CASTLE WIND FARM

PART 2 AMENDMENT

AVIFAUNA COMPARATIVE ASSESSMENT

September 2019

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Submitted to:

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EXECUTIVE SUMMARY

The proposed amendment to the turbine model will not significantly increase the collision risk for birds. This is because the new proposed turbine model (and consequent reduction in number of turbines) will present only 15% more collision risk window, and predominantly at heights above ground where relevant birds were recorded flying least. We have re-assessed the significance of bird collision with turbines as slightly increased (but still Medium significance) on the basis that we have learnt at operational wind farms (including adjacent to Castle) that Verreaux's Eagle (one of the key species at the Castle site) is definitely susceptible to collision with turbines, whereas previously we could only speculate that the species may be susceptible.

The new best practice guidelines for Verreaux's Eagle and Wind Farms requires a 3km no-go buffer around nests. Currently three turbines are situated inside this buffer area around the closest known nest (which was confirmed to be active in September 2019). During micro siting these turbines should be relocated outside of this new buffer area.

1. BACKGROUND

The Castle Wind Farm (Castle Wind Farm (Pty) Ltd) received Environmental Authorisation on 8 May 2015 (EIA Ref No 14/12/16/3/3/2/278). The EIA process was undertaken by Savannah Environmental (Savannah). As part of the EIA an avifaunal impact assessment study was conducted by WildSkies Ecological Services (2014), including 12 months pre-construction bird monitoring. Following this authorisation a further two applications/amendments were conducted by Savannah Environmental as shown in the table below:

Table 1. Summary of amendments preceding the current one.

Nature of application/amendment	DEA response	Approval date
Amendment to the Environmental Authorisation to include the electricity transmission & distribution infrastructure	Amendment authorised	30 June 2015
Amendment to the Environmental Authorisation for changes to turbine specifications	Amendment authorised	4 April 2017

The layout of the proposed Castle Wind Farm is shown in Figure 1.

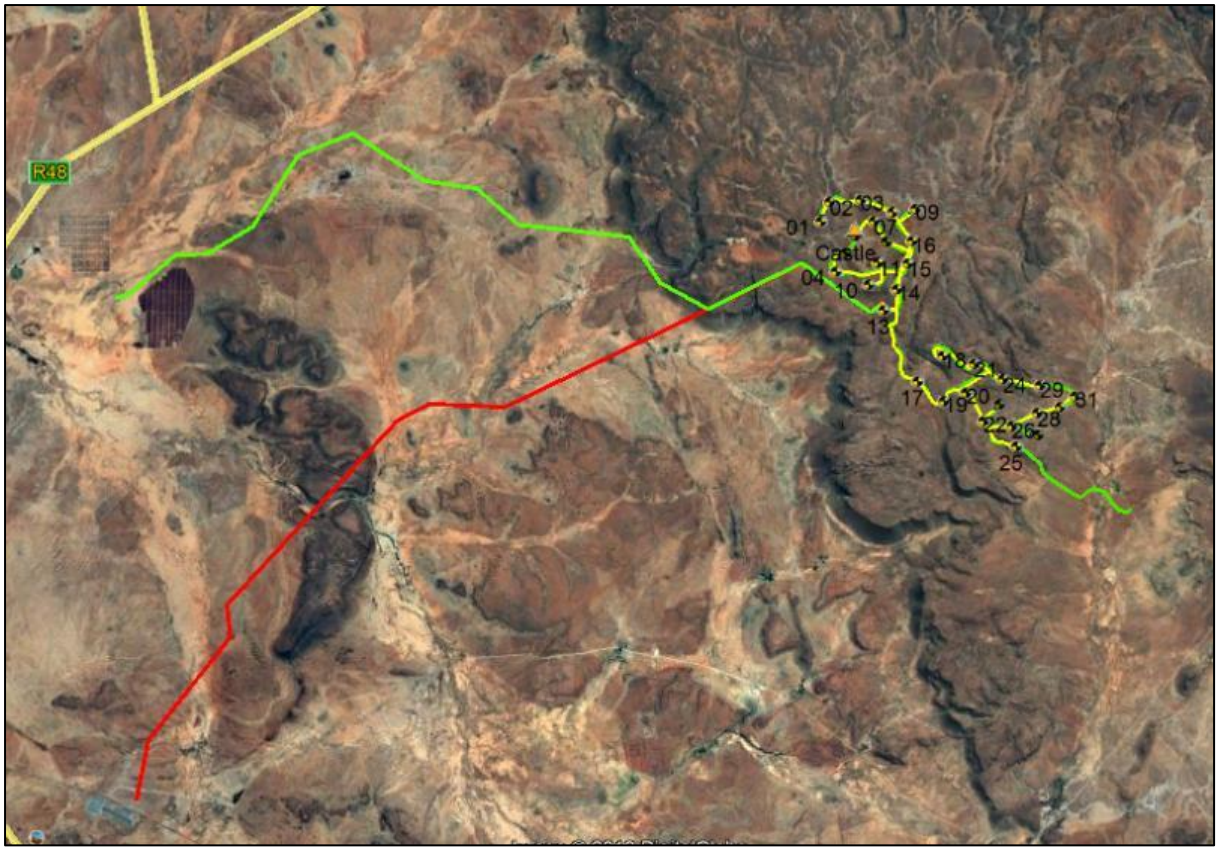

Figure 1. The proposed Castle Wind Farm layout. Note that the powerlines were dealt with under a separate BA process.

The applicant is now proposing the following amendments to the existing authorisation:

- Rotor Diameter increase from up to 150 to **between 110 to 200m**
- Hub height from up to 130 m to **between 90 to 150m**
- Individual turbine capacity from up to **4.5 MW to up to 7.9 MW**
- Overall capacity to remain 118 MW
- No change to the layout

As per the Regulations, Savannah Environmental is required to conduct a substantive amendment, which requires input/comparative specialist assessments (what was assessed in the EIAr and previous Part2 amendment and the current impacts based on the amendments proposed). WildSkies was appointed by Savannah Environmental in May 2019 for this purpose.

The terms of reference for this avifaunal statement are as follows:

- Review original reports & data
- Determine whether the significance of impacts as previously assessed would change under the new proposed amendment. Sensitivity mapping will also be re-examined and amended if necessary
- Describe and explain any such changes
- If any change then recommend necessary mitigation
- Update mitigation measures based on what we have learnt in the industry subsequent to the original study
- Review additional avifaunal best practice guidelines which have been published subsequent to the original studies and advise on the requirements for the above project to comply with these guidelines. These guidelines include:
    - Best Practice Guidelines for birds & wind energy (2015)
    - Best practice Guidelines for Verreaux's Eagle & Wind Energy (2017)

Following the initial desktop work a need was identified for a field visit by the specialist to confirm that no major changes had occurred on site with respect to avifauna. A three day site visit was conducted in early September 2019. During this time the site was examined as thoroughly as possible by vehicle and on foot, and particular attention was paid to the previously known Verreaux's Eagle nest sites near site.

2. ORIGINAL IMPACT ASSESSMENT FINDINGS

The original avifaunal impact assessment study (WildSkies, 2014) made the following findings with respect to impact significance, using the methods and criteria contained in Appendix 1 (developed by Savannah Environmental).

Formal assessment of the significance of impacts on avifauna, according to criteria supplied by Savannah Environmental, resulted in habitat destruction, disturbance of birds, and displacement of birds being rated as MEDIUM significance. Collision of birds with turbines was rated as LOW significance, and collision or electrocution on the grid connection power line was rated as MEDIUM-HIGH significance.

The full tables are shown below:

Table 7. Formal assessment of the significance of destruction of bird habitat.

Nature: ***Destruction of natural bird habitat on and near site – impact on sensitive and threatened species and habitat specialists***		
	Without mitigation	**With mitigation**
Extent	Local – 1	Local – 1
Duration	Permanent – 5	Permanent – 5
Magnitude	4 – Low	4 – Low
Probability	Definite – 5	Definite – 5
Significance	**Medium**	**Medium**
Status (positive or negative)	Negative	
Reversibility	Low	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Not effectively, a certain amount of land surface will be impacted on	
Mitigation: Cannot really be mitigated fully. Avoid construction of infrastructure in sensitive zones identified in Section 6.		
Cumulative impacts: High – the Castle site is almost surrounded by two other authorized wind energy facilities – see Figure 21.		
Residual Impacts: High – difficult to rehabilitate vegetation		

Table 8. Formal assessment of the impact of disturbance of birds.

Nature: Disturbance of birds on site and in surrounding area. Sensitive and threatened species are of most concern and particularly whilst breeding.		
	Without mitigation	**With mitigation**
Extent	Local – 1	Local – 1
Duration	Short – 1	Short – 1
Magnitude	Moderate – 6	Moderate – 6
Probability	Highly probable – 4	Highly probable – 4
Significance	**Medium**	**Medium**
Status (positive or negative)	Negative	
Reversibility	High	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Partially	
Mitigation: Avoid construction of infrastructure in the sensitive areas identified in Section 6.		
Cumulative impacts: High – the Castle site is almost surrounded by two other authorized wind energy facilities – see Figure 21.		
Residual Impacts: None		

Table 9. Formal assessment of displacement of birds from the site.

Nature: Displacement of birds from the site and barrier effects		
	Without mitigation	**With mitigation**
Extent	Regional – 2	Regional – 2
Duration	Long term – 4	Long term – 4
Magnitude	Low – 4	Low – 4
Probability	Probable – 3	Probable – 3
Significance	**Medium**	**Medium**
Status (positive or negative)	Negative	
Reversibility	High	
Irreplaceable loss of resources?	Low	
Can impacts be mitigated?	Partially	
Mitigation: Avoid construction of infrastructure in sensitive areas identified in Section 6		
Cumulative impacts: High – the Castle site is almost surrounded by two other authorized wind energy facilities – see Figure 21.		
Residual Impacts: None		

Table 10. Formal assessment of collision of birds with turbine blades.

Nature: Collision of birds with turbine blades		
	Without mitigation	**With mitigation**
Extent	Local – 1	Local – 1
Duration	Long term – 4	Long term – 4
Magnitude	Low – 4	Low – 4
Probability	Probable – 3	Possible – 2
Significance	**Low - 27**	**Low – 18**
Status (positive or negative)	Negative	
Reversibility	Low – birds are killed	
Irreplaceable loss of resources?	High – birds are killed	

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Can impacts be mitigated?	Partially	
Mitigation: Avoid construction of turbines in sensitive areas identified in Section 6.		
Cumulative impacts: High – the Castle site is almost surrounded by two other authorized wind energy facilities – see Figure 21.		
Residual Impacts: None - if turbines are decommissioned, impact will cease.		

The relevant sensitivity mapping section cross referenced in the table above is also presented below:

6.2 Local on- site level

Avoiding areas of high bird use or sensitivity is the most important means of mitigating the effects of wind turbines (and associated infrastructure) on birds. This section of this study focused on identifying these areas that should be avoided based on the micro habitats present. This is the point at which 'relative sensitivity' becomes relevant. As described below, the site has been classed into medium and low sensitivity areas based on micro habitat factors. All proposed WEF sites are however assigned to similar classes, but it is unlikely that the medium sensitivity zones at two different sites will be comparable in terms of actual sensitivity. Furthermore these sensitivity classes must be used against the background of the entire site being in a medium sensitivity area at the national level.

The surface water sources evident at a desktop level have been mapped and buffered by 300 metres. Ideally infrastructure should not be constructed within these areas. Figures 24 and 25 shows the results of this mapping exercise. There are currently three turbines: T3; T4; and T13 that slightly within these buffer areas. It is recommended that these be slightly re-positioned to obtain more clearance from these dams. In addition, the area around the Verreaux's Eagle nest shown in Figure 26 should be considered high sensitivity. It is recommended that an alternate route be developed for this section of the grid connection power line. This should preferably be to the east of the eagle nest, possibly adjacent to the existing Eskom power line, or further east. The author is aware of additional eagle nests further west of the current power line alignment, so moving the line west is not advisable.

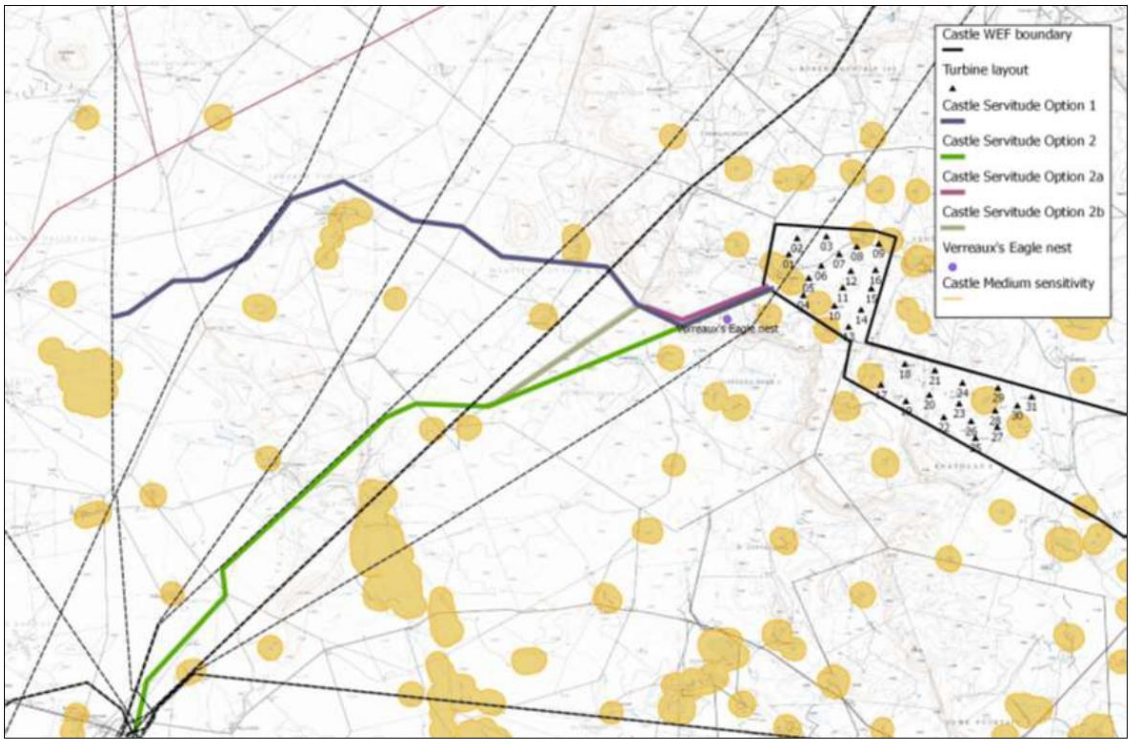


Figure 24. Avifaunal sensitivity analysis for the Castle Wind Energy Facility and associated grid connection corridors.

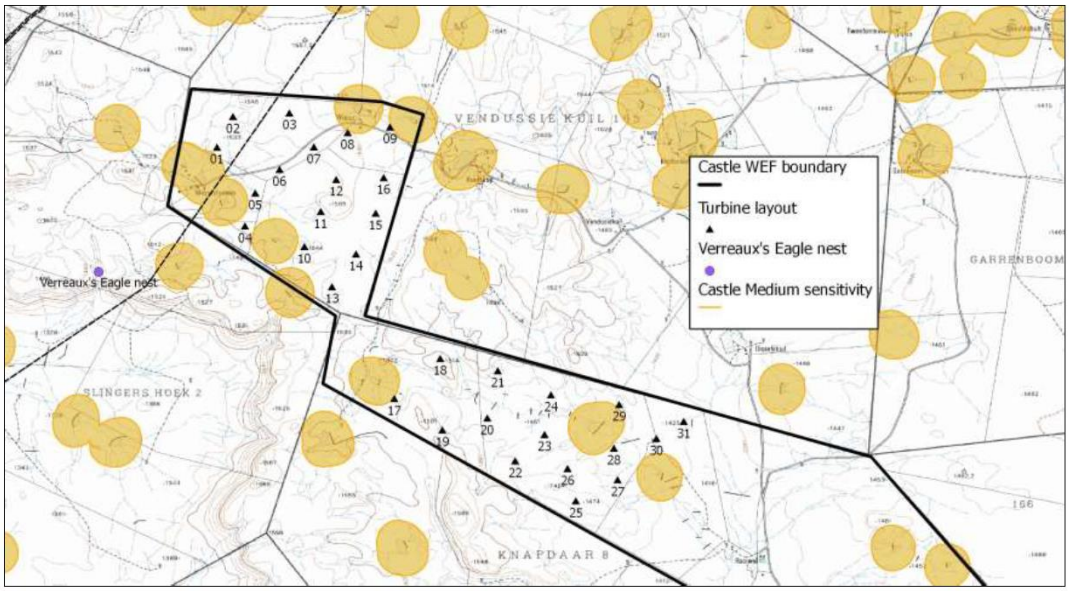


Figure 25. Avifaunal sensitivity analysis for the Castle Wind Energy Facility itself.

3. NEW INFORMATION RELEVANT TO THIS STATEMENT

3.1. Proposed changes to turbine model

The turbine model is to be changed from a hub height of 'up to 130m' and rotor diameter of 'up to 150m' to hub height of '90 – 150m' and rotor diameter of '110 – 200m'. This represents a change from up to 4.5MW to up to 7.9MW.

Two aspects of the change in turbine model are relevant to assessing bird turbine collision risk: the change in height above ground at which the rotor will be; and the change in overall size of rotor. These are discussed in Sections 3.1.1 and 3.1.2 below.

3.1.1 Change in height above ground of rotor

WildSkies (2014) recorded 15 priority bird species flying on site, mostly at very low frequency. A summary of these data is shown in Table 2 below. For the purposes of this analysis, it was assumed the largest turbine model within the range will be applied for. This would result in a rotor swept area from 50m to 250m above ground (c.f. previous of 55 to 205m). Table 2 shows that for most species this would not make a difference to their risk if the species flight height data collected previously (WildSkies, 2014) are examined. The only species for which there could be an increased risk is Booted Eagle, which was recorded flying only twice in 192 hours of observation.

Table 2. Summary of findings.

Species	EIA finding – Smallie, 2014 Passage rate	EIA finding – Smallie, 2014 Flight height	Implications of proposed amendment (rotor zone from 50 – 250m above ground)
Verreaux's Eagle *Aquila verreauxii* (Vulnerable)	7 records in 192 hours or 0.04birds/hr	4 of 7 records above 186m (rotor zone) Mean 189.3m	No change
Northern Black Korhaan *Afrotis afraoides*	35 records or 0.18 birds/hr	100% of records below 54m	No change 100% of records below 55m
Karoo Korhaan *Eupodotis vigorsii* (Near-threatened)	3 records or 0.02birds/hr	10m, 20m, 80m – mean 36.7m	No change
Ludwig's Bustard *Neotis ludwigii* (Endangered)	2 records or 0.01birds/hr	80m & 50m, mean 65m	No change
Pale Chanting Goshawk *Melierax canorus*	12 records or 0.06birds/hr	100% below 54m, mean 10.5m	No change 100% below 55m
Jackal Buzzard *Buteo rufofuscus*	2 records or 0.01birds/hr	40m, 100m	No change
Booted Eagle *Hieraaetus pennatus*	2 records or 0.01 birds/hr	All flights below 54m, mean 26.6m	Slight increase in risk as 1 flight would now fall in rotor zone

Black-chested Snake Eagle *Circaetus pectoralis*	1 record or 0.01birds/hr	30m	No change
Secretarybird *Sagittarius serpentarius* (Vulnerable)	1 record or 0.01birds/hr	3m	No change
Yellow-billed Kite *Milvus migrans*	1 record or 0.01birds/hr	100m	No change
Lanner Falcon *Falco biarmicus* (Vulnerable)	1 record or 0.01birds/hr	20m	No change
South African Shelduck *Tadorna cana*	8 records or 0.04birds/hr	15m, 10m, 40m, 80m Mean of 36.3m	No change
Egyptian Goose *Alopochen aegyptiaca*	8 records or 0.04birds/hr	10m to 80m, mean 36.3m	No change
Black-headed Heron *Ardea melanocephala*	1 record or 0.01birds/hr	15m	No change
Spur-winged Goose *Plectropterus gambensis*	1 record or 0.01birds/hr	30m	No change

Figure 1 below shows the situation visually. Since the lower tip of the proposed new rotor changes only slightly, most of the change in collision risk window comes at the upper blade tip, which is above the height at which most bird flights were recorded.

It can therefore be concluded that the change in height above ground of the rotor zone under the new proposed turbine model will not significantly alter the collision risk.

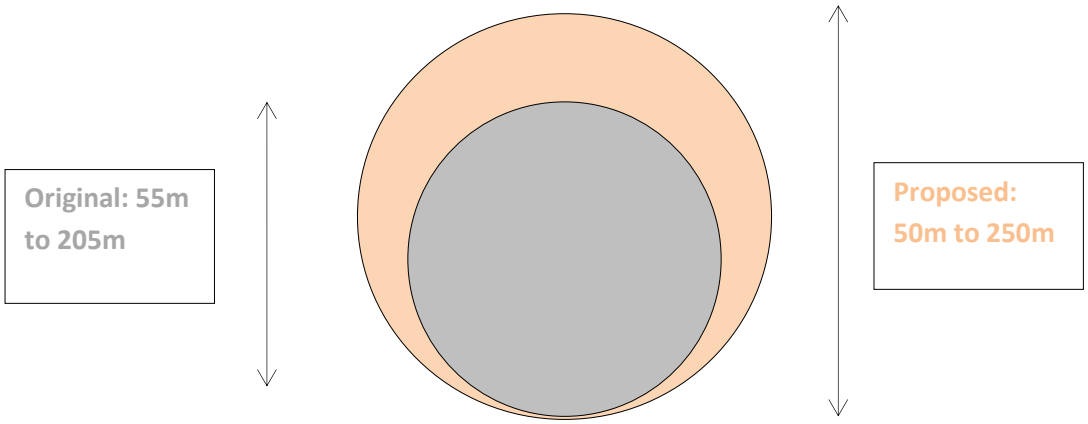


Figure 2. Indicative diagram of the original and proposed rotor swept areas. Not to scale.

3.1.2. Change in overall risk window presented by rotor

The turbine model authorised originally had a 150m rotor diameter and presented a collision risk window of 17 671.46m² per turbine. The proposed change to a 200m (we need to use worst/largest case in this regard) rotor diameter will increase the collision risk window presented by each turbine

to 31 415.93m². This represents an increase in the per-turbine collision risk window of 78%. With this larger turbine model only 20 turbines would be needed to reach the overall facility limit of 118 MW. The overall wind farm collision risk window would therefore increase by 15% (31 x 17 671.46m² = 547 815.26m², c.f. 20 x 31 415.93m² = 628 318.60m²).

Taking the above two factors into account, it can be concluded that the actual realised increase in collision risk to the relevant bird species flying on the site could be low. A 15% increase in the size of the overall facility collision risk window coupled with those factors considered in Section 3.1.1 does not warrant a significant increase in the rating of the collision risk to birds. This is described more in Section 4.

3.2. Changes to proposed facility layout

The layout will not change at all under the amendment.

3.3. Best practice guidelines

As mentioned previously two best practice guidelines have been published subsequent to the original assessment.

3.3.1 Best practice guidelines for birds and wind energy

The updated best practice guidelines (Jenkins *et al*, 2015) state that:

"If there is a significant gap (i.e. more than three years) between the completion of the initial pre-construction monitoring and impact assessment, and the anticipated commencement of construction, it may be advisable to repeat the pre-construction monitoring (or parts thereof) to assess whether there have been any changes in species abundance, movements and/or habitat use in the interim".

Castle Wind Farm has exceeded this three year time frame (pre-construction monitoring having finished in 2014). Based on a site visit undertaken is September 2019 there is however no reason to expect that any particular avifaunal information on site has changed. We therefore recommend that provided that our recommendations in this report are adhered to, there is no need for further monitoring.

3.3.2 Verreaux's Eagle best practice guidelines (Birdlife South Africa, 2017)

Subsequent to the original studies at Castle Wind Farm BirdLife South Africa has published species specific best practice guidelines for the Verreaux's Eagle (BirdLife South Africa, 2017). These guidelines state:

"Where a wind farm is proposed within potentially important Verreaux's Eagle habitat, BirdLife South Africa recommends the following:

1. *Wind turbines should be placed outside of the core territory of eagles to reduce the risk of collisions*.

   We have plotted the three known nests of Verreaux's Eagle relative to the Castle Wind Farm in Figure 3. The closest of these nests is relevant since it is approximately 2.2km from the nearest turbine. Our original study found that this was sufficient distance from the nest. Our recent site visit (September 2019) found that this nest is active and the territory is occupied by a pair of adult eagles. We now need to adhere to the new best practice guidelines and implement a 3km no-go buffer. This means that Turbines 1, 4 and 5 should be relocated outside of the new buffer area during micro siting.

2. *Areas associated with increased flight activity and/or risky behaviour should also be avoided.*

   See Point 1 above.

3. *Dedicated surveys must be conducted to identify potential nest sites.*

   See Point 1 above.

4. *A buffer of 3km is recommended around all nests (including alternate nests). This 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, but nest buffers should never be less than 1.5km.*

   See Point 1 above.

5. *Vantage point surveys should be conducted for a minimum of 72 hours per vantage point per year.*

   See Point 1 above.

6. *Field work must include surveys during the breeding season.*

   See Point 1 above.

7. *Surveys (including vantage point monitoring) should extend beyond the developable area.*

See Point 1.

8. *The relative extent and type of use of the site by eagles must be assessed.*

   This has been achieved based on eagle flight data collected on site during pre-construction monitoring.

9. *Steps should be taken to avoid increasing the prey population (and thereby attracting eagles to the wind farm). For example excavated rocks and animal carcasses should be removed.*

   We have strengthened the recommended mitigation measures in this regard.

10. *If it is suspected that a proposed wind farm may pose a significant risk to Verreaux's Eagles, the duration of pre-construction monitoring should be extended to two years, particularly where alternate nests are some distance apart and/or turbines are proposed in areas that may be associated with increased flight activity and/or risky behaviour.*

    See Point 1 above.

11. *No construction activities (e.g. new roads) should be allowed within 1km of nests during the breeding season.*

    This has been achieved for the wind farm through the buffer already imposed, and the mitigation recommendations made previously.

12. *Nests should be monitored for breeding activity throughout the lifespan of the wind farm (including during construction), but care must be taken to ensure that monitoring activities do not disturb breeding birds.*

    We have recommended this (refer to the mitigation measures in Section 5 of this report).

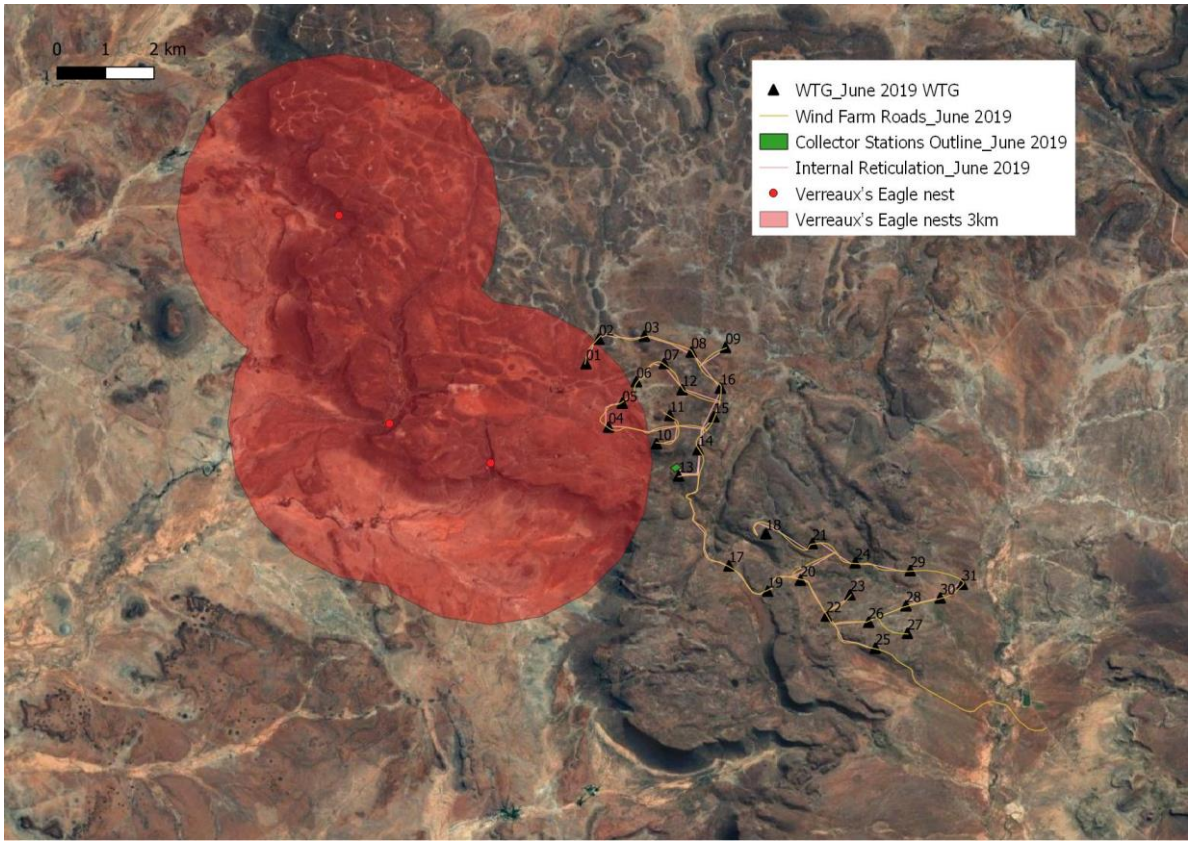


Figure 3. The position of known Verreaux's Eagle nests & 3km buffers relative to the proposed site & layout.

3.4 Results of site inspection

We drove and walked as much of the site as possible during the period 9 to 11 September 2019. We also visited the two closest eagle nests to the Castle site (Slingershoek Waterval at 24.26551, -30.59601; & Slingershoek at 24.24571, -30.58687). Appendix 4 shows our GPS tracks and photographs taken. At the Slingershoek Waterval nest we found the nest to be active and probably used for breeding this past season (Figure 4), but could find no sign of a chick or juvenile. The pair of adult eagles was seen in the territory on two consecutive days, sometimes perched on the nearby Eskom pylons (Figure 4). At the Slingershoek nest (Figure 5) we found no sign of use or breeding activity in recent years and conclude that the nest has been abandoned, or was possibly an alternate nest for the Slingershoek Waterval pair of eagles (it is only 2.4km between these two nests). In addition to the main nest, a second possible alternate eagle nest approximately 50m away was found, as was a presumed Hamerkop nest approximately 200m away.

The nest at Pienaarskloof (at 24.23537, -30.54760) has been abandoned (Van Rooyen, 2019). We also surveyed all potential nesting substrate within these areas. Appendix 3 shows the full species list from the site visit. In total 26 species were recorded, although our priority was not to record all species, rather to examine land use, vegetation and eagle nests.

Figure 6 shows the location of these nest sites.

Figure 4. The Slingershoek Waterval nest (two adjacent alternate nests) and pair of adults.

Figure 5. The Slingershoek nest.

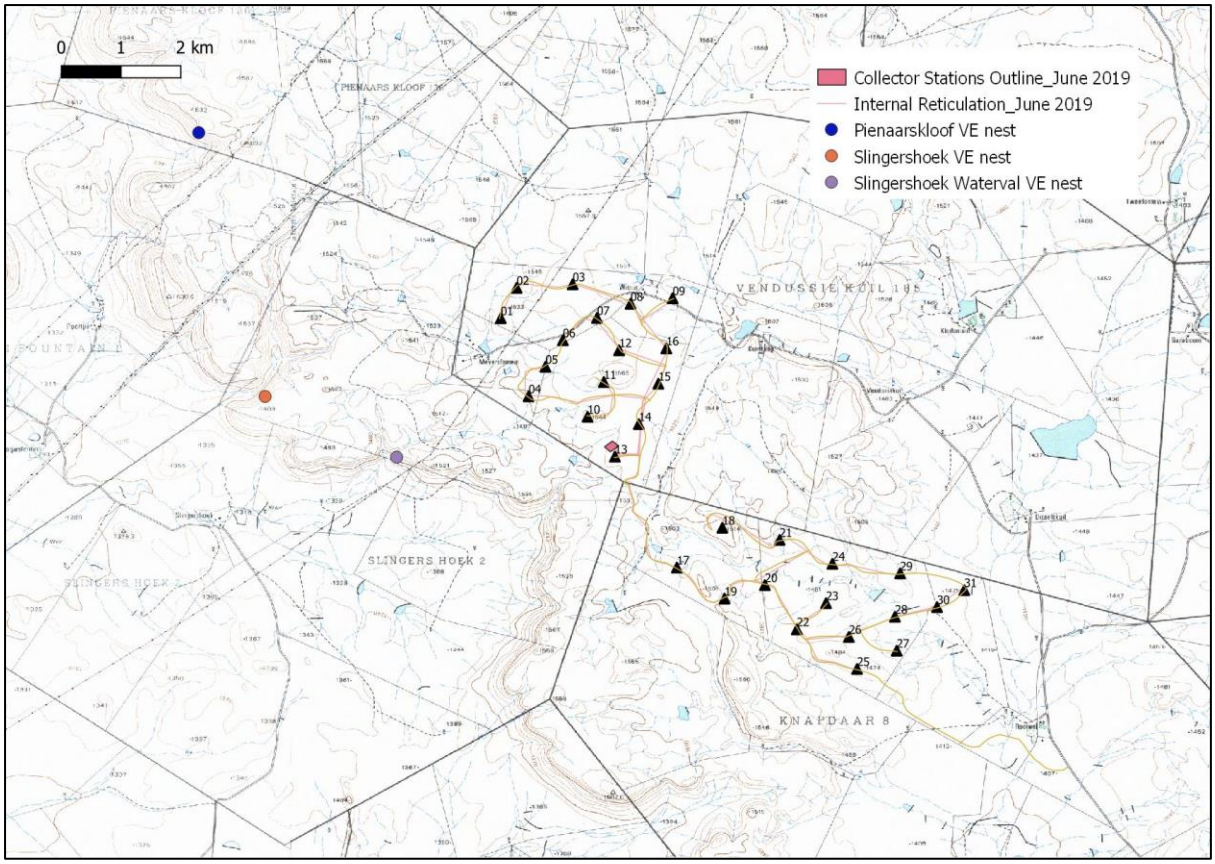


Figure 6. The location of eagle nests close to the Castle Wind Farm.

3.5 Lessons learnt at the adjacent operational wind farms

We have examined the Year 1 final report on operational phase monitoring at the Longyuan Mulilo De Aar 2 North Wind Facility (report supplied by Birdlife South Africa)[1]. This facility is approximately 1.2km north-west (closest turbine) of the closest Castle Wind Farm turbine. Although close to Castle, there are significantly more turbines, and inter-turbine power lines are above ground.

The results from the Longyuan Mulilo De Aar 2 North WEF indicate that the raptor species that are present on Castle Wind Farm are definitely going to be susceptible to turbine collision; and (as previously recommended) there should definitely be no internal overhead power line (power lines linking wind turbines to onsite substation) built as this could have a greater impact on avifauna than the wind farm itself.

[1] It should be noted that the results from the Longyuan Mulilo De Aar 2 North Wind Facility cannot be published in this report as this is proprietary information and belongs to developer.

4 COMPARATIVE ASSESSMENT

Based on the information available to us now, our current assessment of the significance of impacts on avifauna is as follows. In each table the ratings which differ from the original are in shown in red text:

Construction phase

Table 3. Impact assessment for Habitat destruction during construction.

Nature: **Destruction of bird habitat**		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**50 (Medium)**	**50 (Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not effectively , a certain amount is inevitable	
Mitigation: See detail in Section 5.		
Cumulative impacts: High, the Castle Wind Farm is almost surrounded by other wind farms, one of which is operational.		
Residual Risks: Post mitigation the impact of habitat destruction will remain at Medium significance. This is because the removal of natural vegetation on the construction footprint is inevitable and cannot be reduced to zero despite best management during construction.		

This impact has remained unchanged.

Table 4. Impact assessment for Disturbance of birds during construction.

Nature: **Disturbance of birds during construction activities**		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short (1)	Short (1)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**40 (Medium)**	**32 (Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	High	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Partially	
Mitigation:		

See detail in Section 5.
Cumulative impacts: High, the Castle Wind Farm is almost surrounded by other wind farms, one of which is operational.
Residual Risks: Post mitigation the impact of disturbance remains at Medium significance post mitigation since disturbance levels cannot be reduced to zero given the earth moving, machinery, vehicle and human activity on site during construction.

This impact has increased slightly in significance as compared to the original assessment. This is a result of the 3km no-go buffer around the Verreaux's Eagle nest as required by the Best Practice Guidelines.

Operational phase

Table 5. Impact assessment for displacement during operations.

Nature: **Displacement of birds during operational phase**		
	Without mitigation	**With mitigation**
Extent	Regional (2)	Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Partially	
Mitigation: See detail in Section 5.		
Cumulative impacts: High, the Castle Wind Farm is almost surrounded by other wind farms, one of which is operational.		
Residual Risks: The impact of displacement remains at Medium significance post mitigation, since once facility is operational it will not be possible to mitigate this materially if it becomes evident.		

This impact has remained unchanged.

Table 6. Impact assessment for mortality during operational phase.

Nature: **Mortality of birds through collision with turbine blades**		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**36 (Medium)**	**27 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes

Can impacts be mitigated?	Partially	
Mitigation: See detail in Section 5.		
Cumulative impacts: High, the Castle Wind Farm is almost surrounded by other wind farms, one of which is operational.		
Residual Risks: It is likely that this impact will be Medium significance post mitigation, since it is extremely challenging to mitigate the risk of bird collision to zero. Bird flight is not an exact science and birds can fly unpredictably at any point during the operations phase.		

This impact has increased slightly in significance under the current assessment. The primary reasons for this is that a key species which was previously 'suspected' to potentially be susceptible to turbine collision (Verreaux's Eagle) has subsequently proven to actually be susceptible to turbine collision (Ralston-Paton *et al*, 2017), indicating that they require more protection than thought previously. We are able to mitigate the collision risk to some extent by applying no-go buffer areas around known nest sites.

To summarise, the differences between the original and current impact significance are as follows:

Table 7. Summary of original and current impact significance ratings.

Impact	Original (WildSkies, 2014) Pre mitigation/Post mitigation	Current (WildSkies 2019) Pre mitigation/Post mitigation	Nature of change
Construction phase			
Habitat destruction	50 Medium/50 Medium	50 Medium/50 Medium	No change
Disturbance	32 Medium/32 Medium	40 Medium/32 Medium	Change upwards
Operational phase			
Displacement	30 Medium/30 Medium	30 Medium/30 Medium	No change
Mortality through collision with turbines	27 Low/18 Low	36 Medium/27 Low	Change upwards

Cumulative Impacts:

According to the DEA's Renewable Energy EIA Application Database for SA (First quarter 2019), there are currently two authorised wind farms within 20 km of the Castle WEF, namely:

- Longyuan Mulilo Green Energy De Aar 2 North Wind Energy Facility (operational)
- Proposed Mulilo De Aar 2 South Wind Energy Facility

Additionally, there are several operational solar energy facilities authorised in the greater area:

- The Ilanga Lethemba Pv Solar Energy Facility In De Aar, Northern Cape Province
- The Mainstream Photovoltaic (Pv) Plant On Portion 29 Of The Farm Paarde 145, De Aar.

Although solar power installations do not typically contribute directly to bird mortalities, they do result in habitat destruction. This amendment assessment assumes all neighbouring facilities will implement appropriate mitigation measures informed by their preconstruction EIA studies, and that the mitigation measures proposed in this report are adhered to. Thus, there are no additional mitigations required for the proposed amendment with regards to the cumulative impact assessment and there is no change to assessment of the final EIA report.

The cumulative impacts of wind farms or renewable energy on avifauna in the vicinity of the Castle project are considered to be at an acceptable level.

5 MITIGATION MEASURES

The original mitigation recommendations made by WildSkies (2014) are largely still applicable and relevant. Those still relevant have been detailed below along with our updated mitigated measures (underlined).

- No infrastructure should be built in the MEDIUM sensitivity areas identified by this study. Where necessary this can be discussed further with the specialist and agreement reached.
  A 3km no-go buffer has been identified around each of the known Verreaux's Eagle nests. No turbines may be constructed within these areas. There are currently three turbines inside this buffer area and these are to be relocated during micro-siting.
- All power lines linking the turbines and linking turbine strings to the on-site substation should be placed underground.
- A final avifaunal walk through should be conducted prior to construction to ensure that all the above aspects have been adequately managed and to ground truth the final layout of all infrastructure. This will most likely be done as part of the site specific Environmental Management Plan. This will also allow the development of specific management actions for the Environmental Control Officer during construction, and training for relevant on site personnel if necessary.
- The 'during' and post-construction bird monitoring programme outlined by this report should be implemented by a suitably qualified and accredited avifaunal specialist. Post construction monitoring of live bird abundance and movement should be conducted for at least 1 year and carcass searches for at least 2 -3 years and repeated every 5 years thereafter. Carcass searches should be conducted on a full time basis with each turbine searched at least once per two weeks as per Best Practice Guidelines. This monitoring should be done in accordance with the latest version of the best practice guidelines available at the time (Jenkins et al, 2012, & updated 2015). This monitoring should include the grid connection power line.
- The findings of post-construction monitoring should be used to measure the effects of this facility on birds.
- Any significant impacts detected by post-construction monitoring must be mitigated where judged necessary by the avifaunal specialist. The onus is on the wind farm operator to have planned ahead for such an eventuality, particularly in respect of financial budgeting.
- The local population of Verreaux's Eagle must be monitored for the full lifespan of the wind farm to ensure that any impacts are measured. This will require 2-3 visits to each of the 3 known nests (and any new ones subsequently found) during breeding season each year by a suitably qualified independent ornithologist.
- At other operational wind farms it has been suspected that ground burrowing small mammals such as Ground Squirrel found more favourable burrowing conditions along new road and hard stand verges on site after construction, which resulted in an inflated prey base for eagles

close to turbines, and consequent higher turbine collision risk. It is essential that the Castle Wind Farm does not create favourable conditions for such mammals in high risk areas. Discussions with civil engineers previously have determined that it is not possible to adequately compact road verges, drains and hard stand edges during construction to eliminate such burrowing. We therefore recommend then that within the first year of operations a full assessment of this aspect be made by the ornithologist contracted for post construction monitoring. If such burrowing is found, case specific solutions to exclude these mammals from areas close to turbines will need to be developed.

It is important that an Operational Phase Mitigation Plan be in place proactively for the site. We have consolidated this into Table 10 below:

Table 8. Operational Phase Mitigation Plan.

Aspect	**Trigger**	**Threshold for action**	**Corrective Action**	**Time frame**	**Measurement**
Turbine bird collision fatality	Operational phase bird monitoring records fatalities	Regionally Red Listed species – 1 fatality Other species of concern – 2 recorded fatalities	Develop & implement mitigation plan [this could be curtailment, shutdown on demand, habitat management, deterrence & any others available at the time]	3 Months from fatality record	Ongoing operational phase bird monitoring measures fatalities
Alteration of habitat	Audit at start of operational phase reveals problems	Any identified areas with potential to increase raptor prey populations	To be corrected through compaction or other deterrence	3 months from audit findings	Follow up audit to sign off satisfactory solution implemented – ongoing monitoring
Disturbance/displacement of breeding Verreaux's Eagles	Ongoing monitoring of breeding status at nests reveals impacts	Evidence of abandonment of breeding or compromised productivity as a result of the WEF – as advised by avifaunal specialist	Develop & implement offset/compensation plan	3 months from report	Evidence of Nett impact on species reduced-measured by ongoing monitoring

6 CONCLUSION & RECOMMENDATIONS

Our findings are as follows:

- The proposed amendment to the turbine model will not significantly increase the collision risk window area of the wind farm as compared to the original turbine model. This is because the new proposed turbine model (and consequent fewer turbines) will present only a 15% increase in the overall facility collision risk window, and based on actual bird species flight data the changed height of the rotor zone will not change the collision risk.
- New information which has become available subsequent to the original assessment has made a difference to the rating of the impact of mortality of birds through collision with turbines. This impact has increased in significance under the current assessment. A key species which was previously 'suspected' to potentially be susceptible to turbine collision (Verreaux's Eagle) has subsequently proven to actually be susceptible to turbine collision.
- The new best practice guidelines for Verreaux's Eagle and Wind Farms require a 3km no-go buffer around nests. Currently three turbines are situated inside this area. These should be relocated during micro-siting.

The mitigation and operational phase mitigation plan in Section 5 must be implemented by the wind farm operator.

7 REFERENCES

BirdLife South Africa. 2017. Verreaux's Eagle & Wind Farms: Guidelines for impact assessment, monitoring and mitigation.

Jenkins, A.R., Van Rooyen, C.S., Smallie, J., Harrison, J.A., Diamond, M., Smit-Robbinson, H.A. & Ralston, S. 2015. "Best practice guidelines for assessing and monitoring the impact of wind energy facilities on birds in southern Africa" Unpublished guidelines

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

WildSkies, 2014. Castle Wind Energy Facility: Avifaunal Impact Assessment. Unpublished report submitted to Savannah Environmental.

Chris Van Rooyen Consulting, 2019. Avifaunal operational monitoring at the Longyuan Mulilo De Aar 2 North Wind Farm: Year 1. Unpublished report reviewed by WildSkies.

APPENDIX 1. IMPACT ASSESSMENT METHODOLOGY

Impact Assessment methodology:

Direct, indirect and cumulative impacts of the issues identified through the EIA process, as well as all other issues identified due to the amendment must be assessed in terms of the following criteria:

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

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

S = (E+D+M)P

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

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

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

Assessment of impacts must be summarised in the following table format. The rating values as per the above criteria must also be included. The table must be completed and associated ratings for **each** impact identified during the assessment should also be included.

Example of Impact table summarising the significance of impacts (with and without mitigation) when additional impact are identified:

Nature: **[Outline and describe fully the impact anticipated as per the assessment undertaken]**		
	Without mitigation	**With mitigation**
Extent	High (3)	Low (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: "Mitigation", means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible. Provide a description of how these mitigation measures will be undertaken keeping the above definition in mind.		
Cumulative impacts: "Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities[2].		
Residual Risks:		

[2] Unless otherwise stated, all definitions are from the 2014 EIA Regulations (as amended on 07 April 2017), GNR 326.

"Residual Risk", means the risk that will remain after all the recommended measures have been undertaken to mitigate the impact associated with the activity (Green Leaves III, 2014).

Example of Impact table summarising the significance of impacts (with and without mitigation) when the impact has increased or decreased:

Nature of impact: **[Outline and describe fully the impact anticipated as per the assessment undertaken]**				
	Authorised		**Proposed amendment**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Low (1)	Low (1)	Low (1)	Low (1)
Duration	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)	Minor (2)	Minor (2)
Probability	Very improbable (1)	Very improbable (1)	Very improbable (1)	Very improbable (1)
Significance	**8 (Low)**	**8 (Low)**	**8 (Low)**	**8 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Very low	Very low	Very low	Very low
Irreplaceable loss of resources?	Yes	No	Yes	No
Can impacts be mitigated?	Yes		Yes	
Mitigation: "Mitigation", means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible. Provide a description of how these mitigation measures will be undertaken keeping the above definition in mind. **[PLEASE UNDERLINE ALL NEW MITIGATION MEASURES WHICH WERE NOT INCLUDED IN THE EIA].**				
Cumulative impacts: "Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities3.				
Residual Risks: "Residual Risk", means the risk that will remain after all the recommended measures have been undertaken to mitigate the impact associated with the activity (Green Leaves III, 2014).				

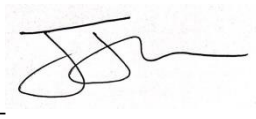
[3] Unless otherwise stated, all definitions are from the 2014 EIA Regulations (as amended on 07 April 2017), GNR 326.

APPENDIX 3. SPECIALIST DECLARATION

SPECIALIST DECLARATION

I, …JONATHAN JAMES SMALLE (WILDSKIES ECOLOGICAL SERVICES)…....., as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study 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: ___  _____

Name of Specialist: ___JON SMALLIE (WILDSKIES ECOLOGICAL SERVICES_____

Date: ____16 SEPTEMBER 2019_____

APPENDIX 3. BIRD SPECIES RECORDED DURING SITE VISIT

Non priority species were recorded only the first time they were seen. Priority species were recorded each time, and some records below may be of the same birds.

Species primary name	Date	Time	Latitude	Longitude
Lark-like Bunting	2019/09/09	12:11:34	-30.6011	24.29972
Spike-heeled Lark	2019/09/09	11:23:55	-30.6293	24.35402
African Harrier-Hawk	2019/09/09	14:05:30	-30.5937	24.26278
Rock Martin	2019/09/09	14:00:27	-30.5936	24.26261
African Red-eyed Bulbul	2019/09/09	13:34:34	-30.5915	24.26239
Karoo Scrub Robin	2019/09/09	11:27:39	-30.6227	24.34984
Blacksmith Lapwing	2019/09/09	16:21:24	-30.5804	24.27949
Pale Chanting Goshawk	2019/09/09	11:51:04	-30.6098	24.31058
Egyptian Goose	2019/09/09	11:21:30	-30.6331	24.35619
Verreaux's Eagle	2019/09/10	11:20:44	-30.595	24.271
Hadeda Ibis	2019/09/09	11:15:23	-30.6359	24.36086
Village Weaver	2019/09/09	11:19:12	-30.6338	24.35749
White-necked Raven	2019/09/09	13:35:52	-30.592	24.262
Cape Bunting	2019/09/09	13:13:05	-30.5874	24.26135
Karoo Prinia	2019/09/09	11:26:37	-30.6227	24.34988
Little Grebe	2019/09/09	16:21:29	-30.5804	24.27949
Pied Crow	2019/09/09	11:10:49	-30.6347	24.3633
Karoo Long-billed Lark	2019/09/09	12:06:04	-30.6055	24.30342
Red-winged Starling	2019/09/09	14:00:22	-30.5936	24.26261
Namaqua Dove	2019/09/09	11:32:23	-30.619	24.34547
South African Shelduck	2019/09/09	16:21:19	-30.5804	24.27949
Speckled Pigeon	2019/09/09	11:15:19	-30.6359	24.36086
Bokmakierie	2019/09/09	11:40:26	-30.6148	24.33215
Verreaux's Eagle	2019/09/09	13:36:34	-30.592	24.262
Ant-eating Chat	2019/09/09	11:27:13	-30.6228	24.34994
Pied Avocet	2019/09/09	16:21:58	-30.5804	24.27933

APPENDIX 4. FIELD WORK GPS TRACKS & PHOTOGRAPHS