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line route to identify any nests/breeding/roosting activity of sensitive species as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise; and - Sensitive zones and no-go areas are to be designated by the specialist (e.g. nesting sites) and must be avoided.							

7.6 Grid Connection for Highlands North (Phase 1) WEF – Operational Phase

7.6.1 Power Line Collisions

The result of this impact is mortality, however due to the relatively short length of the line, excessive mortalities which may affect the viability of a population are not expected and therefore the severity is considered moderate, and restricted to the site. As discussed previously the impact is probable to occur, resulting in a medium significance before mitigation. If mitigation measures are adhered to the probability of the impact can be reduced to low, resulting in a low significance rating.

Table 22: Impact Rating Table for Power Line Collisions for Grid Connection for Highlands North

Impact Phase: Operation							
Potential impact description: Bird mortality from power line collision.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M

Can the impact be reversed?	POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.
Will impact cause irreplaceable loss or resources?	POSSIBLY – Collisions with overhead power lines causes bird fatalities which could significantly impact populations of certain species.
Can impact be avoided, managed or mitigated?	YES – Reducing the total distance of overhead power lines and increasing their visibility by fitting bird flight diverters (BFD's) can reduce the number of collisions.
Mitigation measures to reduce residual risk or enhance opportunities: - Grid infrastructure should not be constructed in No-Go areas; - Construction of grid infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; - Wherever possible, place new overhead power lines adjacent to existing power lines or linear infrastructure (e.g. roads and fence lines). Where the new power line is adjacent to an existing line, ensure that new pylons are staggered so that they are not in line with existing pylons wherever possible; - Prior to construction, the avifaunal specialist must conduct a site walkthrough determine the power line spans that will require marking devices [Bird Flight Diverters (BFDs)] to increase visibility. It is likely that the specialist may recommend all, or the vast majority of spans will need to be mitigated, and suitable financial allowance should be made for this; - Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans. - Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations. - Any mortalities should be reported to the Endangered Wildlife Trust (EWT).	

7.6.2 Electrocution

The impact occurs locally and is restricted to the grid connection area, while it has a moderate severity as the result of the impact is mortality it could affect the breeding success of species and their populations. Without mitigation there is a moderate probability of the impact occurring due to the potential presence of various large raptors in the area, resulting in a medium negative significance. The impact is well understood and relatively easy to mitigate. By using bird friendly structures the probability of the impact can be reduced to low, and the residual impact would therefore be a low negative.

Table 23: Impact Rating Table for Electrocution for Grid Connection for Highlands North

Impact Phase: Operation							
Potential impact description: Bird mortality from electrocution.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	M	Negative	L	L	H
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H

With Mitigation	M	L	M	Negative	L	L	H
Can the impact be reversed?			POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Electrocution from overhead power lines causes bird fatalities, although this is unlikely to happen and therefore won't significantly impact populations.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total length of overhead power lines and using a safe pylon design can reduce the risk of electrocution.				
Mitigation measures to reduce residual risk or enhance opportunities: - Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' structures (in line with standard Eskom guidelines), with clearances between live components of 1.8 m or greater and which provides a safe bird perch; - All electrical infrastructure, including transformers and substations, must be designed in line with Eskom's standards that ensure adequate insulation of all components to prevent electrocution of birds; and - Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations. Any mortalities should be reported to the EWT.							

7.6.3 Disturbance and Displacement

The extent of this impact may extend beyond the site and last for the duration of the operation of the grid connection (medium term). As disturbance is largely restricted to regular maintenance activities that do not occur on a daily basis the intensity of the impact is considered medium, resulting in a medium negative significance. The implementation of mitigation can lower the extent and probability of the impact, which would result in a low residual impact significance.

Table 24: Impact Rating Table for Disturbance and Displacement during Operations for the Grid Connection for Highlands North

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation displaced species will possibly return.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				

Can impact be avoided, managed or mitigated?	PARTIALLY– Some disturbance is inevitable with the operational activities, but these can be minimised.
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations; - No bird nests must be disturbed or removed from any pylon or substation infrastructure prior to consultation with and approval from the avifaunal specialist; - The Manager and field staff responsible for maintenance and repairs on the grid connection line (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Grid Connection site, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction; and - Operational phase bird monitoring, in line with applicable guidelines, must be implemented to include monitoring of the Grid Connection route and must include monitoring of all raptor nest sites for breeding success.	

7.7 Grid Connection for Highlands North (Phase 1) WEF – Decommissioning Phase

7.7.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the Grid Connection can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons), which may result in impacts of moderate severity. Without mitigation there is a moderate probability of this happening, resulting in a medium significance of this impacts. If mitigation is correctly applied, the extent and probability of the impact can both be reduced to low, resulting in a low significance rating.

Table 25: Impact Rating Table for Disturbance and Displacement during Decommissioning for the Grid Connection for Highlands North

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation some displaced species may possibly return.				

Will impact cause irreplaceable loss or resources?	UNLIKELY
Can impact be avoided, managed or mitigated?	PARTIALLY– Some disturbance is inevitable with the decommissioning activities, but these can be minimised.
Mitigation measures to reduce residual risk or enhance opportunities: - An EMP must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted. All contractors are to adhere to the EMP and should apply good environmental practice during decommissioning; - ECOs to oversee activities and ensure that the CEMP for decommissioning is implemented and enforced; - The appointed ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed; and - Prior to decommissioning, an avifaunal specialist should conduct a site walkthrough, covering the entire power line route to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final decommissioning schedule in close proximity to that specific area, including abbreviating activity times, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.	

7.8 Grid Connection for Highlands Central (Phase 2) WEF – Construction Phase

7.8.1 Habitat Destruction

Habitat destruction will be limited to the grid connection area (low extent). And the intensity of habitat destruction is considered to be medium, resulting in an impact of potentially medium negative significance. With appropriate mitigation measures applied the intensity and probability of the impact can be reduced to low, which changes the significance to low.

Table 26: Impact Rating Table for Habitat Destruction during Construction for Grid Connection for Highlands Central

Impact Phase: Construction							
Potential impact description: Destruction of habitat used by birds							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	H	M	M
With Mitigation	L	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	H	M	M
With Mitigation	L	L	M	Negative	L	L	M

Can the impact be reversed?	YES – Areas disturbed during construction can be rehabilitated after construction and after decommissioning
Will impact cause irreplaceable loss or resources?	NO – rehabilitation of habitat is possible
Can impact be avoided, managed or mitigated?	YES –The total area of impact (and thus the intensity rating) can be minimised. The servitude can be rehabilitated after project close.
Mitigation measures to reduce residual risk or enhance opportunities: - Existing roads and farm tracks should be used where possible; - The minimum footprint areas of infrastructure should be used wherever possible, including access road widths and lengths; - A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat. ECOs to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced; - Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line routes to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded; - Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP; - Construction of grid infrastructure (within the WEF site) must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; - Any clearing of stands of alien trees on site should be approved first by an avifaunal specialist; - Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the Construction Environmental Management Plan (CEMP); and - The Grid Connection route should, where possible, follow existing linear infrastructure such as roads and power lines, and should be constructed as close as practically possible to the existing infrastructure.	

7.8.2 Disturbance and Displacement

The duration of disturbance is expected to last for the duration of the construction phase (medium-term) and will be restricted to the grid connection area. Disturbance during the breeding season and close to nesting sites can potentially impact the breeding success of various sensitive species. Therefore this impact is considered of medium severity resulting in a medium negative significance. With mitigation measures applied, the extent and probability of the impact is reduced and the residual impact is expected to be low negative.

Table 27: Impact Rating Table for Disturbance and Displacement during Construction for Grid Connection for Highlands Central

Impact Phase: Construction							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			PARTIALLY – In some areas, birds disturbed during construction may return to their activities after completion of construction.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the activities associated with construction.				
Mitigation measures to reduce residual risk or enhance opportunities: - A CEMP must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. ECOs to oversee activities and ensure that the site specific CEMP is implemented and enforced; - Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line route to identify any nests/breeding/roosting activity of sensitive species as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise; and - Sensitive zones and no-go areas are to be designated by the specialist (e.g. nesting sites) and must be avoided.							

7.9 Grid Connection for Highlands Central (Phase 2) WEF – Operational Phase

7.9.1 Power Line Collisions

The result of this impact is mortality, however due to the relatively short length of the line, excessive mortalities which may affect the viability of a population are not expected and therefore the severity is considered moderate, and restricted to the site. As discussed previously the impact is probable to occur, resulting in a medium significance before mitigation. If mitigation measures are adhered to the probability of the impact can be reduced to low, resulting in a low significance rating.

Table 28: Impact Rating Table for Power Line Collisions for Grid Connection for Highlands Central

Impact Phase: Operation							
Potential impact description: Bird mortality from power line collision.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M

Can the impact be reversed?	POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.
Will impact cause irreplaceable loss or resources?	POSSIBLY – Collisions with overhead power lines causes bird fatalities which could significantly impact populations of certain species.
Can impact be avoided, managed or mitigated?	YES – Reducing the total distance of overhead power lines and increasing their visibility by fitting bird flight diverters (BFD's) can reduce the number of collisions.
Mitigation measures to reduce residual risk or enhance opportunities: - Grid infrastructure should not be constructed in No-Go areas; - Construction of grid infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; - Wherever possible, place new overhead power lines adjacent to existing power lines or linear infrastructure (e.g. roads and fence lines). Where the new power line is adjacent to an existing line, ensure that new pylons are staggered so that they are not in line with existing pylons wherever possible; - Prior to construction, the avifaunal specialist must conduct a site walkthrough determine the power line spans that will require marking devices [Bird Flight Diverters (BFDs)] to increase visibility. It is likely that the specialist may recommend all, or the vast majority of spans will need to be mitigated, and suitable financial allowance should be made for this; - Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans. - Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations. - Any mortalities should be reported to the Endangered Wildlife Trust (EWT).	

7.9.2 Electrocution

The impact occurs locally and is restricted to the grid connection area, while it has a moderate severity as the result of the impact is mortality it could affect the breeding success of species and their populations. Without mitigation there is a moderate probability of the impact occurring due to the potential presence of various large raptors in the area, resulting in a medium negative significance. The impact is well understood and relatively easy to mitigate. By using bird friendly structures the probability of the impact can be reduced to low, and the residual impact would therefore be a low negative.

Table 29: Impact Rating Table for Electrocution for Grid Connection for Highlands Central

Impact Phase: Operation							
Potential impact description: Bird mortality from electrocution.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	M	Negative	L	L	H
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H

With Mitigation	M	L	M	Negative	L	L	H
Can the impact be reversed?			POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Electrocution from overhead power lines causes bird fatalities, although this is unlikely to happen and therefore won't significantly impact populations.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total length of overhead power lines and using a safe pylon design can reduce the risk of electrocution.				
Mitigation measures to reduce residual risk or enhance opportunities: - Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' structures (in line with standard Eskom guidelines), with clearances between live components of 1.8 m or greater and which provides a safe bird perch; - All electrical infrastructure, including transformers and substations, must be designed in line with Eskom's standards that ensure adequate insulation of all components to prevent electrocution of birds; and - Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations. Any mortalities should be reported to the EWT.							

7.9.3 Disturbance and Displacement

The extent of this impact may extend beyond the site and last for the duration of the operation of the grid connection (medium term). As disturbance is largely restricted to regular maintenance activities that do not occur on a daily basis the intensity of the impact is considered medium, resulting in a medium negative significance. The implementation of mitigation can lower the extent and probability of the impact, which would result in a low residual impact significance.

Table 30: Impact Rating Table for Disturbance and Displacement during Operations for the Grid Connection for Highlands Central

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation displaced species will possibly return.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				

Can impact be avoided, managed or mitigated?	PARTIALLY– Some disturbance is inevitable with the operational activities, but these can be minimised.
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations; - No bird nests must be disturbed or removed from any pylon or substation infrastructure prior to consultation with and approval from the avifaunal specialist; - The Manager and field staff responsible for maintenance and repairs on the grid connection line (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Grid Connection site, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction; and - Operational phase bird monitoring, in line with applicable guidelines, must be implemented to include monitoring of the Grid Connection route and must include monitoring of all raptor nest sites for breeding success.	

7.10 Grid Connection for Highlands Central (Phase 2) WEF – Decommissioning Phase

7.10.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the Grid Connection can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons), which may result in impacts of moderate severity. Without mitigation there is a moderate probability of this happening, resulting in a medium significance of this impacts. If mitigation is correctly applied, the extent and probability of the impact can both be reduced to low, resulting in a low significance rating.

Table 31: Impact Rating Table for Disturbance and Displacement during Decommissioning for the Grid Connection for Highlands Central

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation some displaced species may possibly return.				

Will impact cause irreplaceable loss or resources?	UNLIKELY
Can impact be avoided, managed or mitigated?	PARTIALLY– Some disturbance is inevitable with the decommissioning activities, but these can be minimised.
Mitigation measures to reduce residual risk or enhance opportunities: - An EMP must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted. All contractors are to adhere to the EMP and should apply good environmental practice during decommissioning; - ECOs to oversee activities and ensure that the CEMP for decommissioning is implemented and enforced; - The appointed ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed; and - Prior to decommissioning, an avifaunal specialist should conduct a site walkthrough, covering the entire power line route to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final decommissioning schedule in close proximity to that specific area, including abbreviating activity times, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.	

7.11 Grid Connection for Highlands South (Phase 3) WEF – Construction Phase

7.11.1 Habitat Destruction

The severity of habitat destruction is considered to be medium, resulting in an impact of potentially medium negative significance. With appropriate mitigation measures applied the extent and probability of the impact can be reduced to low, changing the significance to low.

Table 32: Impact Rating Table for Habitat Destruction during Construction for Grid Connection for Highlands South

Impact Phase: Construction							
Potential impact description: Destruction of habitat used by birds							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	L	L	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	L	M	Negative	L	L	M

Can the impact be reversed?	YES – Areas disturbed during construction can be rehabilitated after construction and after decommissioning
Will impact cause irreplaceable loss or resources?	NO – rehabilitation of habitat is possible
Can impact be avoided, managed or mitigated?	YES –The total area of impact (and thus the intensity rating) can be minimised. The servitude can be rehabilitated after project close.
Mitigation measures to reduce residual risk or enhance opportunities: - Existing roads and farm tracks should be used where possible; - The minimum footprint areas of infrastructure should be used wherever possible, including access road widths and lengths; - A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat. ECOs to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced; - Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line routes to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded; - Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP; - Construction of grid infrastructure (within the WEF site) must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; - Any clearing of stands of alien trees on site should be approved first by an avifaunal specialist; - Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the Construction Environmental Management Plan (CEMP); and - The Grid Connection route should, where possible, follow existing linear infrastructure such as roads and power lines, and should be constructed as close as practically possible to the existing infrastructure.	

7.11.2 Disturbance and Displacement

The duration of disturbance is expected to last for the duration of the construction phase (medium-term) and will be restricted to the grid connection area. Disturbance during the breeding season and close to nesting sites can potentially impact the breeding success of various sensitive species. Therefore this impact is considered of medium severity resulting in a medium negative significance. With mitigation measures applied, the extent and probability of the impact is reduced and the residual impact is expected to be low negative.

Table 33: Impact Rating Table for Disturbance and Displacement during Construction for Grid Connection for Highlands South

Impact Phase: Construction							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			PARTIALLY – In some areas, birds disturbed during construction may return to their activities after completion of construction.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			PARTIALLY– Some disturbance is inevitable with the activities associated with construction.				
Mitigation measures to reduce residual risk or enhance opportunities: - A CEMP must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. ECOs to oversee activities and ensure that the site specific CEMP is implemented and enforced; - Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line route to identify any nests/breeding/roosting activity of sensitive species as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise; and - Sensitive zones and no-go areas are to be designated by the specialist (e.g. nesting sites) and must be avoided.							

7.12 Grid Connection for Highlands South (Phase 3) WEF – Operational Phase

7.12.1 Power Line Collisions

The result of this impact is mortality, and due to the relatively long length of the line (for both alternatives), excessive mortalities which may affect the viability of a population beyond the project site are possible. The impact has a high probability of occurring, resulting in a high negative significance before mitigation. If mitigation measures are adhered to the extent and probability of the impact can be reduced, resulting in a medium negative significance rating.

Table 34: Impact Rating Table for Power Line Collisions for Grid Connection for Highlands South

Impact Phase: Operation							
Potential impact description: Bird mortality from power line collision.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	H	M	Negative	H	H	M
With Mitigation	H	M	M	Negative	M	M	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	H	M	Negative	H	H	M
With Mitigation	H	M	M	Negative	M	M	M

Can the impact be reversed?	POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.
Will impact cause irreplaceable loss or resources?	POSSIBLY – Collisions with overhead power lines causes bird fatalities which could significantly impact populations of certain species.
Can impact be avoided, managed or mitigated?	YES – Reducing the total distance of overhead power lines and increasing their visibility by fitting bird flight diverters (BFD's) can reduce the number of collisions.
Mitigation measures to reduce residual risk or enhance opportunities: - Grid infrastructure should not be constructed in No-Go areas; - Construction of grid infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; - Wherever possible, place new overhead power lines adjacent to existing power lines or linear infrastructure (e.g. roads and fence lines). Where the new power line is adjacent to an existing line, ensure that new pylons are staggered so that they are not in line with existing pylons wherever possible; - Prior to construction, the avifaunal specialist must conduct a site walkthrough determine the power line spans that will require marking devices [Bird Flight Diverters (BFDs)] to increase visibility. It is likely that the specialist may recommend all, or the vast majority of spans will need to be mitigated, and suitable financial allowance should be made for this; - Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans. - Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations. - Any mortalities should be reported to the Endangered Wildlife Trust (EWT).	

7.12.2 Electrocution

While the impact occurs locally, a number of electrocutions along the line may effect populations beyond the site. The impact has a moderate severity as the result of the impact is mortality it could affect the breeding success of species and their populations. Without mitigation there is a moderate probability of the impact occurring due to the potential presence of various large raptors in the area, resulting in a medium negative significance. The impact is well understood and relatively easy to mitigate. By using bird friendly structures the extent and probability of the impact can be reduced to low, and the residual impact would therefore be a low negative.

Table 35: Impact Rating Table for Electrocution for Grid Connection for Highlands South

Impact Phase: Operation							
Potential impact description: Bird mortality from electrocution.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	H
With Mitigation	M	L	M	Negative	L	L	H
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	H

With Mitigation	M	L	M	Negative	L	L	H
Can the impact be reversed?			POSSIBLY – Bird fatalities are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Electrocution from overhead power lines causes bird fatalities, although this is unlikely to happen and therefore won't significantly impact populations.				
Can impact be avoided, managed or mitigated?			YES – Reducing the total length of overhead power lines and using a safe pylon design can reduce the risk of electrocution.				
Mitigation measures to reduce residual risk or enhance opportunities: - Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' structures (in line with standard Eskom guidelines), with clearances between live components of 1.8 m or greater and which provides a safe bird perch; - All electrical infrastructure, including transformers and substations, must be designed in line with Eskom's standards that ensure adequate insulation of all components to prevent electrocution of birds; and - Develop and implement a carcass search programme for large terrestrial birds, covering the Grid Connection line (or strategic locations along the line selected by the specialist), to be implemented as a minimum over the course of the first two years of operations. Any mortalities should be reported to the EWT.							

7.12.3 Disturbance and Displacement

The extent of this impact may extend beyond the site and last for the duration of the operation of the grid connection (medium term). As disturbance is largely restricted to regular maintenance activities that do not occur on a daily basis the intensity of the impact is considered medium, resulting in a medium negative significance. The implementation of mitigation can lower the extent and probability of the impact, which would result in a low residual impact significance.

Table 36: Impact Rating Table for Disturbance and Displacement during Operations for the Grid Connection for Highlands South

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation displaced species will possibly return.				
Will impact cause irreplaceable loss or resources?			UNLIKELY – Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				

Can impact be avoided, managed or mitigated?	PARTIALLY– Some disturbance is inevitable with the operational activities, but these can be minimised.
Mitigation measures to reduce residual risk or enhance opportunities: - A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations; - No bird nests must be disturbed or removed from any pylon or substation infrastructure prior to consultation with and approval from the avifaunal specialist; - The Manager and field staff responsible for maintenance and repairs on the grid connection line (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Grid Connection site, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction; and - Operational phase bird monitoring, in line with applicable guidelines, must be implemented to include monitoring of the Grid Connection route and must include monitoring of all raptor nest sites for breeding success.	

7.13 Grid Connection for Highlands South (Phase 3) WEF – Decommissioning Phase

7.13.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the Grid Connection can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons), which may result in impacts of moderate severity. Without mitigation there is a high probability of this happening, resulting in a medium significance of this impact. If mitigation is correctly applied, the probability of the impact can be reduced to low, resulting in a low significance rating.

Table 37: Impact Rating Table for Disturbance and Displacement during Decommissioning for the Grid Connection for Highlands South

Impact Phase: Operation							
Potential impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.							
GRID ALTERNATIVE 1							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	M	M	Negative	L	L	M
GRID ALTERNATIVE 2							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	H	M	M
With Mitigation	M	M	M	Negative	L	L	M
Can the impact be reversed?			POSSIBLY – After decommissioning and rehabilitation some displaced species may possibly return.				

Will impact cause irreplaceable loss or resources?	UNLIKELY
Can impact be avoided, managed or mitigated?	PARTIALLY– Some disturbance is inevitable with the decommissioning activities, but these can be minimised.
Mitigation measures to reduce residual risk or enhance opportunities: - An EMP must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted. All contractors are to adhere to the EMP and should apply good environmental practice during decommissioning; - ECOs to oversee activities and ensure that the CEMP for decommissioning is implemented and enforced; - The appointed ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed; and - Prior to decommissioning, an avifaunal specialist should conduct a site walkthrough, covering the entire power line route to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final decommissioning schedule in close proximity to that specific area, including abbreviating activity times, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.	

7.14 Assessment of no-go alternative

Should the proposed development not be constructed (i.e. the no-go alternative is realised), the status quo with regards to the current land use is likely to persist in the medium to long term. The bird baseline as described in the report is unlikely to change significantly, apart from changes caused by natural environmental fluctuations (e.g. dry vs wet years). There will be no negative impact on the avifauna of the proposed development site if the no-go alternative is realised.

7.15 Cumulative Impacts

Three operational wind farms are located in the Cookhouse/Bedford area, approximately 47 km east of the proposed Highlands Development. They are the Cookhouse Wind Farm, Nojoli Wind Farm and the Amakhala Emoyeni Wind Farm. Available operational monitoring reports from these wind farms were obtained from BLSA and were reviewed, because impacts arising from these wind farms could act synergistically with impacts from the proposed development (as well as other proposed developments), potentially negatively affecting some species.

Cookhouse Wind Farm is a 138.6 MW WEF, consisting of 66 turbines and reached its Commercial Operations Date in May 2014. Operational monitoring only commenced almost a year later in March 2015. A total of 41 bird fatalities were recorded on Cookhouse Wind Farm during the first year of monitoring, none of which were Red Data species (IWS, 2016). The most important findings were 2 Lesser Kestrel and 9 Rock Kestrel fatalities. Adjusting the results for biases, IWS (2016) estimated 219 birds were killed using Huso (2012), although there was low confidence in the modelled output. Based on recorded fatality rates, and the bird species recorded as fatalities IWS (2016) did not recommend any management mitigation, but recommended monitoring continue for a second year[23].

[23]No data is available from the second year, and it could not be confirmed if any additional monitoring has been done.

The Nojoli Wind Farm (NWF) consists of 44 turbines and operational phase bird and bat monitoring was initiated in early July 2017. The first year is recently completed and a final report is not yet available. The most recent progress report (Smallie and MacEwan, 2018) gives the findings for the monitoring period 4 July 2017 – 31 March 2018 (~9 months). They noted though that 7 of the 9 months, carcass searching did not take place (only activity monitoring of live birds was conducted) due to transport issues for the searchers. Key findings from the two months when searchers were that 12 bird fatalities were recorded, and five fatalities were Cape Vulture. Rock Kestrel and African Harrier Hawk were the other raptor fatalities.

The Amakhala Emoyeni Wind Farm consists of 56 wind turbines and construction of this facility was completed in July 2016. The first year of operational phase bird and bat monitoring was carried out at the Amakhala Emoyeni wind farm between August 2016 and August 2017 (Smallie and MacEwan, 2017). Habitat alteration as a result of the construction of the wind farm was estimated at 0.46% of the total area. A total of 44 bird fatalities from approximately 19 bird species were recorded by formal searching at turbines. These included: three Cape Vultures; one Blue Crane; and 1 Martial Eagle. A fourth Cape Vulture was found incidentally at a turbine, while a fifth mortality of this species resulted from a power line incident. Smallie and MacEwan (2017) estimated that approximately 112 birds were killed at Amakhala Emoyeni Wind Farm during the monitoring period.

Recent discussions with the specialist (per. Com. Jon Smallie), did not reveal any significant additional mortalities at the above WEFs, not described in the reports reviewed. One of the most important findings of this review, is that in the Cookhouse/Bedford area, at least 10 Cape Vultures have suffered mortality between August 2016 and July 2018. The actual number is possibly higher as there have been gaps when monitoring has not been conducted, especially at NWF and Cookhouse Wind Farm.

There is the potential for at least five additional wind farms to be constructed in the Bedford/Cookhouse area in the future namely: 140 MW Msenge Emoyeni Wind Farm (under same EA as Amakhala); Proposed 140 MW Middleton Wind Energy Project; Proposed Golden Valley 1 WEF; Proposed Golden Valley 2 WEF; and Proposed Nxuba Wind Farm. Available bird data from the applicable EIAs and/or monitoring reports at these sites was reviewed and showed a similarity in key issues and key species identified for the operation sites. Generally concerns relate one or more of Cape Vulture, Amur Falcon, Blue Crane, Ludwig's Bustard and Black Harrier.

No bird information could be obtained for the PV sites considered, although their potential presence and impacts on avifauna (which are likely to be low) was noted for the cumulative assessment. The main potential impacts of solar PV facilities on birds is habitat destruction and collision impacts associated with the grid connection lines.

7.15.1 Cumulative Assessment

The cumulative effect of Proposed Highlands Development along with the actual and predicted impacts of the operational and proposed facilities discussed above, has the potential to affect various bird species at a higher significance than the impacts of the Proposed Highlands Development alone. Key species that may possibly be impacted upon cumulatively include Cape Vulture, Blue Crane, Ludwig's Bustard, Martial Eagle, Amur Falcon, Lesser Kestrel, Rock Kestrel Jackal Buzzard and potentially Verreaux's' Eagle and Black Harrier. Of these, Cape Vulture is of primary concern, as it has suffered collision mortality in the Bedford/Cookhouse area. Even though collisions of Cape Vulture, are not highly likely at Highlands (due to the low abundance and activity of the species on the site), they are possible and even a few mortalities may result in a cumulative impact of high significance.

The cumulative habitat destruction impact for the proposed Highlands development is concluded to be of moderate significance.

The cumulative disturbance and displacement impact for the proposed Highlands development is concluded to be of moderate significance.

Details regarding the routes and lengths of the grid connection power lines for all the projects considered were not all available, and therefore a precautionary approach has been adopted and the cumulative impact of power line collisions (particularly involving Blue Crane and Ludwig's Bustard) is rated as high.

If all operational facilities implement appropriate and effective mitigation as outlined by their respective specialists, and if all mitigation measures outlined in this report are implemented for the proposed Highlands development, the cumulative impact after mitigation is likely to have a moderate significance.

Table 38: Cumulative Impact Rating

Impact Phase: All phases							
Potential impact description: Cumulative impact of all impacts on avifauna							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	H	M	Negative	M	H	M
With Mitigation	M	H	M	Negative	L	M	M
Can the impact be reversed?			PARTIALLY				
Will impact cause irreplaceable loss or resources?			POSSIBLY				
Can impact be avoided, managed or mitigated?			PARTIALLY				
Mitigation measures to reduce residual risk or enhance opportunities: - All mitigation measures listed above and recommended for other projects listed above must be adhered to. - The applicant and/or operational project company should proactively collaborate with other wind farm operators in the broader Somerset East/Cookhouse/Bedford area (i.e. currently Nojoli, Cookhouse and Amakhala Emoyeni wind farms) with regards to Cape Vulture turbine collision research and mitigation. Data must be shared, and research efforts co-ordinated to reduce vulture mortality in the region, and where applicable and agreed, effort must be made to assist in funding of such research.							

8 CONCLUSION AND IMPACT STATEMENT

Activity and abundance of priority species and red data species were generally found to be moderate to high on the proposed Highlands development site after one year of pre-construction monitoring. Activity was particularly high in summer, coinciding with the arrival of migratory raptors. Activity of other resident Red Data species, e.g. Verreaux's Eagle, Blue Crane and Ludwig's Bustard was relatively constant across the year, at a moderate level. Activity of the non-Red Data raptors, Jackal Buzzard and Rock Kestrel was high to very high throughout the year, and these species are the priority species or raptors most likely to suffer collision mortality.

Abundances of small passerines were also found to be moderate, with a relatively moderate to high diversity of species recorded, including a number of endemics or near-endemics. However, due to most of these species being relatively common, and the extensive available habitats for these birds on and around the development site, it was predicted that the impacts to these birds was likely to be low.

Verreaux's Eagle were confirmed as breeding on and around the proposed development site, and all nests were buffered at a minimum by 3 km, with no turbines proposed within these buffers. Additional Verreaux's Eagle nest sites were found in 2019, some distance away from the site in the more mountainous areas north of the proposed site, and this was not unexpected as far more suitable Verreaux's Eagle habitat is present in this area. Recorded Verreaux's Eagle flight activity on the WEF site was relatively high compared with other priority species recorded, although when compared with the activity of this species on other WEFs in South Africa, the activity levels are moderate. It was confirmed that the Highlands Wind Farm Project site is "*proposed within potentially important Verreaux's Eagle habitat*" and therefore the Verreaux's Eagle monitoring guidelines were applied, resulting in substantial flight data being recorded from 72 hours of monitoring at each VP. Following input from I&AP's during the environmental authorisation process, the DEA requested that the VERA model be run for the known Verreaux's Eagle nest sites. This was done, resulting in an update to the identified high risk areas. Many of these areas coincided with high risk areas originally identified and excluded from development of turbines by Arcus in version 1 of this report. However, additional sensitive areas were identified by the model, and it was recommended that all turbines be removed from these areas, which has been done in the final mitigated layout updated by the applicant.

As all proposed turbines are located outside of high risk areas (e.g. ridge and slope buffers, nest buffers, high recorded flight activity areas and VERA model exclusion areas) an additional year of monitoring is not recommended, and the project is unlikely to have highly significant impacts to Verreaux's Eagle. While it is likely that this species will suffer collision mortality at some stage during operations of the proposed development, the amount and frequency of collisions (if all recommendations are adhered to) are not expected to reach a level that would be unsuitable for the regional population. Furthermore, if mortalities are recorded certain mitigation options (such as curtailment, shut-down on demand or painting blades) can be implemented (subject to the results of operational monitoring), that can reduce the levels of mortality. The applicant should explore the possibility and benefits of fitting two Verreaux's Eagles (preferably one from each active territory) with GPS tracking devices (subject to support from Dr Murgatroyd, confirmation that the devices to be used are safe, and ethical clearance from BLSA ethics committee) at the start of the construction phase. This information could feed into the construction and operational monitoring programme by assisting in determining disturbance and displacement effects (as well as possible collision impacts), and advising future additional mitigation actions if required.

Cape Vulture was only recorded during the final summer season, with an estimated minimum of 8 birds, being responsible for 11 recorded flights. Overall, this represented a very low passage rate, with most activity also being on the northern boundary of the proposed development site (an area that does not have proposed turbine locations in the latest layout). It was concluded that Cape Vulture is only likely to be an occasional visitor to the proposed Development site, and should mortalities occur for this species (which is unlikely but possible), they could be mitigated (or reduced in future) by implementing mitigation such as carcass management strategies and/or shut down on demand strategies. Regarding this species, more concern is around cumulative impacts. If low mortality manifests at the proposed Development, this may be acceptable (at the scale of the development). However, if this low level of mortality coincides with high levels of mortality at the WEFs in the Cookhouse/Bedford area, the cumulative impacts to the regional population could be high. It will be essential, to reduce cumulative effects, that all WEFs in the region implement mitigations and recommendations given by the respective avifaunal specialists, and that there is collaboration and sharing of information between specialists.

Ludwig's Bustard and Blue Crane were relatively widespread and abundant, although they did not fly regularly at turbine risk height. They are therefore more likely to be impacted upon by possible disturbance or through collisions with overhead power lines, associated

with either the WEFs or the grid connections. Both of these impacts can be mitigated against. It will be vitally important to ensure all overhead lines are correctly marked with BFD's, and if the shortest routes for the grid connections are used the impacts are likely to be low-moderate and acceptable, although ongoing monitoring of overhead lines during operation will be required to confirm this. It is likely that the vast majority of spans will need to be mitigated, and suitable financial allowance should be made for this.

The rated impacts of each WEF phase and Grid Connection separately were found to be acceptable. However, if all phases are granted EA, they will not be constructed as separate WEFs, and not all turbines proposed for each phase would be constructed. Therefore an assessment of a WEF[24] up to a maximum of 140 MW and utilising 40 or less turbine positions from all three phases was conducted. This assessment found that the impact (post mitigation) of collision is likely to be moderate and the other identified impacts on avifauna are likely to be low. Therefore the construction of a medium sized WEF of less than 40 turbines would be acceptable, if all turbine positions are outside of all the identified avifaunal No-Go areas and all other mitigations and recommendations in this report are implemented. It is noted that based on the rapid pace of technology advancement, less turbines (each with a higher capacity) may be used to meet the required MW output, and wherever feasible this should be encouraged as for birds, fewer larger turbines are preferable than more smaller turbines.

Considering the Grid Connections and Associated Infrastructure (e.g. substations):

- The potential impacts of Alternative 1 and Alternative 2 for Phase 1 (North) were found to be the same. Either alternative is acceptable with mitigation.
- The potential impacts of Alternative 1 and Alternative 2 for Phase 2 (Central) were found to be the same. Either alternative is acceptable with mitigation.
- The potential impacts of Alternative 1 and Alternative 2 for Phase 3 (South) were found to be the same. Either alternative is acceptable with mitigation.
- Due to their much longer lengths, either alternative (1 or 2) for Phase 3 (South) are likely to have higher impacts on birds than the grid connection alternatives proposed for Phase1 or Phase 2. Therefore, it is strongly recommended that the substation locations (and associated grid connection options) for either Phase 1 or 2 are used to connect the final project/s to the grid.
- All substation locations are acceptable, subject to mitigations, (however, those proposed for Phases 1 and 2 are preferred as they result in shorter grid connection).

If an Environmental Authorisation (EA) is granted, the following conditions applicable to avifauna should be included:

- All recommendations and proposed mitigation measures in the avifaunal specialist report are to be included in the implemented;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough covering the final road and power line routes as well as the final turbine positions, to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded (or timed to be outside of an applicable breeding season). The walkthrough must also cover the Grid Connection route;
- During the site walkthrough the specialist must determine the power line spans of the grid connection route that will require marking devices [Bird Flight Diverters (BFDs)] to increase visibility.
- Install bird flight diverters as per the instructions of the specialist which may include the need for modified BFDs fitted with solar powered LED lights on certain spans;

[24] Bid as two separate projects in the REIPP with two separate grid connections.

- All new internal power lines linking the wind turbine generators to each other on site must be placed underground where technically and environmentally feasible. Certain spans can only be above ground if it is impossible and completely unfeasible to bury them or if there is a reasonable other environmental aspect present which prevents them being buried (e.g. a sensitive wetland area);
- On the WEF if any power line spans connecting turbines are not buried they must be fitted with [Bird Flight Diverters (BFDs)];
- Turbines must not be constructed within any designated No-Go Areas, including the additional exclusion zones identified by VERA and the additional nest survey work The turbine blade should not protrude into these areas, and therefore the bases should be constructed suitably far from these areas to prevent this;
- During the construction phase, an avifaunal specialist must conduct surveys/exploration of the WEF site. This should be done during and after, the breeding season (i.e. approximately in July and again in September) of large Eagles (e.g. Martial and Verreaux's Eagle). The aim will be to locate any nest sites not yet found (although this is unlikely due to the already extensive searches that have been conducted, for precautionary reasons it is still recommended), so that these may continue to be monitored during the construction and operation phases, along with the monitoring of already identified nest sites (see point below);
- Appoint a specialist to design and conduct monitoring of the breeding of raptors at the various nests identified to date as well as any additionally located nests (see point above). This monitoring can be combined with the exploration described above, and should be conducted on two occasions (i.e. approximately in July and again in September) across each calendar year, during construction;
- During construction phase, conduct a search (during spring/summer breeding seasons) for breeding sites of Blue Cranes and monitor any such sites for breeding success/failure during the construction phase;
- Develop and implement a carcass search programme for birds as a minimum during the first three years of operation followed by year 5, 10, 15, 20 and 25, in line with the applicable South African monitoring guidelines;
- Develop and implement a minimum 12 month post-construction bird activity monitoring program that mirrors the pre-construction monitoring surveys and is in line with the applicable South African post-construction monitoring guidelines; and
- If unacceptable impacts are observed (in the opinion of the bird specialist after consultation with BLSA, relevant stakeholders and an independent review), the specialist should conduct a literature review specific to the impact (e.g. collision and/or electrocution) and provide updated and relevant mitigation options to be implemented. These updated mitigations must then be implemented in a concerted effort to reduce the impacts to acceptable levels.

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APPENDIX I: PRE-CONSTRUCTION MONITORING SEASONAL BIRD LIST

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Apalis, Bar-throated	*Apalis thoracica*				x	x	x	x	x	x	x	
Avocet, Pied	*Recurvirostra avosetta*				x						x	
Barbet, Acacia Pied	*Tricholaema leucomelas*				x	x	x	x	x	x	x	x
Barbet, Black-collared	*Lybius torquatus*						x					
Batis, Chinspot	*Batis molitor*				x	x	x	x	x	x	x	x
Batis, Pririt	*Batis pririt*				x	x	x		x			
Bokmakierie	*Telophorus zeylonus*				x	x	x	x	x	x	x	x
Boubou, Southern	*Laniarius ferrugineus*						x		x	x	x	
Bulbul, African Red-eyed	*Pycnonotus nigricans*				x	x	x	x	x	x	x	
Bulbul, Cape	*Pycnonotus capensis*		x				x	x	x	x		
Bulbul, Dark-capped	*Pycnonotus tricolor*				x		x					
Bunting, Cape	*Emberiza capensis*				x	x	x	x	x	x	x	x
Bunting, Cinnamon-breasted	*Emberiza tahapisi*				x	x		x	x	x		
Bunting, Golden-breasted	*Emberiza flaviventris*				x	x	x	x	x			
Bunting, Lark-like	*Emberiza impetuani*				x	x						
Bustard, Denham's	*Neotis denhami*	VU		300							x	
Bustard, Kori	*Ardeotis kori*	NT		260	x	x	x	x		x	x	

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Bustard, Ludwig's	*Neotis ludwigii*	EN		320	x	x	x	x	x	x	x	x
Buzzard, Jackal	*Buteo rufofuscus*		x	250	x		x	x	x	x	x	
Buzzard, Steppe	*Buteo buteo*			210					x	x	x	x
Canary, Black-headed	*Serinus alario*		x						x	x	x	
Canary, Brimstone	*Crithagra sulphurata*						x					
Canary, Cape	*Serinus canicollis*				x	x	x		x	x		
Canary, White-throated	*Crithagra albogularis*				x	x	x	x	x	x	x	
Canary, Yellow	*Crithagra flaviventris*				x	x	x	x	x	x	x	x
Canary, Yellow-fronted	*Crithagra mozambica*					x	x	x	x	x		
Chat, Ant-eating	*Myrmecocichla formicivora*				x	x	x	x	x	x	x	x
Chat, Familiar	*Cercomela familiaris*				x	x	x	x	x	x	x	x
Chat, Sickle-winged	*Cercomela sinuata*		x		x	x	x		x	x		
Cisticola, Cloud	*Cisticola textrix*		x						x	x	x	
Cisticola, Grey-backed	*Cisticola subruficapilla*				x	x	x	x	x	x	x	x
Cisticola, Zitting	*Cisticola juncidis*				x							
Cormorant, Reed	*Phalacrocorax africanus*				x	x		x				
Cormorant, White-breasted	*Phalacrocorax lucidus*				x	x					x	

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Crane, Blue	*Anthropoides paradiseus*	NT		320	x	x	x	x	x	x	x	x
Crombec, Long-billed	*Sylvietta rufescens*				x	x	x		x	x		
Crow, Cape	*Corvus capensis*				x	x	x	x	x	x	x	
Crow, Pied	*Corvus albus*				x	x	x	x	x	x	x	x
Cuckoo, Diederik	*Chrysococcyx caprius*								x	x	x	x
Cuckoo, Great Spotted	*Clamator glandarius*							x	x	x		
Cuckoo, Klaas's	*Chrysococcyx klaas*					x				x		
Dove, Cape Turtle	*Streptopelia capicola*				x	x	x	x	x	x	x	x
Dove, Laughing	*Streptopelia senegalensis*				x	x	x		x	x	x	x
Dove, Red-eyed	*Streptopelia semitorquata*				x	x			x	x	x	
Dove, Rock	*Columba livia*				x							
Drongo, Fork-tailed	*Dicrurus adsimilis*				x	x	x	x	x	x	x	x
Duck, Yellow-billed	*Anas undulata*				x	x	x	x	x	x	x	x
Eagle, African Fish	*Haliaeetus vocifer*			290	x		x		x		x	
Eagle, Black-chested Snake	*Circaetus pectoralis*			230			x				x	
Eagle, Booted	*Hieraaetus pennatus*			230			x		x		x	x
Eagle, Brown Snake	*Circaetus cinereus*			180							x	
Eagle, Martial	*Polemaetus bellicosus*	EN		350	x	x	x	x				

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Eagle, Verreauxs'	*Aquila verreauxii*	VU		360	x	x	x		x	x	x	
Falcon, Amur	*Falco amurensis*			210							x	x
Falcon, Lanner	*Falco biarmicus*	VU		300							x	
Firefinch, African	*Lagonosticta rubricata*						x					
Fiscal, Common	*Lanius collaris*				x	x	x	x	x	x	x	x
Flycatcher, Fairy	*Stenostira scita*		x				x					
Flycatcher, Fiscal	*Sigelus silens*		x		x	x	x	x	x	x	x	x
Francolin, Grey-winged	*Scleroptila africana*		x	190	x				x		x	
Goose, Egyptian	*Alopochen aegyptiaca*				x	x	x	x	x	x	x	x
Goose, Spur-winged	*Plectropterus gambensis*				x		x					
Goshawk, Gabar	*Melierax gabar*				x		x					
Goshawk, Pale Chanting	*Melierax canorus*			200	x	x	x	x	x	x	x	x
Grebe, Little	*Tachybaptus ruficollis*				x	x			x			
Greenbul, Sombre	*Andropadus importunus*				x		x		x	x	x	x
Greenshank, Common	*Tringa nebularia*										x	
Guineafowl, Helmeted	*Numida meleagris*				x		x	x	x	x	x	
Hamerkop	*Scopus umbretta*				x	x	x	x				
Harrier, Black	*Circus maurus*	EN	x	345	x		x					
Hawk, African Harrier-	*Polyboroides typus*			190	x		x	x	x		x	

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Heron, Black-headed	*Ardea melanocephala*				x	x	x		x	x		
Heron, Grey	*Ardea cinerea*				x		x		x		x	
Honeyguide, Greater	*Indicator indicator*								x	x		
Hoopoe, African	*Upupa africana*				x	x	x	x	x	x	x	x
Ibis, African Sacred	*Threskiornis aethiopicus*				x				x	x	x	
Ibis, Hadeda	*Bostrychia hagedash*				x	x	x	x	x	x	x	x
Kestrel, Lesser	*Falco naumanni*			214							x	
Kestrel, Rock	*Falco rupicolus*				x	x	x		x		x	x
Kingfisher, Brown-hooded	*Halcyon albiventris*				x		x		x		x	
Korhaan, Southern Black	*Afrotis afra*	VU	x	270	x		x	x	x	x	x	
Lapwing, Blacksmith	*Vanellus armatus*				x	x	x	x	x	x	x	
Lapwing, Crowned	*Vanellus coronatus*				x	x	x	x	x	x	x	x
Lark, Eastern Clapper	*Mirafra fasciolata*				x	x	x	x	x	x	x	x
Lark, Karoo Long-billed	*Certhilauda subcoronata*				x		x	x	x	x		
Lark, Large-billed	*Galerida magnirostris*		x		x	x	x	x	x	x	x	
Lark, Red-capped	*Calandrella cinerea*				x				x			
Lark, Rufous-naped	*Mirafra africana*						x	x	x	x	x	x
Lark, Spike-heeled	*Chersomanes albofasciata*				x	x	x	x	x	x	x	x

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Longclaw, Cape	*Macronyx capensis*				x		x		x	x	x	
Martin, Rock	*Hirundo fuligula*				x	x	x	x	x	x	x	x
Mousebird, Red-faced	*Urocolius indicus*				x	x	x		x	x	x	x
Mousebird, Speckled	*Colius striatus*				x	x	x	x	x	x		
Neddicky	*Cisticola fulvicapilla*				x	x	x	x	x	x	x	x
Oriole, Black-headed	*Oriolus larvatus*				x	x	x		x	x		
Ostrich, Common	*Struthio camelus*										x	
Owl, Spotted Eagle-	*Bubo africanus*			170	x							
Penduline-tit, Cape	*Anthoscopus minutus*				x	x		x	x	x		x
Petronia, Yellow-throated	*Gymnoris superciliaris*				x	x	x		x	x		
Pigeon, Speckled	*Columba guinea*				x	x	x	x	x	x	x	x
Pipit, African	*Anthus cinnamomeus*				x	x	x	x	x	x	x	x
Pipit, African Rock	*Anthus crenatus*	NT	x	200			x		x		x	
Pipit, Long-billed	*Anthus similis*							x				
Pipit, Plain-backed	*Anthus leucophrys*				x			x	x	x		
Plover, Three-banded	*Charadrius tricollaris*				x	x	x	x	x	x	x	
Prinia, Karoo	*Prinia maculosa*		x		x		x	x	x	x	x	x
Quail, Common	*Coturnix coturnix*				x		x		x		x	
Quail-finch, African	*Ortygospiza fuscocrissa*								x	x		
Quelea, Red-billed	*Quelea quelea*					x	x		x			
Raven, White-necked	*Corvus albicollis*				x	x	x	x	x	x	x	x

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Robin, Karoo Scrub	*Erythropygia coryphoeus*				x	x	x	x	x	x	x	x
Robin, White-browed Scrub	*Erythropygia leucophrys*				x		x		x			
Robin-chat, Cape	*Cossypha caffra*				x	x	x	x	x	x	x	x
Sandgrouse, Namaqua	*Pterocles namaqua*					x			x			
Secretarybird	*Sagittarius serpentarius*	VU		320	x		x		x	x	x	x
Seedeater, Streaky-headed	*Crithagra gularis*				x	x	x	x	x	x	x	x
Shelduck, South African	*Tadorna cana*				x	x	x		x		x	
Sparrow, Cape	*Passer melanurus*				x	x	x	x	x	x	x	x
Sparrow, Southern Grey-headed	*Passer diffusus*					x	x		x	x		
Spoonbill, African	*Platalea alba*				x	x	x	x	x	x	x	
Starling, Cape Glossy	*Lamprotornis nitens*				x	x	x	x	x	x	x	
Starling, Common	*Sturnus vulgaris*				x				x			
Starling, Pied	*Lamprotornis bicolor*		x		x	x	x	x	x	x	x	x
Starling, Red-winged	*Onychognathus morio*				x	x	x		x	x	x	x
Starling, Wattled	*Creatophora cinerea*								x			
Stilt, Black-winged	*Himantopus himantopus*				x	x	x	x	x			
Stint, Little	*Calidris minuta*										x	

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Stonechat, African	*Saxicola torquatus*				x	x	x	x	x	x	x	x
Stork, Black	*Ciconia nigra*	VU		330			x					
Stork, White	*Ciconia ciconia*			220							x	
Sunbird, Amethyst	*Chalcomitra amethystina*					x			x			
Sunbird, Dusky	*Cinnyris fuscus*				x				x			
Sunbird, Greater Double-collared	*Cinnyris afer*		x		x				x	x		
Sunbird, Malachite	*Nectarinia famosa*				x	x	x	x	x	x	x	x
Sunbird, Southern Double-collared	*Cinnyris chalybeus*		x		x	x	x		x	x		x
Swallow, Barn	*Hirundo rustica*				x				x	x	x	
Swallow, Greater Striped	*Cecropis cucullata*				x				x	x	x	x
Swallow, Pearl-breasted	*Hirundo dimidiata*								x			
Swallow, White-throated	*Hirundo albigularis*								x		x	x
Swift, African Black	*Apus barbatus*								x		x	
Swift, Alpine	*Tachymarptis melba*				x		x		x	x	x	x
Swift, Little	*Apus affinis*										x	
Swift, White-rumped	*Apus caffer*								x			
Teal, Cape	*Anas capensis*				x	x			x		x	
Thick-knee, Spotted	*Burhinus capensis*				x		x		x		x	x
Thrush, Cape Rock	*Monticola rupestris*		x		x		x		x			

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Thrush, Karoo	*Turdus smithi*		x					x				
Thrush, Olive	*Turdus olivaceus*					x			x	x		
Thrush, Short-toed Rock	*Monticola brevipes*						x					
Tinkerbird, Red-fronted	*Pogoniulus pusillus*							x	x	x		
Tit, Grey	*Parus afer*		x		x	x	x	x	x	x	x	
Tit, Southern Black	*Parus niger*				x	x	x		x			
Tit-Babbler, Chestnut-vented	*Sylvia subcaerulea*				x	x	x	x	x	x	x	
Turaco, Knysna	*Tauraco corythaix*		x		x							
Vulture, Cape	*Gyps coprotheres*	EN		405							x	
Wagtail, Cape	*Motacilla capensis*				x	x	x	x	x	x	x	x
Warbler, Rufous-eared	*Malcorus pectoralis*				x	x	x	x	x	x	x	x
Warbler, Willow	*Phylloscopus trochilus*										x	
Waxbill, Common	*Estrilda astrild*					x		x	x			
Weaver, Cape	*Ploceus capensis*		x		x			x	x	x	x	
Wheatear, Mountain	*Oenanthe monticola*						x		x			
White-eye, Cape	*Zosterops capensis*		x		x	x	x		x	x	x	x
Whydah, Pin-tailed	*Vidua macroura*								x	x	x	
Wood-hoopoe, Green	*Phoeniculus purpureus*				x		x		x			
Woodpecker, Cardinal	*Dendropicos fuscescens*				x	x	x	x		x	x	

Alphabetical Name	Scientific	Regional Red Data Status	Endemic / Near-endemic	Priority Species Score	Autumn		Winter		Spring		Summer	
					WEF	Control	WEF	Control	WEF	Control	WEF	Control
Woodpecker, Ground	*Geocolaptes olivaceus*		x						x		x	
Wryneck, Red-throated	*Jynx ruficollis*				x				x		x	

APPENDIX II: SPECIALIST DECLARATION AND CV

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Proposed Highlands WEF North, Highlands WEF Central, Highlands WEF South, Highlands WEF North Grid Connection, Highlands WEF Central Grid Connection, and Highlands WEF South Grid Connection.

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	Arcus Consultancy Services South Africa (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)		Percentage Procurement recognition	
Specialist name:	Andrew Pearson			
Specialist Qualifications:	BSc. Conservation Ecology			
Professional affiliation/registration:	SACNASP / Pr. Sci. Nat			
Physical address:	Office 607 Cube Workspace, Cnr Long & Hans Strijdom Av. 8001			
Postal address:	As above			
Postal code:	8001	Cell:	072 558 0080	
Telephone:	021 412 1529	Fax:	—	
E-mail:	andrewp@arcusconsulting.co.za			

2. DECLARATION BY THE SPECIALIST

I, Andrew Pearson, declare that –

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

Signature of the Specialist

Arcus Consultancy Services South Africa (Pty) Ltd.

Name of Company:

09/10/2019

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

Signature of the Specialist

Arms Consultancy Services South Africa (Pty) Ltd.

Name of Company

09/10/2019

Date

Signature of the Commissioner of Oaths

Safeera Ally
Commissioner of Oaths
Practising Attorney SA
ENSafrica
1 North Wharf Square
Loop Street Cape Town 8001

9/10/2019

Date

CURRICULUM VITAE

Andrew Pearson *Pr.Sci.Nat*

Senior Ecology Specialist (Avifauna)

Email: andrewp@arcusconsulting.co.za Tel: +27 (0) 21 412 1529

Specialisms

- Avifauna Impact Assessment
- Ecology
- Pre-construction Avifauna Monitoring
- Construction Phase and Operational Phase Avifauna Monitoring
- Survey Design and Management
- Project Management

Summary of Experience

Andrew is an Avifauna Specialist with over eleven years of environmental management experience and has worked as an avifaunal specialist for the past eight years. Andrew has gained a strong level of experience in avifauna assessments across a multitude of sectors, including various powerline assessments and walk-downs. To date, Andrew has provided avifaunal specialist services on over 50 solar, power line and wind farm projects in Southern Africa. Andrew provides specialist input into the design of projects and environmental management plans, assesses environmental due diligence and compliance with international environmental policies (World Bank, IFC, Equator Principles) and peer reviews avifaunal specialist reports. Andrew holds a four-year BSc degree in Conservation Ecology from the University of Stellenbosch, is a professional natural scientist registered with SACNASP, and is a selected member of the Birds and Renewable Energy Specialist Group (BARESG).

Professional History

January 2014 to Present - Avifauna Specialist, Arcus Consultancy Services Ltd:

- Specialist Bird Impact Assessment Studies for energy infrastructure;
- Design of high quality bird surveys in line with applicable guidance and legal requirements;
- Avifaunal and environmental due diligence and feasibility studies;
- Design and implementation of operational carcass search programme including the training and management of locally based observers; and
- Specialist raptor nest surveys.

March 2011 to December 2013 - Environmental Impact Assessment & Avifaunal Specialist, Endangered Wildlife Trust

- Specialist Bird Impact Assessment Studies for energy infrastructure;
- Extensive work in the Wind Energy Sector, often in partnership with Eskom, to reduce possible impacts on birds and bats;
- 12 month Bird Monitoring on WEF sites - compilation of monitoring protocol, recruitment, management and co-ordination of observers, on-site bird observation and compilation of final monitoring reports; and
- Presentations and Environmental Training.

January 2008 to March 2011 - Group Environmental Manager, Basil Read (Pty) Ltd

- Environmental management of roads and civil construction projects;
- Implementation and certification of an ISO 14001:2004 Environmental Management System;
- Group Internal Environmental Audits;
- Compilation of EMPs and Environmental site inspections;
- Environmental Awareness Training; and
- Compilation of Group Carbon Footprint.

February 2006 to January 2008 - Game Ranger and Walking Guide, CC Africa (now *&BEYOND*), Phinda Private Game Reserve

- Game drives and walks in a Big 5 reserve;
- Hosting guests and sharing environmental and wildlife knowledge; and
- Environmental management, waste management.

CURRICULUM VITAE

Qualifications and Professional Interests

- **University of Stellenbosch, 2005.**
  Bachelor of Science: Conservation Ecology.
- August 2010 - Hazard Identification and Risk Assessment (HIRA) Course, IRCA Global.
- April 2010 - SAMTRAC, NOSA, East Rand Office.
- April 2009 - Green Star Accredited Professional Exam, (GBCSA), PROMETRIC.
- May 2008 - Environmental Auditing: ISO 14001:2004, Lead Auditors' Course (SAACTA approved), Centre for Environmental Management at North West University (NWU), Potchestroom.
- February 2008 - Environmental Law for Managers, Centre for Environmental Management at NWU.
- February 2008 - Implementing Environmental Management Systems - ISO 14001:2004, Centre for Environmental Management at NWU.
- August 2007 - Bird Identification Course, Lawson's Birding Academy, Intensive training in Makuleke, Kruger National Park.

Professional Membership

- South African Council for Natural Scientific Professions (SACNASP), "Ecological Science". Professional Natural Scientist (*Pr. Sci. Nat.*), Reg. no 400423/11.

Recent Conferences and Seminars

- Windaba 2013, 2014, 2015, 2016, 2017 and 2018; Solar Indaba 2013; Africa Utility Week 2014, 2015, 2016, 2017, 2018 and 2019.
- IAIA SA National Conference 2011, 2013 and 2016.
- March 2011 Endangered Wildlife Trust (EWT) Wildlife and Energy Symposium.

Additional Skills

- Liaison with farmers including fluency in Afrikaans.
- ArcGIS, Google GEO Tools and Google Earth.
- Computer Skills: Office 2013 including Microsoft Word, Excel, Outlook and PowerPoint.
- Field work skills involving various sampling methods, data capturing & analysis.
- Excellent knowledge of fauna (especially birds) and flora.
- 4x4 driving skills.

Project Experience

- **Due Diligence**
  Due Diligence of bird work conducted at the Kangnas WEF (ERM); Due Diligence of Bird Work conducted at the Excelsior WEF (ERM); Due Diligence of Bird Work conducted at the Golden Valley WEF (ERM); Due Diligence of Bird Work at the Roggeveld Wind Farm (IBIS Consulting).

- **Peer Review**
  Peer Review of Operational Monitoring at the Jeffreys Bay Wind Farm (Globeleq South Africa Management Services (Pty) Ltd); Review and design mitigation strategies for birds at the Kinangop Wind Park, Kenya (African Infrastructure Investment Managers); Review of Bird Specialists reports for the Boulders WEF.

- **Feasibility Studies**
  Highlands WEF Feasibility, Feasibility for a WEF site near Indwe, Feasibility for a WEF site near Sutterheim, Feasibility for a WEF site near Aberdeen, Feasibility for a WEF site near Poffadder, Feasibility for a WEF site near Putsonderwater, Feasibility for a WEF site near Kenhardt, Feasibility for a WEF site near DeAar (all WKN Windcurrent SA (Pty) Ltd); Prieska WEF Bird Feasibility; Langeberg WEF Bird Feasibility (both juwi Renewable Energies (Pty) Ltd).

- **Pre-Construction Monitoring and/or Impact Assessment (including amendments) - Wind Energy Facility (WEF) Projects:**
  Kouga WEF; Aberdeen WEF; Hidden Valley WEF (i.e Great Karoo WEF, Soetwater WEF); Middleton WEF; Springfontein WEF, Moorreesburg WEF; Grassridge WEF; Grassridge II WEF; Ukomeleza WEF; Chaba WEF; Waainek WEF; Vryheid WEF; Kouga Western Cluster WEF; Hopefield WEF; Spitskop East WEF; Spitskop West WEF; DNA Elliot WEF;

Confidential WEF near Elliot; Umsinde Emoyeni WEF; Komsberg East WEF; Komsberg West WEF; Gouda WEF; ZEN WEF; Sonop WEF; Universal WEF; Confidential WEF near Touws River; Kap Vley WEF; Highlands WEF; Putsonderwater WEF; Haga Haga WEF; Gemini WEF; Suurplaat WEF; Klipfontein WEF; and Molteno WEF.

- **Operational Monitoring - WEF Projects:**
  Hopefield WEF; Gouda WEF; Aurora West Coast 1 WEF.

- **Impact Assessment - Powerline Projects:**
  St Francis Bay Kouga 66kV; Ncwane Okuku 88kV; Vulcan Ekangala 132kV; Merapi Everest 400kV; Mathibestad Majaneng 132kV; Majaneng Themba Main-Babelegi 132kV; Ngoma Pandamatenga 400kV (ZIZABONA Phase 2); Estancia Thuli 132kV; Estancia Zamokuhle 132kV; Gumeni Bosloop 132kV; Mbumbu Tsakani 132kV; Normandie Heyshope 132kV; Mookodi Integration Project; Wildebees Bethal 132kV; Zaaifontein Mathondwane 88kV; Hlabisa Nongoma 88kV; Mandeni Gingindlovu 132kV; Tabor Nzhelele 400kV; Leksand St James 88kV; Emondlo St James 88kV; Randfontein Mine 132kV; Droogfontein CSP 132kV; Mtubatuba St Lucia 132kV; Ndumo Gezisa 132kV; Ermelo Uitkoms 88kV; TCTA Spring Grove 88kV; Springfontein 132kV.

- **Pre-construction Monitoring and/or Impact Assessment - Concentrated Solar Power (CSP) Plants and Solar Photovoltaic (PV) Plants:**
  Humansrus 100MW CSP; Arriesfontein 100MW CSP; Arriesfontein 225MW PV; Eenzaamheid PV; Vaal Dam PV; Mokopole PV; Kalkaar CSP and PV; Droogfontein PV; Bokpoort II CSP; Metsimatala CSP; Redstone CSP Solar PV Extension; Robben Island PV Plant.

- **Other:**
  Expansion of Hendrina Power Station Ash Disposal Facilities; Expansion of Majuba Power Station Ash Disposal Facilities; Expansion of Tutuka Power Station Ash Disposal Facilities; Eskom Distribution Cedarville Upgrade; Eskom Limpopo Operating Unit (LOU) Head Office, Polokwane; and Trekoskraal Housing Development.

APPENDIX III: VERA MODEL REPORT

Verreaux's Eagle Risk Analysis (VERA): Highland's WEF

Prepared for Arcus Consulting by:

Dr Megan Murgatroyd
HawkWatch International, Salt Lake City, Utah
FitzPatrick Institute of African Ornithology, University of Cape Town

Project background: There are eight known Verreaux's eagle nests located during EIA monitoring at the Highlands WEF, of which one falls inside the development boundary. This document outlines the tracking data and VERA modelling which has been used to predict collision risk for Verreaux's eagle at the site.

Model background: VERA has been modelled using a Maximum Entropy model (MaxEnt) in R version 3.5.2 using the 'dismo' package. The model was built using GPS tracking data from 15 individual adult Verreaux's eagles, tracked in four different regions of South Africa (Sandveld, Cederberg, Overberg, Karoo). Tracking data was filtered to include only locations where eagles were considered to be flying at an altitude of less than 210 meters above ground, considered to be at wind turbine collision risk for this site, and separated by a minimum of 10 minutes to reduce autocorrelation problems and standardise sampling across individual eagles. For each tracked eagle, pseudo-absence (random) points were generated in a 12 km buffer around the nest site (the number of random points was three times the number of tracking locations per eagle). Pseudo-absence points represent the actual availability of habitat so that this can be statistically compared with the topography over which risky flight occurs. For both the GPS locations and pseudo-absence points, variables that were expected to determine the likelihood of flying in the at-risk zone were extracted. Through a process of model testing, we found that the most significant variables for predicting wind turbine collision risk on an individual level are: distance from nest, slope, and distance to other neighbouring nests. We tested different variable combinations and different modelling techniques (glmer, gamm, MaxEnt), to identify the model used here.

Model outputs: The initial risk predictions are produced at a resolution equal to the digital elevation model which topographic variables were derived from (*c.* 90 x 90 m). To make this relevant to the size of a turbine, the maximum value was calculated for each 2 x 2 grid, providing risk predictions at approximately 180 x 180 m resolution. Collision risk is initially calculated as values from 0 to 1 (Figure 1a). To provide clear guidelines on the likelihood of collision, these were re-classified as "1" or "0", whereby cells with "1" have model predictions higher than the risk threshold (derived from the model's AUC value) and are likely to pose a collision risk to Verreaux's eagles, thus development is not recommended in these cells (Figure 1b).

The collision risk estimates are dependent on accurate information on nest locations and will only be reliable if all nest locations are provided. Recommendations are intended to minimise collision risk to resident adult eagles but will not be relevant to non-breeding eagles using the area. The modelling methods used here are currently being compiled for scientific publication and may be subject to further refinements. The final published VERA model may differ from the one used here, but it unlikely to significantly change the overall patterns of risk outlined in this report.

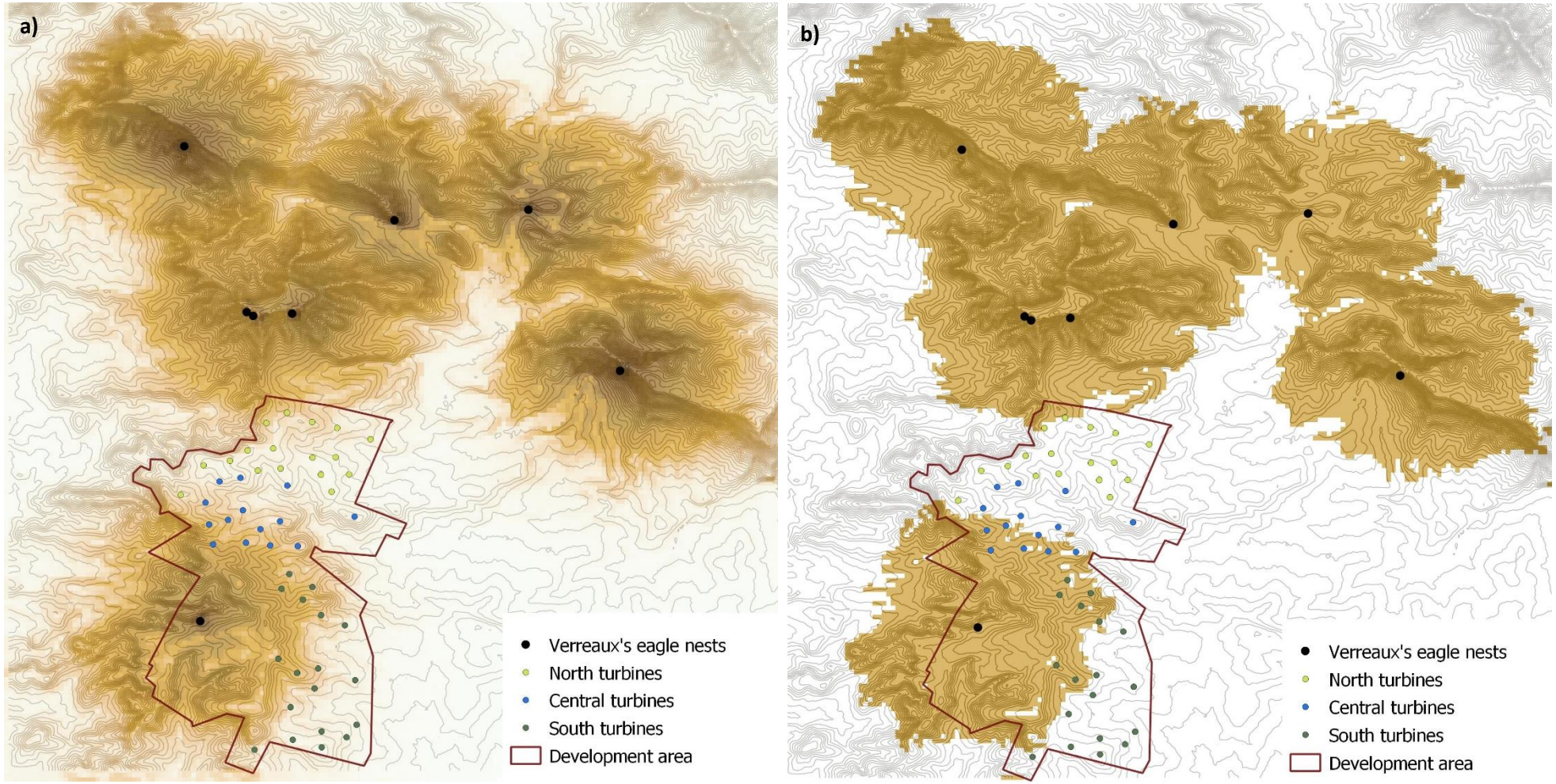
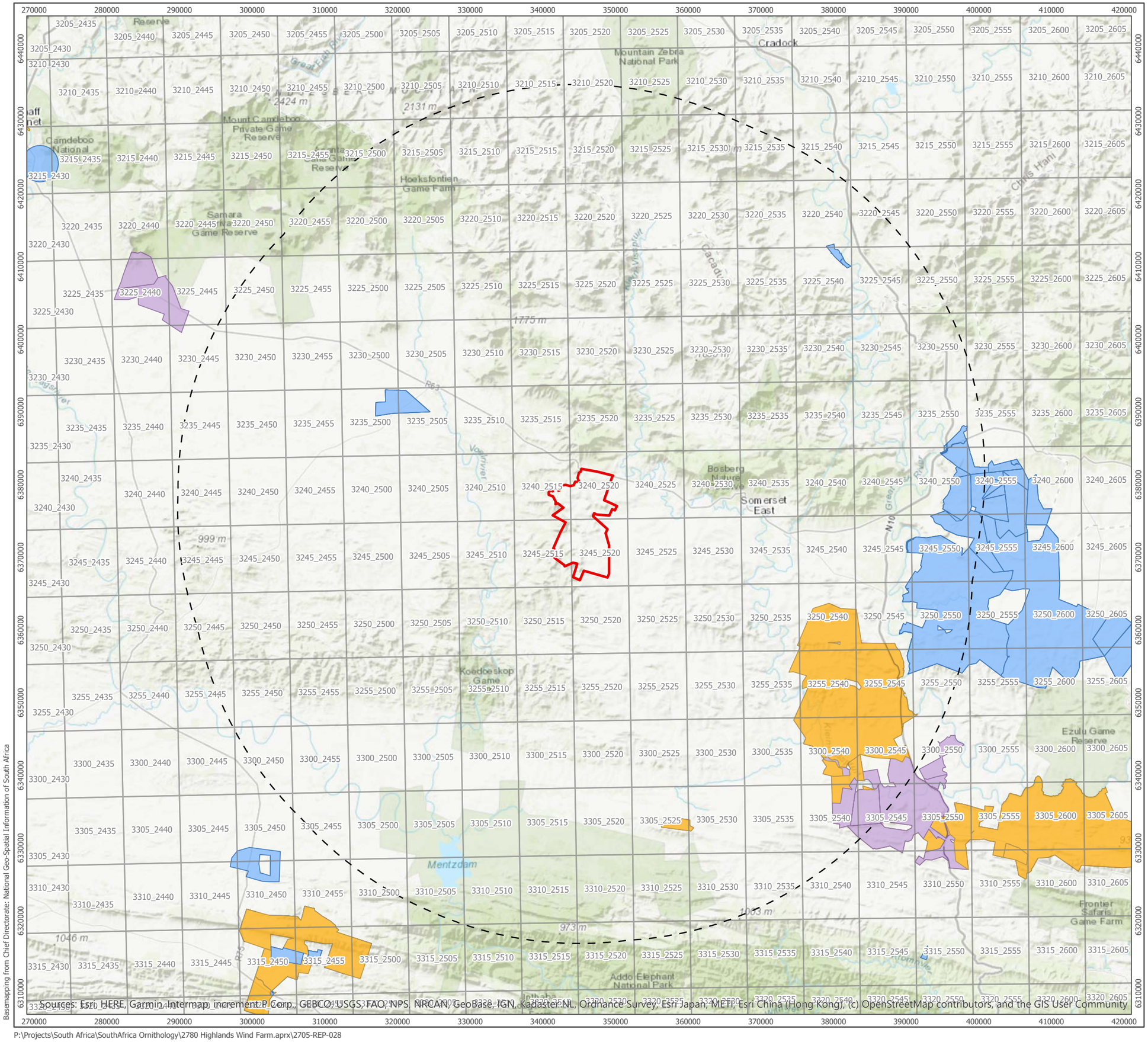


Figure 1. Wind turbine collision risk for Verreaux's eagles at Highland WEF, South Africa. a) Initial collision risk predictions from 0 to 1. b) Predictions re-classified to show areas considered high risk and development not recommended (orange). Background lines show 20 meter topographic contours.



Produced By: SC	Ref: 2705-REP-028
Checked By: AP	Date: 07/10/2019

Project Location and SABAP Grid Squares
Figure 1

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment

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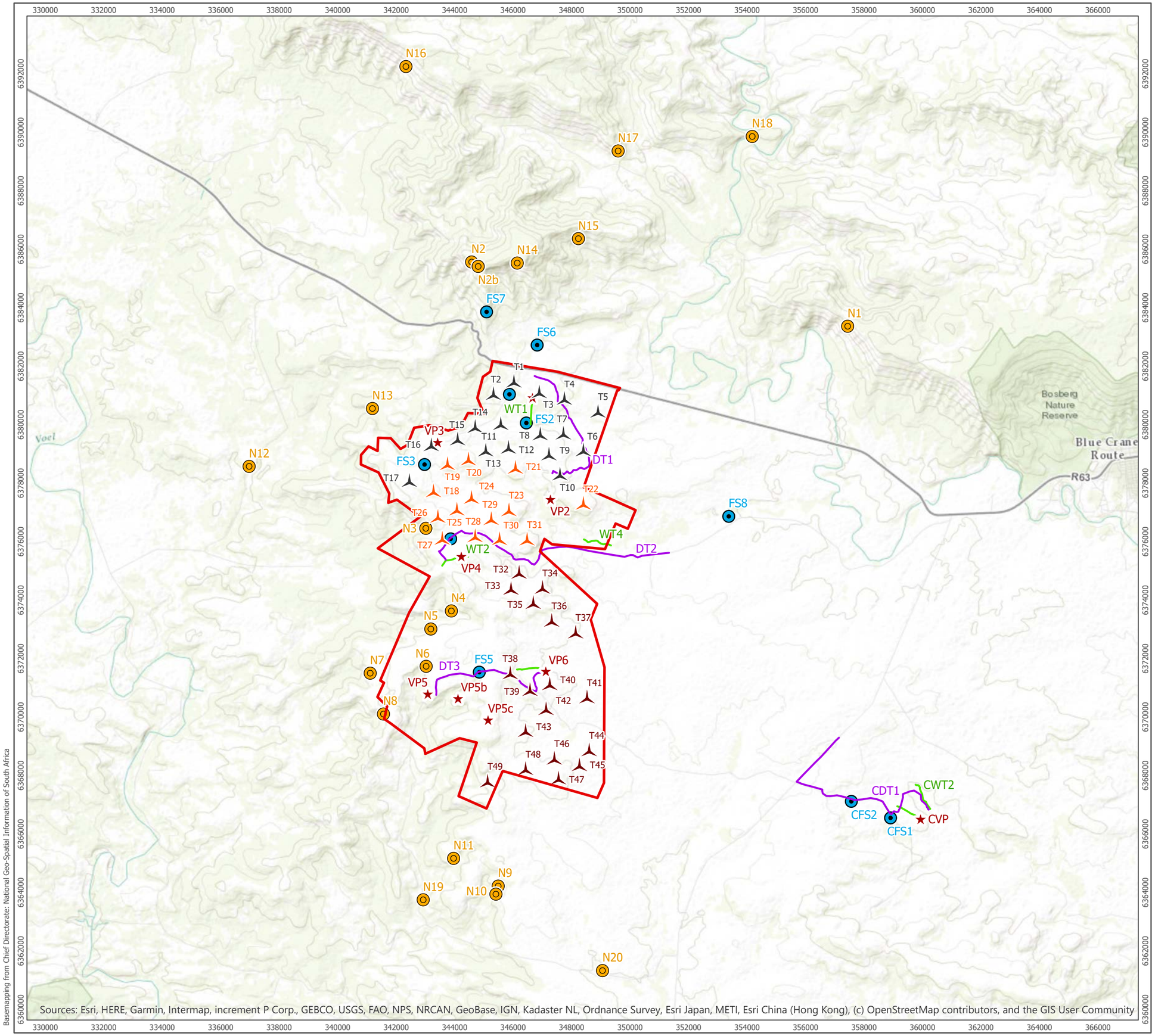

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

ARCUS

- Development Boundary
- Highlands North Proposed Layout
- Highlands Central Proposed Layout
- Highlands South Proposed Layout
- Vantage Point Location
- Driven Transect Route
- Walked Transect Route
- Focal Sites
- Nest Sites

1:125,000 Scale @ A3

0 2.5 5 km

NORTH

Produced By: SC	Ref: 2705-REP-029
Checked By: AP	Date: 07/10/2019

Project and Control Site Survey Locations
Figure 2

Highlands Wind Energy Facility Pre-Construction Bird Monitoring Final Report and Impact Assessment

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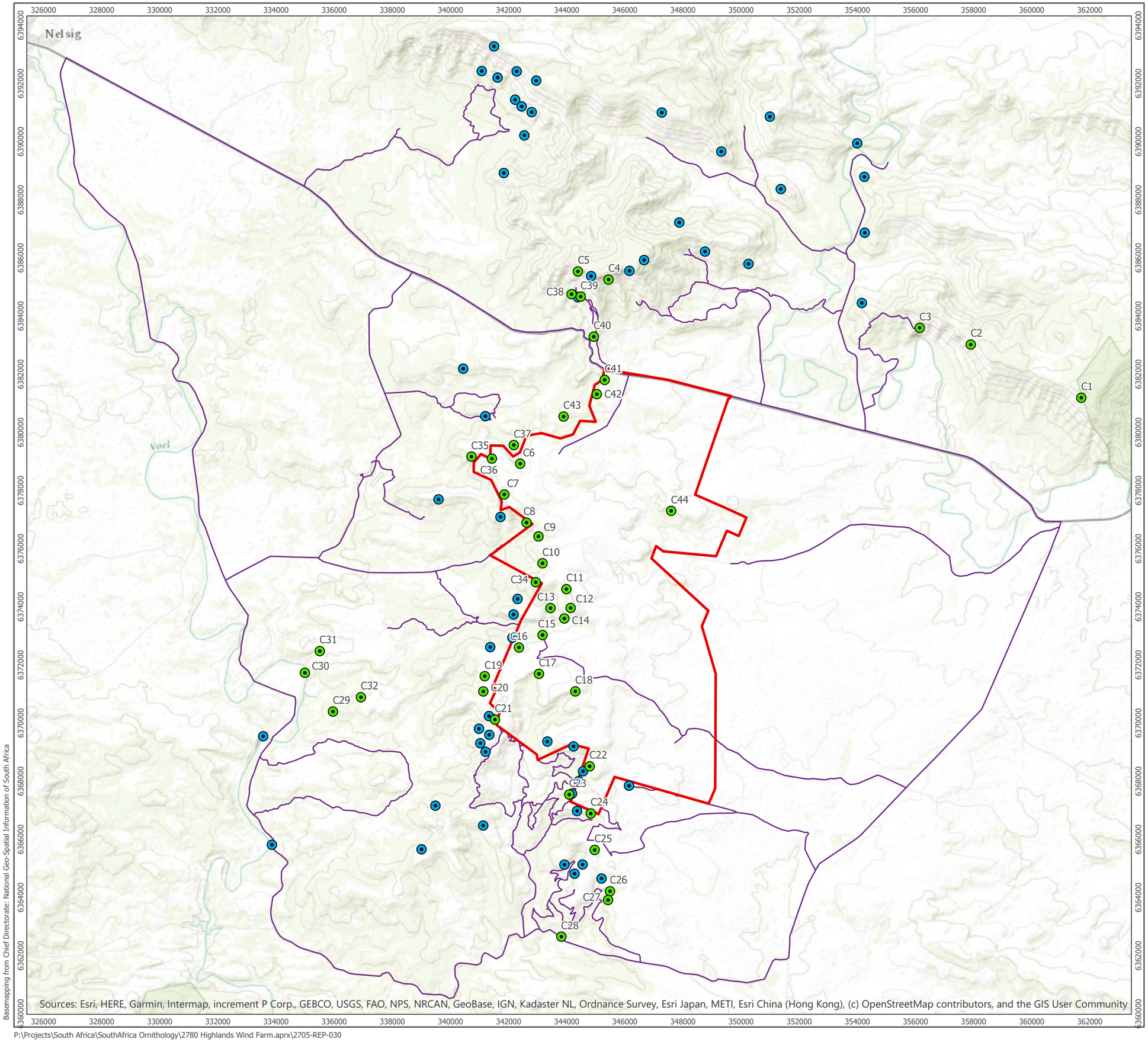

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

ARCUS

- Development Boundary
- Cliffs searched during original 12 month monitoring
- Additional Cliffs/Ridges Searched in 2019
- Specialist coverage-August 2019

1:125,000 Scale @ A3

0 2.5 5 km

NORTH

Produced By: SC	Ref: 2705-REP-030
Checked By: AP	Date: 07/10/2019

Surveyed Cliffs and Additional 2019 Coverage

Figure 3

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment

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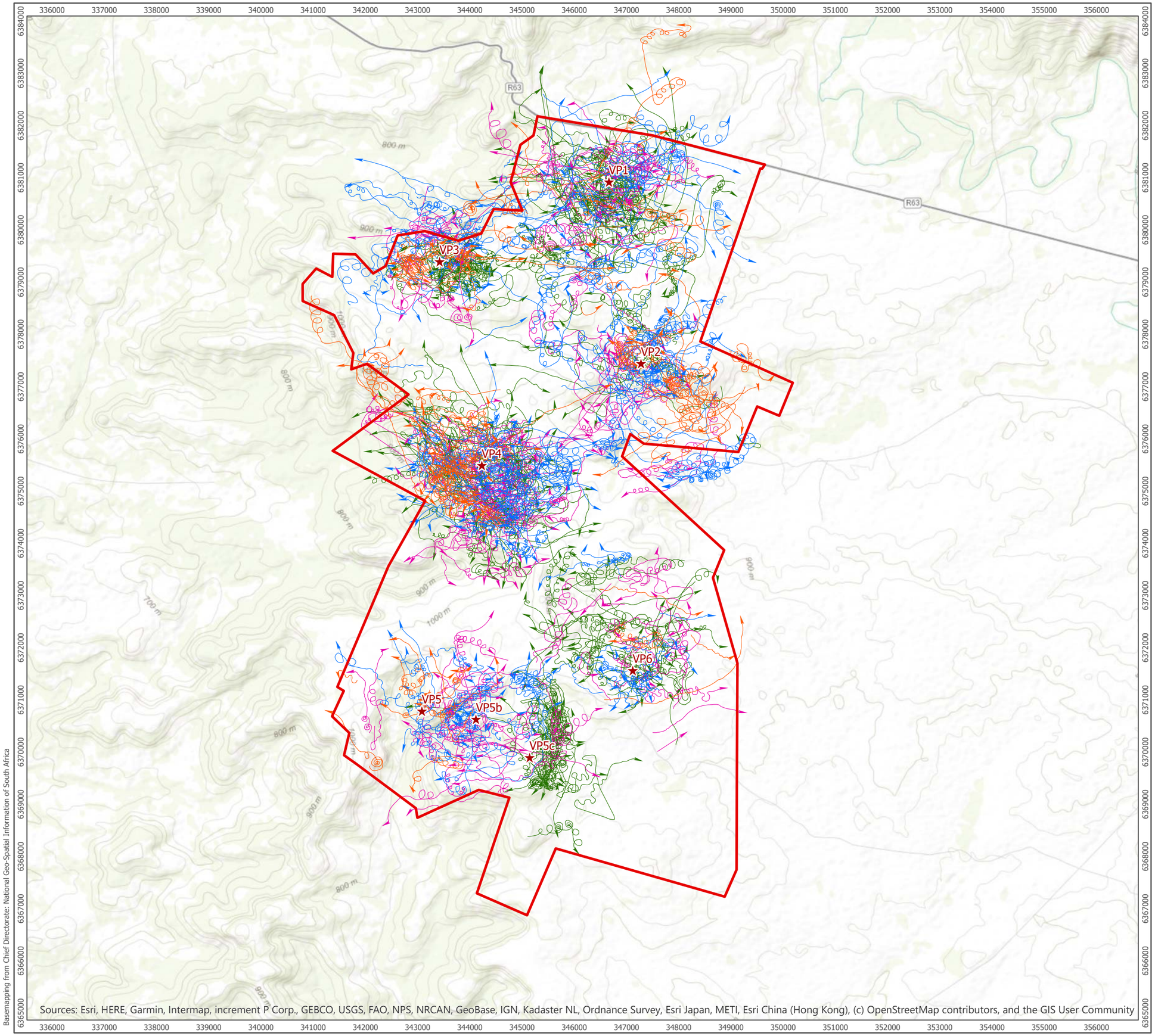


Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

P:\Projects\South Africa\SouthAfrica Ornithology\2780 Highlands Wind Farm.aprx\2705-REP-031

ARCUS

- Development Boundary
- ★ Vantage Point Location

Flights

- Autumn
- Winter
- Spring
- Summer

1:70,000 Scale @ A3

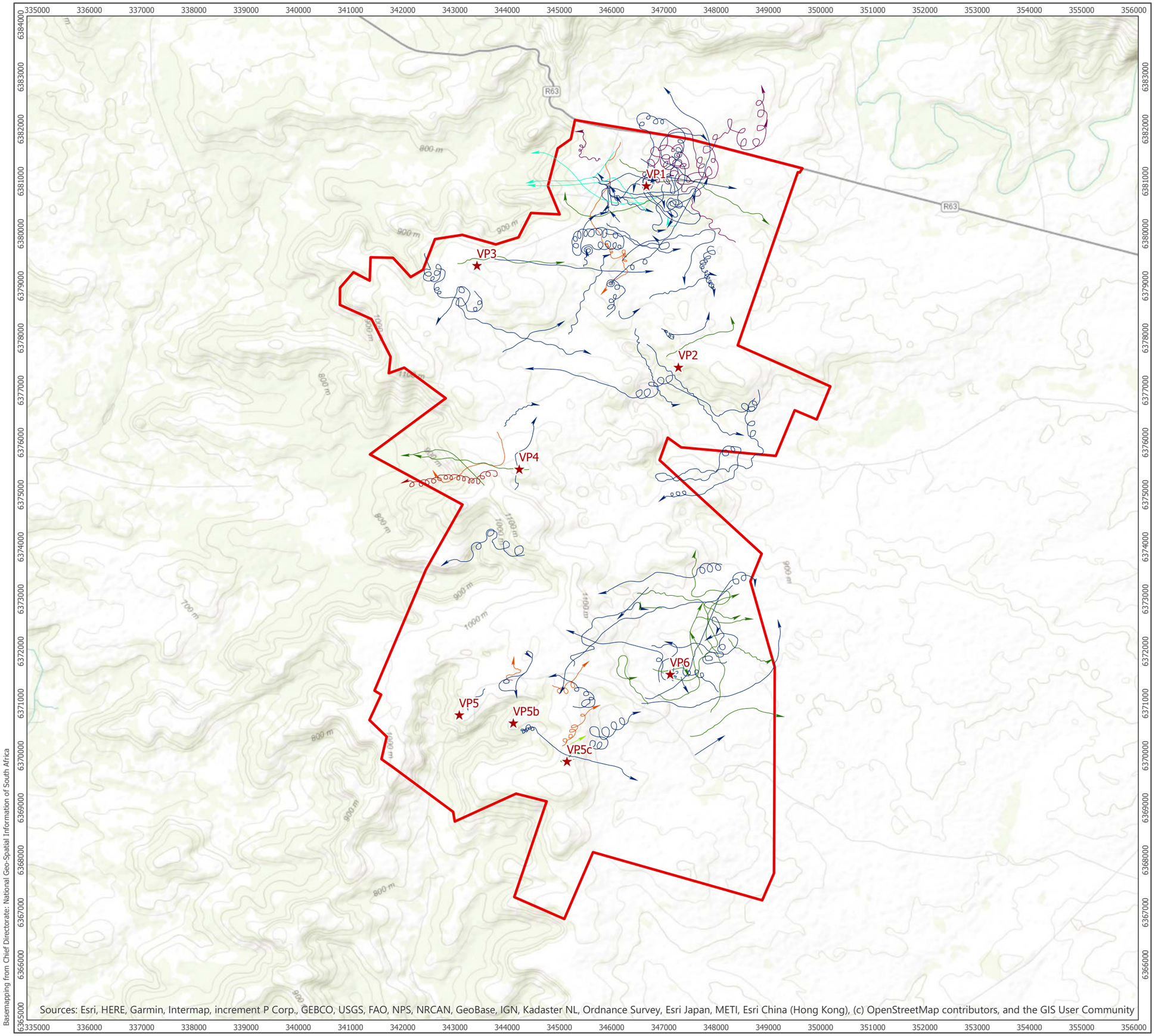
0 1 2 km

NORTH

Produced By: SC	Ref: 2705-REP-031
Checked By: AP	Date: 07/10/2019

All Priority Species and Raptor Flights
Figure 4

Highlands Wind Energy Facility Pre-Construction Bird Monitoring Final Report and Impact Assessment



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

P:\Projects\South Africa\SouthAfrica Ornithology\2780 Highlands Wind Farm.aprx\2705-REP-032

ARCUS

Development Boundary

Vantage Point Location

Crane, Bustard, Stork and Secretarybird Flights

Flights

- Blue Crane
- Denham's Bustard
- Kori Bustard
- Ludwig's Bustard
- Black Stork
- White Stork
- Secretarybird

1:70,000 Scale @ A3

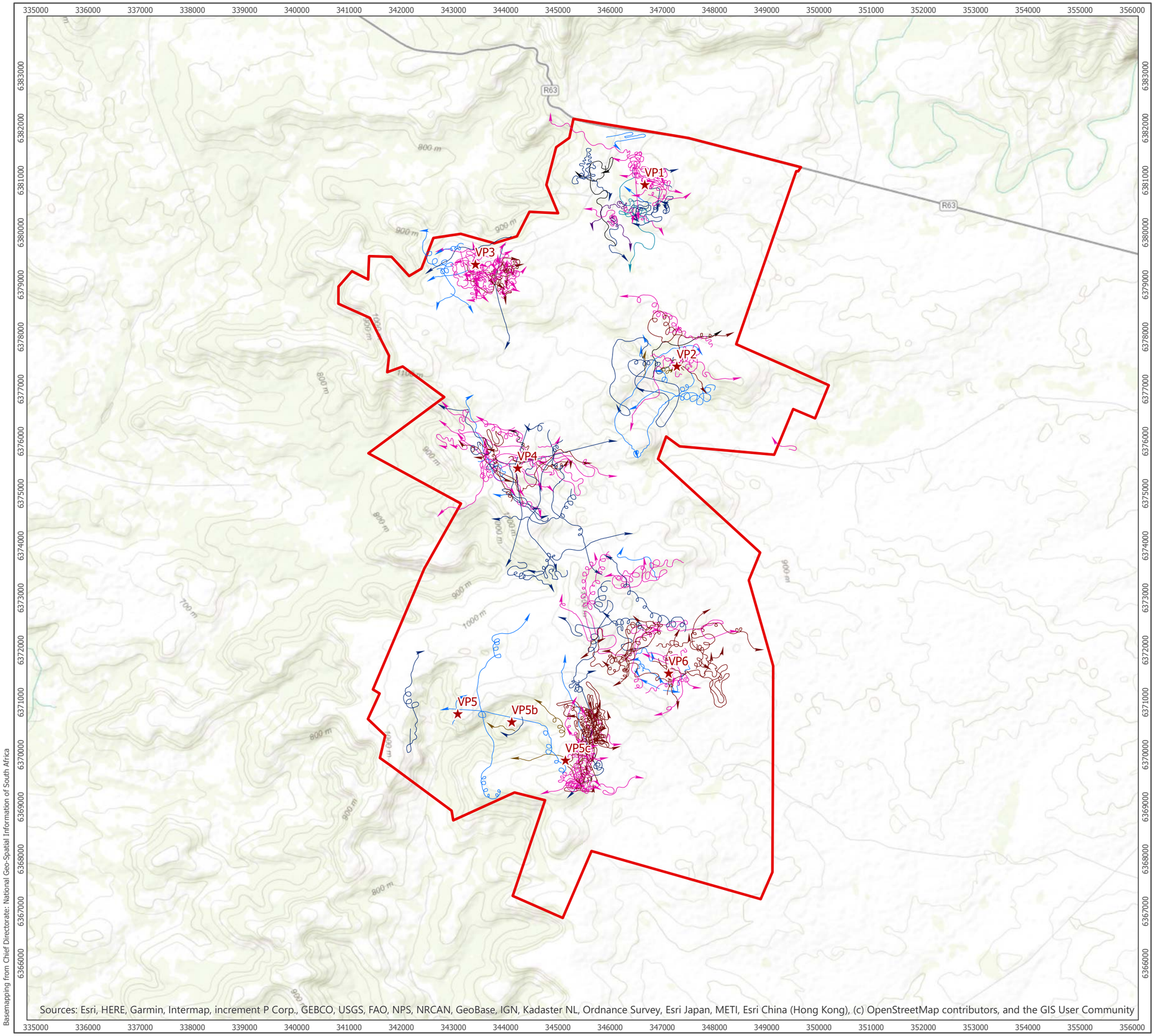
0 1 2 km

NORTH

Produced By: SC	Ref: 2705-REP-032
Checked By: AP	Date: 09/10/2019

Crane, Bustard, Stork and Secretarybird Flights
Figure 5

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

P:\Projects\South Africa\SouthAfrica Ornithology\2780 Highlands Wind Farm.aprx\2705-REP-033

ARCUS

- Development Boundary
- ★ Vantage Point Location

Flights

- African Harrier Hawk
- Black Harrier
- Lesser Kestrel
- Unidentified Kestrel
- Amur Falcon
- Lanner Falcon
- Pale Chanting Goshawk
- Steppe Buzzard

1:70,000 Scale @ A3

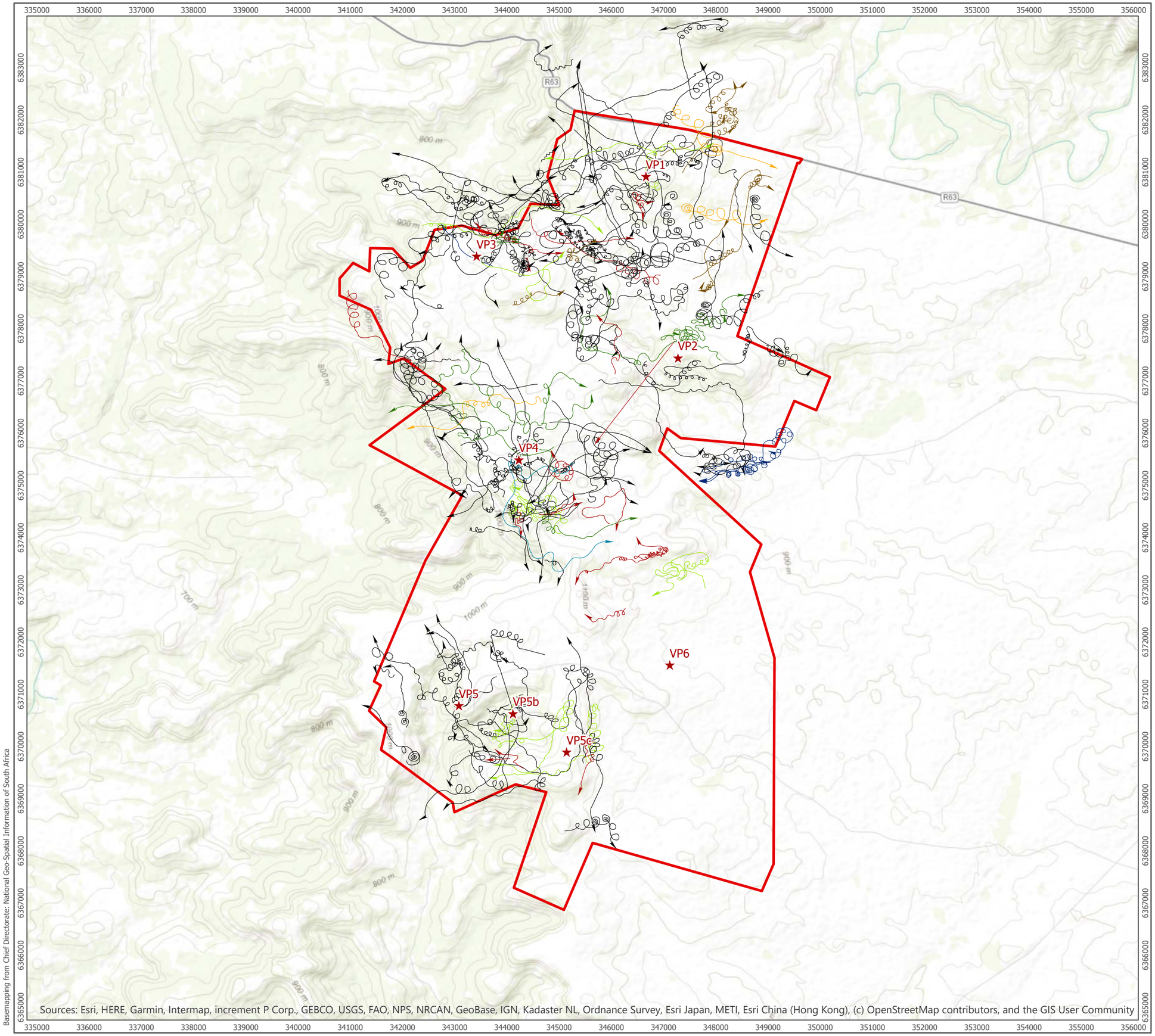
0 1 2 km

NORTH

Produced By: SC	Ref: 2705-REP-033
Checked By: AP	Date: 09/10/2019

Selected Raptor Flights A
Figure 6

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

P:\Projects\South Africa\SouthAfrica Ornithology\2780 Highlands Wind Farm.aprx\2705-REP-034

ARCUS

- Development Boundary
- ★ Vantage Point Location

Flights

- African Fish Eagle
- Black-chested Snake Eagle
- Booted Eagle
- Brown Snake Eagle
- Martial Eagle
- Verreaux's Eagle
- Cape Vulture
- Unidentified Raptor

1:70,000 Scale @ A3

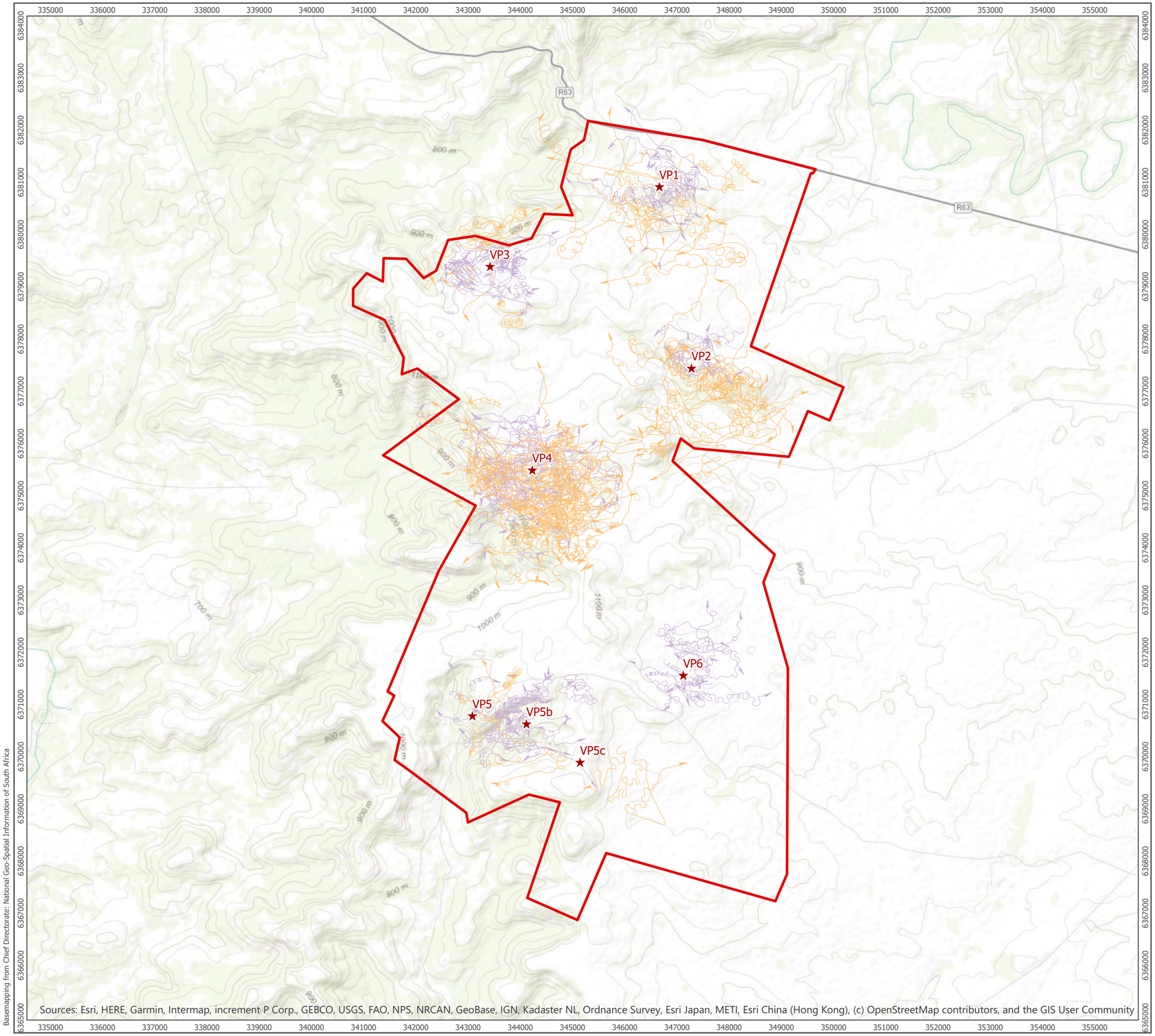
0 1 2 km

NORTH

Produced By: SC	Ref: 2705-REP-034
Checked By: AP	Date: 09/10/2019

Selected Raptor Flights B
Figure 7

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment



Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

ARCUS

Development Boundary

Vantage Point Location

Flights

Jackal Buzzard

Rock Kestrel

1:70,000 Scale @ A3

0 1 2 km

NORTH

Produced By: SC	Ref: 2705-REP-035
Checked By: AP	Date: 09/10/2019

Rock Kestrel and Jackal Buzzard Flights

Figure 8

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment

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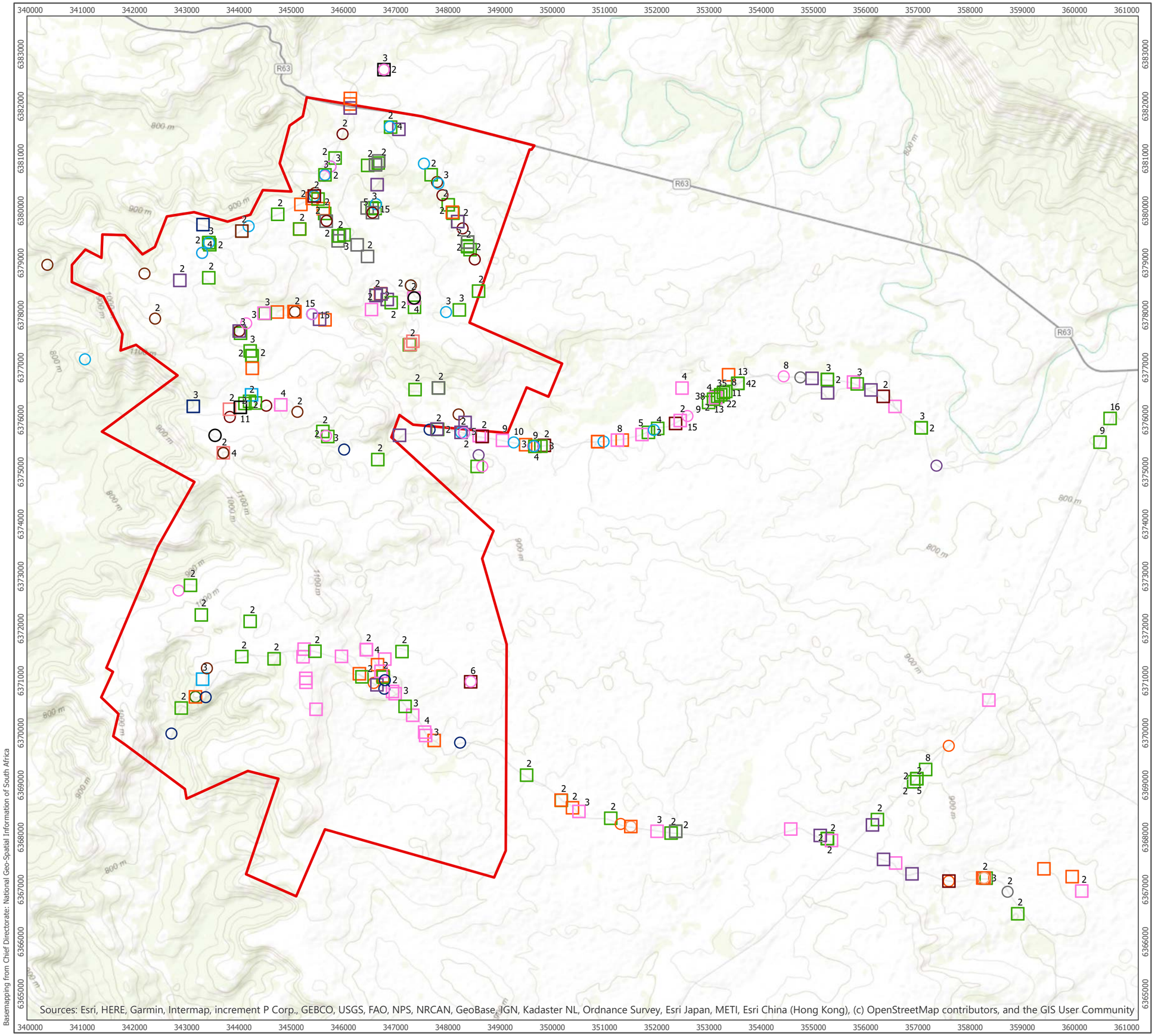

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

ARCUS

- Development Boundary
- African Harrier Hawk
- African Rock Pipit
- Amur Falcon
- Black-chested Snake Eagle
- Black-shouldered Kite
- Blue Crane
- Denham's Bustard
- Grey-winged Francolin
- Jackal Buzzard
- Kori Bustard
- Lesser Kestrel
- Ludwig's Bustard
- Martial Eagle
- Pale Chanting Goshawk
- Secretarybird
- Southern Black Korhaan
- Spotted Eagle-Owl
- Steppe Buzzard
- Unidentified Kestrel
- Unidentified Raptor
- Verreaux's Eagle
- White Stork

1:70,000 Scale @ A3

0 1 2 km

NORTH

Produced By: SC	Ref: 2705-REP-036
Checked By: AP	Date: 07/10/2019

Priority Species Incidental and Driven Transect Records
Figure 9

Highlands Wind Energy Facility Pre-Construction Bird Monitoring Final Report and Impact Assessment

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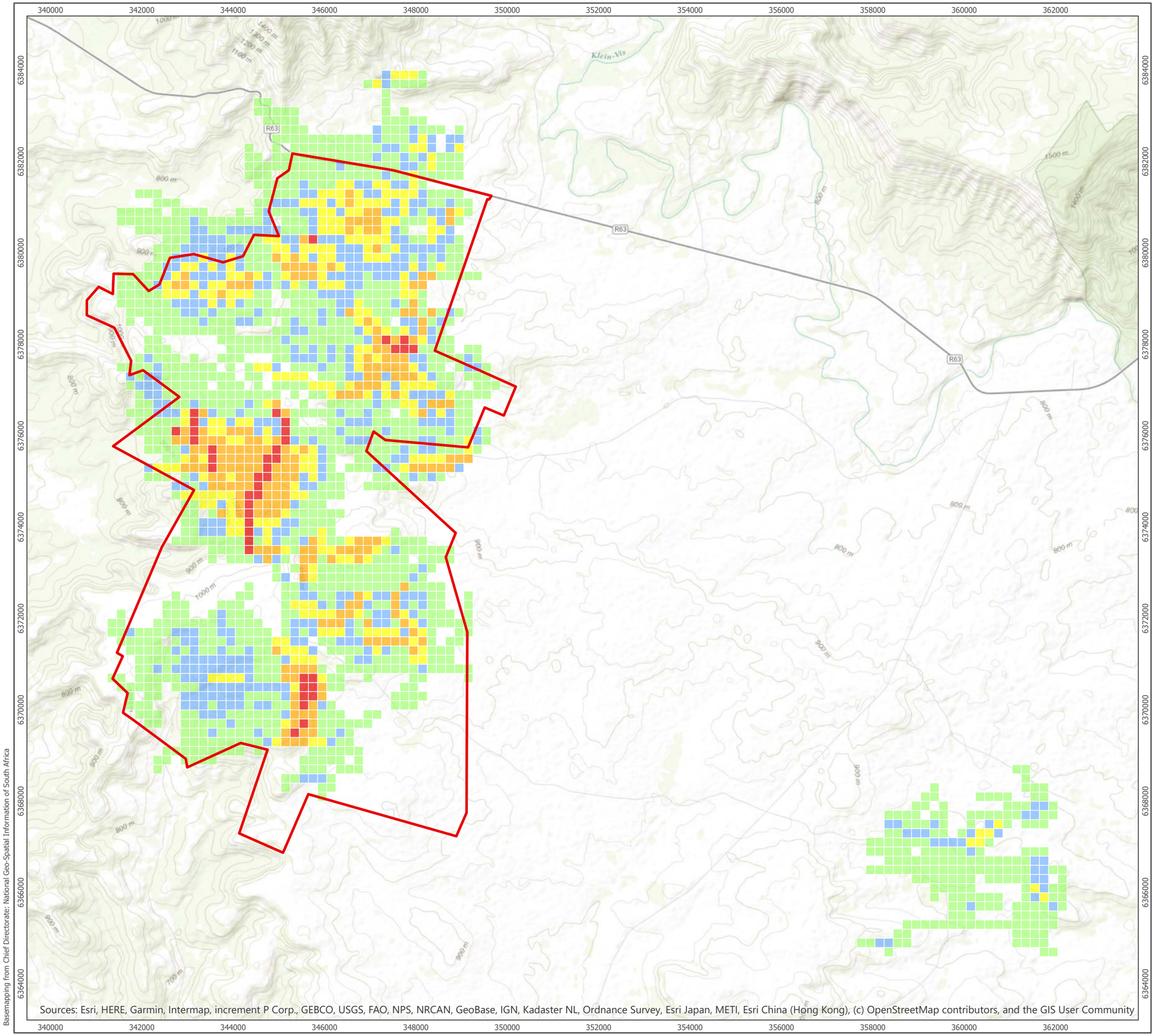

Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

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ARCUS

Development Boundary

GCSS Score

- Low (< 500)
- Medium (500 - 1250)
- Medium - High (1250 - 2500)
- High (2500 - 10000)
- Very High (> 10000)

1:80,000 Scale @ A3

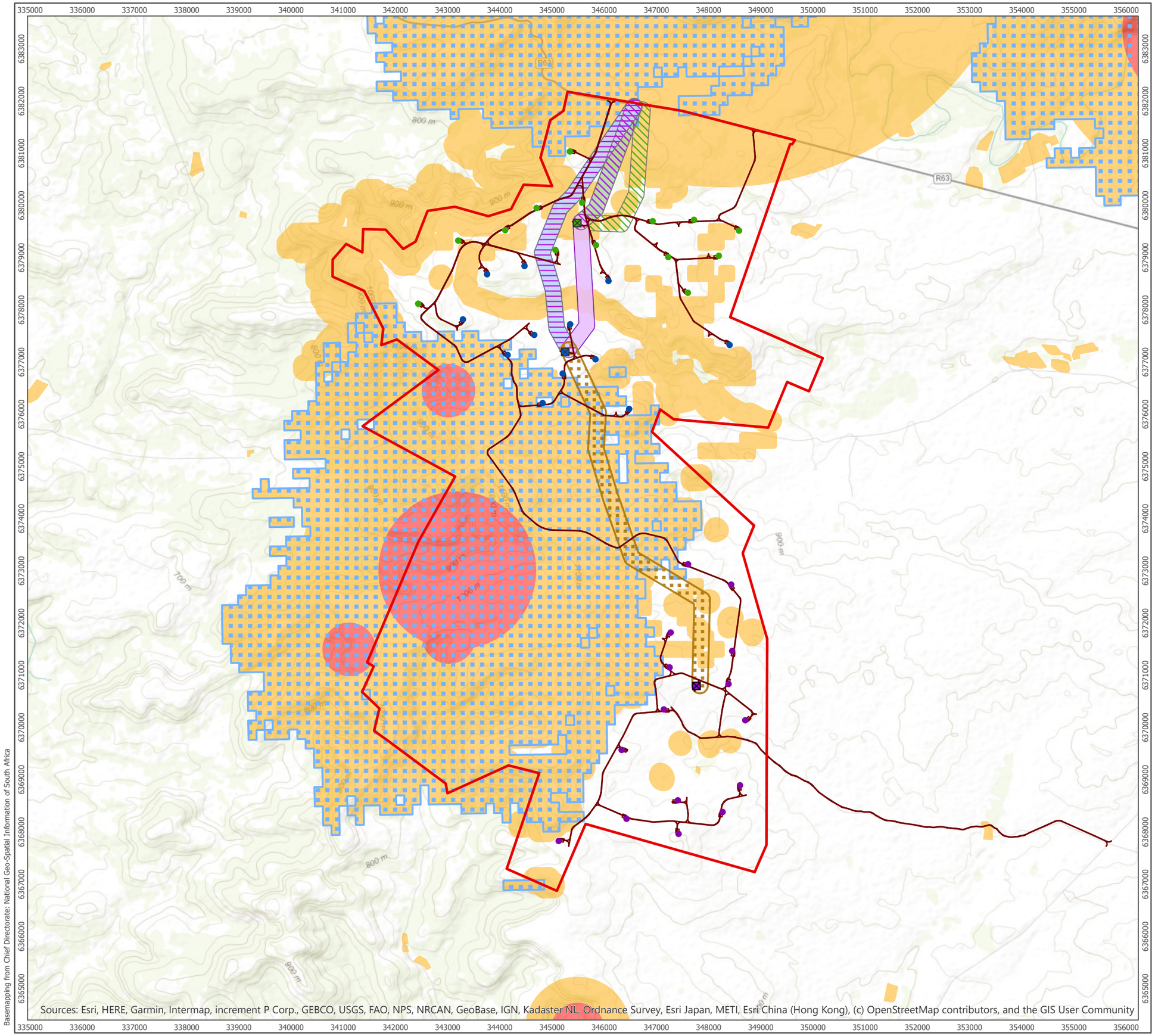
0 1.5 3 km

NORTH

Produced By: SC	Ref: 2705-REP-037
Checked By: AP	Date: 07/10/2019

Flight Sensitivity Map
Figure 10

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment



Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

P:\Projects\South Africa\SouthAfrica Ornithology\2780 Highlands Wind Farm.aprx\2705-REP-038

ARCUS

- Site Boundary
- Central WEF Substation (B)
- North WEF Substation (A)
- South WeF Substation (C)
- Central WEF Turbine Location
- North WEF Turbine Location
- South WEF Turbine Location
- Roads and Crane Pads
- Central Grid Alternative 1a
- Central Grid Alternative 1b
- Central Grid Alternative 2
- North Grid Alternative 1
- North Grid Alternative 2
- South Grid Alternative 1a
- South Grid Alternative 1b
- South Grid Alternative 2
- South Grid SSC to SSB

Avifaunal Sensitivity

- No-Go for All Infrastructure
- No-Go for Turbines only (other infrastructure permitted)
- VERA Model Results

1:70,000 Scale @ A3

0 1 2 km

Produced By: SC	Ref: 2705-REP-038
Checked By: AP	Date: 10/10/2019

Combined Avifaunal Sensitivity
Figure 11

Highlands Wind Energy Facility
Pre-Construction Bird Monitoring
Final Report and Impact Assessment

Arcus Consulting Services
Office 211 Cube Workspace
Cnr Long Street and Hans Strijdom Road
Cape Town
8001

7 October 2019

RE: AVIFAUNAL PEER REVIEW OF THE UPDATED AVIFAUNAL IMPACT ASSESSMENT REPORT FOR THE HIGHLANDS WIND FARM PROJECT.

To whom it may concern,

1. Background

WildSkies Ecological Services (Pty) Ltd was appointed by Arcus to conduct a peer review of the study entitled: "Highlands Wind Farm Pre-construction Bird Monitoring: Impact Assessment Report" in 2018. The results of this peer review are attached in Appendix 1 of this report.

Subsequently the avifaunal studies conducted by Arcus were updated to include additional aspects at the request of the Department of Environmental Affairs (DEA). Arcus therefore asked WildSkies to review the updated work, and with specific consideration of the actions highlighted below in a letter from DEA (Figure 1):

The Applicant must do the following:

1. The avifaunal studies for all projects (14/12/16/3/3/1/1955; 14/12/16/3/3/1/1958; and, 14/12/16/3/3/1/1960) must be revised and strengthened to reflect the following aspects:
   i. The specialist must consider and incorporate the Verreaux's Eagle Risk Model Analysis to augment the identification of impacts on avifauna.
   ii. Scope of Cliff Survey: Figure 1 that was excluded from the avifaunal reports submitted with the final BARs must be considered and included in the reports.
   iii. Further interrogation and strengthening of the approach used to identify no-go areas as well as impacts on site in light of the context of the site in relation to the CBA's and Protected Areas Expansion Strategy Area must be considered.
   iv. Additional nest locations searches for Martial Eagle within 5km of the site must be conducted.
   v. Findings of 1(i) and 1(ii) must be used to further determine/inform the demarcation of no-go areas, the location of turbine positions and all associated infrastructure.
   vi. The avifaunal specialist must recommend practical mitigation measures for inclusion in the EMPr.
2. The peer review undertaken by Wildskies on the avifaunal report must consider the above as well as highlight the following:
   i. Acceptability of the terms of reference of the specialist studies;
   ii. The suitability of the different assessment methodology used for data gathering and analysis;
   iii. Evaluate the validity of the findings (review data evidence);
   iv. Discuss the suitability of the mitigation measures and recommendations;
   v. Identify any short comings and mitigation measures to address the short comings;
   vi. Evaluate the appropriateness of the reference literature;
   vii. A CV clearly showing the expertise of the peer reviewer;
   viii. Indicate whether a site-inspection was carried out as part of the peer review; and
   ix. Indicate whether the article is well-written and easy to understand.

Figure 1. Extract from DEA letter with relevant avifaunal aspects.

In conducting this updated peer review we have considered the following documents supplied to us by Arcus:

- The revised Highlands Final Bird Impact Assessment report.
- Various KMZ files of the relevant information used for figures in the study.
- Collision Risk 210m.kmz" – The high risk no go areas identified by the VERA modelling.
- "VERA metadata_highlands.pdf" – The report produced by Megan Murgatroyd from the VERA model.
- The DEA letter mentioned above.

2. Findings

Acceptability of the terms of reference of the specialist studies

The terms of reference utilised for the study are acceptable and adequate in our view. We cannot identify any gaps or omissions. The new aspects considered by the revised study in 2019 (as contained in the DEA letter extract above – Figure 1) have further strengthened the study.

The suitability of the different assessment methodology used for data gathering and analysis

Overall the methods used and level of effort of study are suitable in our view. One exception is the walked transects, where we feel 4 x 1km transects for a large site such as the Highlands site is on the low side in terms of effort. However , if more transects had been done it is unlikely to have changed any of the findings of the impact assessment materially as the smaller bird species did not turn out to be a high priority for this site or to influence the facility layout in any way.

The consideration of the outputs of the VERA model is useful as an additional information source, although to our knowledge this model has not yet been robustly tested in field. In our opinion it may have been premature to insist on its application on this project, although it does hold lots of potential in the future.

Evaluate the validity of the findings (review data evidence)

Overall the findings are sound, and based on the data collected on site.

Discuss the suitability of the mitigation measures and recommendations

In general the mitigation measures appear appropriate. One comment we have is on the statement *"All new internal power lines linking the wind turbine generators to each other on site must be placed underground where technically and environmentally feasible. Certain spans can only be above ground if it is impossible and completely unfeasible to bury them or if there is a reasonable other environmental aspect present which prevents them being buried (e.g. a sensitive wetland area)".* Subsequent to the original study and our review thereof we have become aware of two wind farms elsewhere in South Africa which built overhead internal power lines. The impacts of these power lines on birds at the two sites have been significant and demonstrate that a repeat of that situation should be avoided at future wind farms (such as Highlands). The above mitigation measure should in our view be strengthened. As it reads now the proponent could decide where it is technically and environmentally acceptable to build above ground power line. We do acknowledge in certain situations very short sections of above ground power line may be preferable to underground (although if underground power line is trenched directly adjacent to roads as should be the case, it may still be preferable to place it underground), but suggest that a limit be placed on this. This could possibly be done by placing a maximum of (for example) a total of 1-2km of above ground power line per wind farm. This approach could limit the impact of such above ground power line impacts on birds to acceptable levels.

Identify any short comings and mitigation measures to address the mitigation measures

We have not identified any short comings requiring action. We would recommend that the wind farm (if built) be required to monitor breeding status and productivity at the set of raptor nests identified by this study, both during construction (mentioned in the report) and for the first three years of operations at a minimum (not specified in the report as far as we can see), longer if raptor fatalities are recorded on site. This is necessary to measure the impacts of any fatalities on the local breeding populations and to provide a better understanding of the ecology of these raptors in the area, which may be necessary for the application of adaptive management during the project lifespan.

Evaluate the appropriateness of the reference literature

The literature review done for each potential impact is thorough and up to date. We judge it to be appropriate for this purpose.

A CV clearly showing the expertise of the peer reviewer

This is shown in Appendix 2.

Indicate whether a site inspection was carried out as part of the peer review

No site inspection was carried out as part of the peer review. A brief once off site inspection would carry very little value considering that more than a year's worth of data collection on site is presented by the avifaunal impact assessment. There are no specific issues that could have benefited from an on-site examination by the peer reviewer.

Indicate whether the article is well written and easy to understand

The avifaunal impact assessment study is well written in our view and follows a logical sequence throughout. It is easy as a reader to follow the sequence from background, to baseline data, to impact assessment, to management and mitigation.

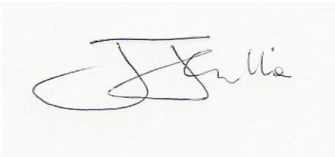
One minor criticism we have is that figures are not presented adjacent to relevant text. This makes it cumbersome for the reader to scroll to the end of the report each time to examine something stated in the text.

3. Conclusions

We conclude that this site has been thoroughly and adequately studied both by the original study and now more recently by the revised study. We believe that the findings are reasonable and based on sound data.

Please don’t hesitate to contact us if you have any further questions.

Kind regards



Jon Smallie

APPENDIX 1. ORIGINAL PEER REVIEW

Arcus Consulting Services
Office 211 Cube Workspace
Cnr Long Street and Hans Strijdom Road
Cape Town
8001

3 August 2018

RE: AVIFAUNAL PEER REVIEW OF THE AVIFAUNAL IMPACT ASSESSMENT REPORT FOR THE HIGHLANDS WIND FARM PROJECT.

To whom it may concern,

WildSkies Ecological Services (Pty) Ltd was appointed by Arcus to conduct a peer review of the study entitled: "Highlands Wind Farm Pre-construction Bird Monitoring: Impact Assessment Report".

The terms of reference for this review are below. We have studied the report and engaged verbally with the author Andrew Pearson on any minor points of clarification. Our findings are as follows, reported on relative to each of the terms of reference.

1. If the specialist is qualified and experienced enough to have authored the report

The avifaunal specialist (Andrew Pearson) is certainly qualified and sufficiently experienced to conduct this assessment. Mr Pearson has >5 years avifaunal consulting experience, at least two years of which involved Andrew working closely with me whilst we were both employed by the Endangered Wildlife Trust. Andrew is a competent and very thorough avifaunal specialist.

2. Is the report in line with the applicable guidelines.

The report is in line with the applicable guidelines. The applicable guidelines are the:

- "BirdLife South Africa/Endangered Wildlife Trust Birds and Wind-Energy Best-Practice Guidelines – Best practice guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa, Third Edition, 2015" by Jenkins, van Rooyen, Smallie, Harrison, Diamond, Smit-Robinson and Ralston; and
- The "Verreaux's Eagle and Wind Farms: Guidelines for impact assessment, monitoring and mitigation" by BirdLife South Africa (2017).

This study conforms to both sets of guidelines.

3. If the effort was suitable and efficient etc.

Overall, the survey scope is suitable and adequate. More specific feedback is provided relative to each of the main forms of data collection prescribed by Jenkins *et al* (2015):

- Vantage Points. The coverage of the developable area is adequate.
- Walked transects. While the number of walked transects conducted on site is relatively low in our view for a site of this size, it is acceptable as the four transect used cover all important bird habitats (of which there are relatively few on the site). The relatively low geographic coverage is offset somewhat by repeating transects twice in each season.
- Drive transects. The number and length of transects are acceptable. The repetition of each transect twice in each season is excellent.
- Incidental observations. It is not possible to evaluate this in terms of effort as it is site specific.
- Focal sites. This is determined by need so not possible to evaluate this.
- Nest surveys. The study has conducted a very thorough survey of available nesting substrate on site, and provides high confidence in the status quo with respect to sensitive species breeding.

4. Agreement with methodology and presentation of findings

We confirm that we agree with the methodology and presentation of findings.

5. Based on the data if you are in agreement with the impact ratings and findings of the report etc

Overall, the impact ratings and findings are acceptable in our view. The various options of either north, south or central phases alone or a combination thereof does make for complex reading. In some cases the significance of impacts does not increase for a consequent increase in number of turbines, but we understand that this probably due to the categorical approach to impact rating, whereby the increase may not be sufficient to warrant an increase from Medium to High for example. The impact criteria used (Hacking, 2001) calculates the significance as a category either low/med/high, based on various factors including severity, duration, extent and probability. While an increase in number of turbines may change one or two of these factors, this does not always result in a step up in category regarding the significance, for example from Medium to High.

6. Additional suggestions if any

We have the following suggestions:

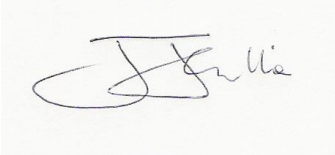
- We support the recommendation in the 'Conclusion' that two Verreaux's Eagles be fitted with GPS trackers, but recommend this also be repeated elsewhere in the report under mitigation measures so that it is not missed by anyone extracting listed mitigation from the tables.

7. Agreement that the work was conducted fairly and independently

Our impression is that the work was conducted both fairly and independently.

Thank-you for the opportunity to review this work. Please don't hesitate to contact us if you have any further questions.

Kind regards



Jon Smallie

APPENDIX 2. CV OF PEER REVIEWER

JONATHAN JAMES SMALLIE
WildSkies Ecological Services (2011/131435/07)
Curriculum Vitae

BACKGROUND

Date of birth:	20 October 1975
Qualifications:	BSC – Agriculture (Hons) (completed 1998) University of Natal – Pietermaritzburg MSC – Environmental Science (completed 2011) University of Witwaterstrand
Occupation:	Specialist avifaunal consultant
Profession registration:	South African Council for Natural Scientific Professions

CONTACT DETAILS

Cell number: 082 444 8919
Fax: 086 615 5654
Email: jon@wildskies.co.za
Postal: 36 Utrecht Avenue, Bonnie Doon, East London, 5210
ID #: 7510205119085

PROFESSIONAL EXPERIENCE

Strategic Assessments:

East Cape Biodiversity Strategy & Action Plan – avifauna.

Renewable energy:

Post construction bird monitoring for wind energy facilities:

Dassieklip (Caledon) –initiated in April 2014 (2yrs); Dorper Wind Farm (Molteno) – initiated in July 2014 (2yrs); Jeffreys Bay Wind Farm – initiated in August 2014 (4yrs); Kouga Wind Farm – started Feb 2015 (2yrs); Cookhouse West Wind Farm – started March 2015 (1yr); Grassridge Wind Farm – initiated in April 2015 (2yrs); Chaba Wind Farm – initiated December 2015 (1yr); Amakhala Emoyeni 01 Wind Farm initiated August 2016 (2yrs); Gibson Bay Wind Farm – initiated March 2017 (2yrs); Nojoli Wind Farm initiated March 2017 (2yrs); Sere Wind Farm (2yrs).

Pre-construction bird monitoring & EIA for wind energy facilities:

Golden Valley 1; Middleton; Dorper; Qumbu; Ncora; Nqamakhwe; Ndakana; Thomas River; Peddie; Mossel Bay; Hluhluwe; Richards Bay; Garob; Outeniqua; Castle; Wolf; Inyanda-Roodeplaat; Dassiesridge; Great Kei; Bayview; Grahamstown; Bakenskop; Umsobomvu; Stormberg; Zingesele; Oasis; Gunstfontein; Naumanii; Golden Valley Phase 2; Ngxwabangu; Hlobo; Woodstock; Scarlet Ibis; Albany; Golden Valley 1 2nd monitoring; Umtathi Emoyeni; Pensulo Zambia; Unika 1 Zambia; Impofu; Nuweveld; Kleinsee wind energy facilities.

Screening studies for wind energy facilities:

Tarkastad Wind Farm; Quanti Wind Farm; Ruitjies Wind Farm; Stutterheim Wind Farm; Molteno Wind Farm; Noupoort Wind Farm.

Avifaunal walk through for wind energy facilities:
Garob Wind Farm; Golden Valley 1 wind farm; Nxuba Wind Farm.

Pre-construction bird monitoring and EIA for Solar energy facilities:
Bonnievale Solar Energy Facility; Dealesville Solar Energy Facility; Rooipunt Solar Energy Facility; De Aar Solar Energy Facility; Noupoort Solar Energy Facility, Aggeneys Solar Energy Facility; Eskom Concentrated Solar Power Plant; Bronkhorstspruit Solar Photovoltaic Plant; De Aar Solar Energy Facility; Paulputs Solar Energy Facility; Kenhardt Solar Energy Facility; Wheatlands Solar Energy Facility; Nampower CSP project;

Other Electricity Generation:
Port of Nqura Power Barge EIA; Tugela Hydro-Electric Scheme; Mmamabula West Coal Power Station (Botswana).

Electricity transmission & distribution:
Overhead transmission power lines (>132 000 kilovolts):
Oranjemund Gromis 220kv; Perseus Gamma 765kv; Aries Kronos 765kv; Aries Helios 765kv; Perseus Kronos 765kv; Helios Juno 765kv; Borutho Nzelele 400kv; Foskor Merensky 275kv; Kimberley Strengthening; Mercury Perseus 400kV; Eros Neptune Grassridge 400kV; Kudu Juno 400kV; Garona Aries 400kV; Perseus Hydra 765Kv; Tabor Witkop 275kV; Tabor Spencer 400kV; Moropule Orapa 220kV (Botswana); Coega Electrification; Majuba Venus 765kV; Gamma Grassridge 765kV; Gourikwa Proteus 400KV; Koeberg Strengthening 400kV; Ariadne Eros 400kV; Hydra Gamma 765kV; Zizabona transmission – Botswana; Maphutha Witkop 400kv; Makala B 400kv; Aggeneis Paulputs 400kv; Northern Alignment 765kv; Kappa Omega 765kv; Isundu 400kv and Substation; Senakangwedi B Integration; Oranjemund Gromis;

Overhead distribution power lines (<132 000 kilovolts):
Kanoneiland 22KV; Hydra Gamma 765kV; Komani Manzana 132kV; Rockdale Middelburg 132kV; Irenedale 132 kV; Zandfontein 132kV; Venulu Makonde 132 kV; Spencer Makonde 132 kV; Dalkeith Jackal Creek 132Kv; Glen Austin 88kV; Bulgerivier 132kV; Ottawa Tongaat 132kV; Disselfontein 132kV; Voorspoed Mine 132kV; Wonderfontein 132kV; Kabokweni Hlau Hlau 132kV; Hazyview Kiepersol 132kV; Mayfern Delta 132kV; VAAL Vresap 88kV; Arthursview Modderkuil 88kV; Orapa, AK6, Lethakane substations and 66kV lines (Botswana); Dagbreek Hermon 66kV; Uitkoms Majuba 88kV; Pilanesberg Spitskop 132kV; Qumbu PG Bison 132kV; Louis Trichardt Venetia 132kV; Rockdale Middelburg Ferrochrome 132kV; New Continental Cement 132KV; Hillside 88kV; Marathon Delta 132kV; Malelane Boulder 132kV; Nondela Strengthening 132kV; Spitskop Northern Plats 132kV; West Acres Mataffin 132kV; Westgate Tarlton Kromdraai 132kV; Sappi Elliot Ugie 132kV; Melkhout Thyspunt 132kV; St Francis Bay 66kv; Etna Ennerdale 88kv; Kroonstad 66kv; Firham Platrand; Paradise Fondwe 132kv; Kraal Mafube 132kv; Loeriesfontein 132kv; Albany Mimosa 66kv; Zimanga 132kv; Grootpan Brakfontein; Mandini Mangethe; Valkfontein Substation; Sishen Saldanha; Corinth Mzongwana 132kv; Franklin Vlei 22kv; Simmerpan Strengthening; Ilanga Lethemba 132kv; Cuprum Burchell Mooidraai 132; Oliphantskop Grassridge 132;

Risk Assessments on existing power lines:
Hydra-Droerivier 1,2 & 3 400kV; Hydra-Poseidon 1,2 400kV; Butterworth Ncora 66kV; Nieu-Bethesda 22kV; Maclear 22kV (Joelshoek Valley Project); Wodehouse 22kV (Dordrecht district); Burgersdorp Aliwal North Jamestown 22kV; Cradock 22kV; Colesberg area 22kV; Loxton self build 11kV; Kanoneiland 22kV; Stutterheim Municipality 22kV; Majuba-Venus 400kV; Chivelston-Mersey 400kV; Marathon-Prairie 275kV; Delphi-Neptune 400kV; Ingagane – Bloukrans 275kV; Ingagane – Danskraal 275kV; Danskraal – Bloukrans 275kV

Avifaunal "walk through" (EMP's):

Kappa Omega 765kv; Rockdale Marble Hall 400kv; Beta Delphi 400kV; Mercury Perseus 765kV; Perseus 765kV Substation; Beta Turn 765kV in lines; Spencer Tabor 400kV line; Kabokweni Hlau Hlau 132kV; Mayfern Delta 132Kv; Eros Mtata 400kV; Cennergi Grid connect 132kV; Melkhout Thyspunt 132kv; Imvubu Theta 400kv; Outeniqua Oudshoorn 132kv; Clocolan Ficksburg 88kv.

Strategic Environmental Assessments for Master Electrification Plans:

Northern Johannesburg area; Southern KZN and Northern Eastern Cape; Northern Pretoria; Western Cape Peninsula

Other electrical infrastructure work

Investigation into rotating Bird Flapper saga – Aberdeen 22Kv; Special investigation into faulting on Ariadne-Eros 132kV; Special investigation into Bald Ibis faulting on Tutuka Pegasus 275kV; Special investigation into bird related faulting on 22kV Geluk Hendrina line; Special investigation into bird related faulting on Camden Chivelston 400kV line

Water sector:

Umkhomazi Dam and associated tunnel and pipelines; Rosedale Waste Water Treatment Works; Lanseria Outfall Sewer; Lanseria Wastewater Treatment Works;

Wildlife airport hazards:

Kigali International Airport – Rwanda; Port Elizabeth Airport – specialist study as part of the EIA for the proposed Madiba Bay Leisure Park; Manzini International Airport (Swaziland); Polokwane International Airport; Mafekeng International Airport; Lanseria Airport

Other sectors:

Lizzard Point Golf Estate – Vaaldam; Lever Creek Estates housing development; East Cape Biodiversity Strategy and Action Plan 2017; Cathedral Peak Road diversion; Dube Tradeport; East London Transnet Ports Authority Biodiversity Management Plan; Leazonia Feedlot; Carisbrooke Quarry; Senekal Sugar Development; Frankfort Paper Mill;

Employment positions held to date:

- August 1999 to May 2004: Eastern Cape field officer for the South African Crane Working Group of the Endangered Wildlife Trust
- May 2004 to November 2007: National Field officer for Eskom-EWT Strategic Partnership and Airports Company SA – EWT Strategic Partnership (both programmes of Endangered Wildlife Trust)
- November 2007 to August 2011: Programme Manager – Wildlife & Energy Programme – Endangered Wildlife Trust
- **August 2011 to present: Independent avifaunal specialist – Director at WildSkies Ecological Sevices (Pty) Ltd**

Relevant achievements:

- Recipient of BirdLife South Africa's Giant Eagle Owl in 2011 for outstanding contribution to bird conservation in SA
- Founded and chaired for first two years – the Birds and Wind Energy Specialist Group (BAWESG) of the Endangered Wildlife Trust & BirdLife South Africa.

Conferences attended & presented at:

- August 2019. Conference of Wind Energy and Wildlife, Stirlign, Scotland.
- November 2018. Raptor Research Foundation. Skukuza, Soith Africa.
- October 2017. Conference of Wind Energy and Wildlife, Estoril Portugal
- May 2011. Conference of Wind Energy and Wildlife, Trondheim, Norway.
- March 2011. Chair and facilitator at Endangered Wildlife Trust – Wildlife & Energy Programme – "2011 Wildlife & Energy Symposium", Howick, SA
- September 2010 – Raptor Research Foundation conference, Fort Collins, Colorado. Presented on the use of camera traps to investigate Cape Vulture roosting behaviour on transmission lines
- May 2010 - Wind Power Africa 2010. Presented on wind energy and birds
- October 2008. Session chair at Pan-African Ornithological Conference, Cape Town, South Africa
- March 27 – 30 2006: International Conference on Overhead Lines, Design, Construction, Inspection & Maintenance, Fort Collins Colorado USA. Presented a paper entitled "Assessing the power line network in the Kwa-Zulu Natal Province of South Africa from a vulture interaction perspective".
- June 2005: IASTED Conference at Benalmadena, Spain – presented a paper entitled "Impact of bird streamers on quality of supply on transmission lines: a case study"
- May 2005: International Bird Strike Committee 27th meeting – Athens, Greece. Presented a paper entitled Bird Strike Data analysis at SA airports 1999 to 2004.
- 2003: Presented a talk on "Birds & Power lines" at the 2003 AGM of the Amalgamated Municipal Electrical Unions – in Stutterheim - Eastern Cape
- September 2000: 5th World Conference on Birds of Prey in Seville, Spain.

Papers & publications:

- Prinsen, H.A.M., J.J. Smallie, G.C. Boere, & N. Pires. (compilers), 2011. Guidelines on how to avoid or mitigate impacts of electricity power grids on migratory birds in the African-Eurasian Region. CMS Technical Series Number XX. Bonn, Germany.
- Prinsen, H.A.M., J.J. Smallie, G.C. Boere, & N. Pires. (compilers), 2011. Review of the conflict between migratory birds and electricity power grids in the African-Eurasian region. CMS Technical Series Number XX, Bonn, Germany.
- Jenkins, A.R., van Rooyen, C.S, Smallie, J.J, Harrison, J.A., Diamond, M.D., Smit-Robinson, H.A & Ralston, S. 2014. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa
- Jenkins, A.R., Shaw, J.M., Smallie, J.J., Gibbons, B., Visagie, R. & Ryan, P.G. 2011. Estimating the impacts of power line collisions on Ludwig's Bustards Neotis ludwigii. Bird Conservation International.
- Jordan, M., & Smallie, J. 2010. A briefing document on best practice for pre-construction assessment of the impacts of onshore wind farms on birds. Endangered Wildlife Trust , Unpublished report
- Smallie, J., & Virani, M.Z. 2010. A preliminary assessment of the potential risks from electrical infrastructure to large birds in Kenya. Scopus 30: p32-39
- Shaw, J.M., Jenkins, A.R., Ryan, P.G., & Smallie, J.J. 2010. A preliminary survey of avian mortality on power lines in the Overberg, South Africa. Ostrich 2010. 81 (2) p109-113
- Jenkins, A.R., Smallie, J.J., & Diamond, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. Bird Conservation International 2010. 20: 263-278.
- Shaw, J.M., Jenkins, A.R., Ryan, P.G., & Smallie, J.J. 2010. Modelling power line collision risk for the Blue Crane *Anthropoides paradiseus* in South Africa. Ibis 2010 (152) p590-599.
- Jenkins, A.R., Allan, D.G., & Smallie, J.J. 2009. Does electrification of the Lesotho Highlands pose a threat to that countries unique montane raptor fauna? Dubious evidence from surveys of three existing power lines. Gabar 20 (2).
- Smallie, J.J., Diamond, M., & Jenkins, A.R. 2008. Lighting up the African continent – what does this mean for our birds? Pp 38-43. In Harebottle, D.M., Craig, A.J.F.K., Anderson, M.D., Rakotomanana, H.,

& Muchai. (eds). Proceedings of the 12th Pan-african Ornithological Congress. 2008. Cape Town. Animal Demography Unit. ISBN (978-0-7992-2361-3)
- Van Rooyen, C., & Smallie, J.J. 2006. The Eskom –EWT Strategic Partnership in South Africa: a brief summary. Nature & Faunae Vol 21: Issue 2, p25
- Smallie, J. & Froneman, A. 2005. Bird Strike data analysis at South African Airports 1999 to 2004. Proceedings of the 27th Conference of the International Bird Strike Committee, Athens Greece.
- Smallie, J. & Van Rooyen, C. 2005. Impact of bird streamers on quality of supply on transmission lines: a case study. Proceedings of the Fifth IASTED International Conference on Power and Energy Systems, Benalmadena, Spain.
- Smallie, J. & Van Rooyen, C. 2003. Risk assessment of bird interaction on the Hydra-Droërivier 1 and 2 400kV. Unpublished report to Eskom Transmission Group. Endangered Wildlife Trust. Johannesburg. South Africa
- Van Rooyen, C. Jenkins, A. De Goede, J. & Smallie J. 2003. Environmentally acceptable ways to minimise the incidence of power outages associated with large raptor nests on Eskom pylons in the Karoo: Lessons learnt to date. Project number 9RE-00005 / R1127 Technology Services International. Johannesburg. South Africa
- Smallie, J. J. & O'connor, T. G. (2000) Elephant utilization of *Colophospermum mopane*: possible benefits of hedging. African Journal of Ecology 38 (4), 352-359.

Courses & training:

- Successfully completed a 5 day course in High Voltage Regulations (modules 1 to 10) conducted by Eskom – Southern Region
- Successfully completed training on, and obtained authorization for, live line installation of Bird Flappers

APPENDIX 2: Specialist Declaration & CV

P O Box 31108, Tokai, 7966, South Africa
Mobile 072 601 0803 ~ Fax 086 653 1765 ~ e-mail: ross@hollandandassociates.net
Web: www.hollandandassociates.net

ANJA ISABEL ALBERTYN

neé Terörde, in Germany 1977
RSA permanent resident

CURRICULUM VITAE

Ornithologist and Environmental Consultant and with eleven years of experience in the environmental consulting field, including five years conducting EIAs & Basic Assessments, and nine years of avifaunal specialist studies. SACNASP Registered Professional Natural Scientist (Ecological Science) (400037/16) with eight scientific publications on avian ecology to date. Selected member of the Birds and Renewable Energy Specialist Group (BARESG).

Professional Experience

2019 - present	**Environmental Assessment Practitioner and Avifaunal Specialist** *Holland & Associates Environmental Consultants, Tokai*
2017-2019	**Avifauna Specialist & Environmental Assessment Practitioner** *Arcus Consultancy Services South Africa, Cape Town*
2013 - 2017	**Ecology Consultant (Avifauna)** *Arcus Consultancy Services South Africa, Cape Town*
2011 - 2013	**Avifaunal Monitoring Services** *Self-employed, Cape Town*
2011 - 2013	**Project Manager and UX Designer (part-time)** *the binary family, Cape Town / Berlin*
2009 - 2011	**Researcher** *Anchor Environmental Consultants, Tokai*
2005 - 2008	**Director & Co-founder** *Fishriver Horse Safaris, Port Alfred*
2002 - 2003	**Assistant Camp Manager** *Mashatu Game Reserve, Tuli Block, Botswana*
1999 - 2002	**Wildlife Research Assistant** *Centre for Wildlife Management, Pretoria / Mashatu Game Reserve, Botswana*

Academic Qualifications

- *Department of Environmental Science, Rhodes University, 2015:* Introduction to Environmental Impact Assessment Procedure **Short Course** *(Highly competent)*
- *Percy FitzPatrick Institute, University of Cape Town, 2006-2009:* Zoology (Ornithology), **Master of Science**

- *Rhodes University, 2005-2006:* Zoology, Bachelor of Science (**Honours**)
- *University of South Africa, 2002 – 2004:* Zoology & Botany, **Bachelor of Science** (*cum laude*)
- *Heinrich-Heine Universität, Düsseldorf, Germany, 1999 – 2002,* Biology, Vordiplom

PROJECT EXPERIENCE

Pre-construction Avifaunal Monitoring and Impact Assessments for Wind Energy Facilities:

- Proposed WEF Mossel Bay, WC
- Proposed WEF Pofadder, NC
- Proposed WEF Aggeneys, NC
- Paulputs WEF Pofadder, NC
- Highlands WEF Somerset East, EC
- Proposed WEF Victoria West, NC
- Proposed WEF Loxton, NC
- Proposed WEF Riebeek East, EC
- Proposed WEF Eastern Cape
- Kap Vley WEF Kleinzee, NC
- Kolkies WEF Touw's River, WC
- Karee WEF Touws River, WC
- Komsberg WEFs, Sutherland WC
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- Proposed WEF Elliot, EC
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- Koingnaas WEF NC
- Richtersveld WE Alexander Bay, NC
- Namakwaland WEF, NC
- Springbok WEF, NC

Post-construction Avifaunal Monitoring for Wind Energy Facilities:

- West Coast 1 WEF, Western Cape
- Hopfield WEF, Western Cape
- Gouda WEF, Western Cape

Avian Species Specialist Impact Assessments / Compliance Statements:

- Welgegund Agricultural Expansion, Robertson
- Jan Rabie Dam Enlargement Robertson
- Auriga Thermal Power Plant Saldanha Bay
- Vortum Gas Cycle Turbine in Saldanha Bay
- SPV Renfields Solar PV Facility Hopefield
- Parsons PV Power Park, Qbergha, EC
- Hive Energy Solar Project, Qberha, EC
- Bokpoort Solar Farm, Groblershoop, NC
- Metsimatala CSP Facility, NC
- Avifaunal Impact Assessment 132 kV Mbumbu-Tsakani Powerline
- Avifaunal Walkthrough, Robben Island PV, Western Cape

<u>Avian Feasibility Studies and Specialist Nest Surveys</u>

- Avifaunal Feasibility Assessment, 2 Confidential WEFs, Western Cape
- Avifaunal Feasibility Assessment, 5 Confidential WEFs, Eastern Cape
- Avifaunal Feasibility Assessment, 6 Confidential WEFs, Northern Cape
- Canal Walk Wetlands Avifauna Study, Cape Town
- Review and mitigation strategy design for birds at the Kinangob Wind Park, Kenya

<u>Environmental Impact Assessment Practitioner:</u>

- Brandwagt Agricultural Expansion Robertson, Basic Assessment Process
- Ouplaas Dam Enlargement, near Greyton, S24G Application
- Boekenhoutskloof Agricultural Expansion near Hermanus, Basic Assessment Process

- Malmesbury Mall & Hospital, WC, Basic Assessment Process
- Namaquasfontein Skool Dam, WC, Section 24G Application
- De Molen Dam, WC, Section 24G Application, De Molen Dam, WC
- Oude Schuur Agricultural Developments, Worcester, Scoping & EIA Process
- Highlands WEFs, Eastern Cape, Scoping & EIA Process
- Phezukomoya WEF, Noupoort, Scoping & EIA Process
- San Kraal WEF, Noupoort, Scoping & EIA Process
- Kolkies WEF, Scoping Process, Western Cape
- Karee WEF, Scoping Process, Western Cape
- Komsberg WEFs, Sutherland, Scoping & EIA Process
- Umsinde Emoyeni WEFs and Grids, Murraysburg, WC, Scoping & EIA Process

Scientific Publications & Conferences

Cowley, PD, Terörde, AI & Whitfield, AK. **2018**. Birds as major predators of fishes in a small estuary: does this influence the nursery area concept for estuary-associated fish species? African Zoology 52: 147-154

Maree, BA, Cowley, PD, Naesje, TF Childs, A-R, Terörde, AI & Thorstad, EB. 2016. Influence of prey abundance and abiotic factors on the long-term home-range and movement dynamics of spotted grunter Pomadasys commersonnii in an intermittently open estuary. African Journal of Marine Science 2016: 1-10

Terörde, AI & Turpie, JK. 2013. Influence of habitat structure and mouth dynamics on avifauna of intermittently-open estuaries: A study of four small South African estuaries. Estuarine, Coastal and Shelf Science 125: 10-19

Terörde, AI & Turpie, JK. 2012. Use of a small, intermittently-open estuary by waterbirds: a case study of the East Kleinemonde Estuary, Eastern Cape, South Africa. African Journal of Aquatic Science 37: 183-190

Terörde, AI, Clark, B. Hutchings, K. Orr, K. 2011. Ballast water management technology testing. South African Marine Science Symposium 2011.

Turpie, JK. Clark, B.M., Bornman, T, Cowley, PD & Terörde, AI. 2009. Integrated Ecological-Economic Modeling as an Estuarine Management Tool: A Case Study of the East Kleinemonde Estuary. Volume II: Model Construction, Evaluation and User Manual. WRC Report No. 1679/2/08

Terörde, AI & Turpie, JK. 2008. Appendix K. Specialist Report: Birds. In: van Niekerk, L., Bate, G.C. & Whitfield, A.K. (eds). East Kleinemonde Estuary Reserve determination study: Technical report. Department of Water Affairs & Forestry, Pretoria.

Whitfield, AK, Adams, JB, Bate, GC, Bezuidenhout, K, Bornman, TG, Cowley, PD, Froneman, PW, Gama, PT, James, NC, Mackenzie, B, Riddin, T, Snow, GC, Strydom, NA, Taljaard, S, Terörde, AI, Theron, AK, Turpie, JK, van Niekerk, L, Vorwerk, PD & Wooldridge, T.H. 2008. A multidisciplinary study of a small, intermittently open South African estuary, with particular emphasis on the influence of mouth state on the ecology of the system. African Journal of Marine Science 30: 453-474

Terörde, AI & Turpie, JK. 2008. Use of a small, intermittently-open estuary by waterbirds: a case study of the East Kleinemonde estuary, Eastern Cape, South Africa. South African Marine Science Symposium 2008. (Awarded best student oral presentation)

Terörde, AI & Turpie, JK. 2007. Birds. In: Whitfield AK, Bate GC (eds). A Review of Information on Temporarily Open/closed Estuaries in the Warm and Cool Temperate Biogeographic Regions of South Africa, with Particular Emphasis on the Influence of River Flow on these Systems. WRC Report No. 1581/1/07.

Appendix C2b:

CV of specialist

ANJA ISABEL ALBERTYN

neé Terörde, in Germany 1977
RSA permanent resident

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- De Molen Dam, WC, Section 24G Application, De Molen Dam, WC
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- San Kraal WEF, Noupoort, Scoping & EIA Process
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Appendix C2c:

Specialist declaration

Appendix C2d:

Avifaunal independent peer review (including specialist declaration)

Holland & Associates Environmental Consultants
PO Box 31108
Tokai
Cape Town
7966

28 May 2021

RE: AVIFAUNAL PEER REVIEW OF THE ADDENDUM AVIFAUNAL IMPACT ASSESSMENT REPORT FOR THE HIGHLANDS SOUTH WIND FARM.

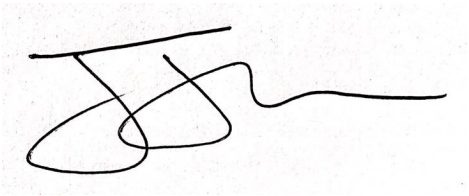
To whom it may concern,

WildSkies Ecological Services (Pty) Ltd was appointed in 2018 by Arcus Consulting to conduct a peer review of the study entitled: "Highlands Wind Farm Pre-construction Bird Monitoring: Impact Assessment Report". Subsequently the avifaunal studies conducted by Arcus were updated to include additional aspects at the request of the Department of Environmental Affairs (DEA). Arcus therefore asked WildSkies to review the updated work, and with specific consideration of the actions highlighted by DEA. This was done in October 2019. In May 2021 WildSkies was again asked to review the addendum reports for the three wind farms, this time by Holland & Associates Environmental Consultants, who had been appointed to undertake an Application for Amendment of the Environmental Authorisation for the project.

WildSkies was sent the report entitled 'Proposed Highlands South Wind Energy Facility near Somerset East, Eastern Cape province: Application for Amendment of the Environmental Authorisation (14/12/16/3/3/1/1960): Addendum to the Avifaunal Specialist Impact Assessment". The report has been reviewed and we conclude (as with our previous reviews) that the study and its findings are reasonable and based on sound data. The proposed amendments, including proposed amendments to the turbine specifications and number of turbines, will not change the original impact assessment findings.

Please don't hesitate to contact us if you have any further questions.

Kind regards



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