Castle Wind Farm

Juwi Renewable Energies (Pty) Ltd

Final layout avifaunal walk through

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Prepared by:
WildSkies Ecological Services (Pty) Ltd
Jon Smallie
jon@wildskies.co.za

Submitted to:
Savannah Environmental
Tebogo Mapinga
tebogo@savannahsa.com

1. Introduction

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 three 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
Amendment to the Environmental Authorisation for changes to turbine specifications	Amendment authorised	26 February 2020

The latest authorised turbine model is for a rotor diameter between 110 – 200 m and a hub height of 90-150m.

The final facility layout is presented in Figure 1.

There is now a need to conduct a final avifaunal walk through for the facility, to provide input into the site specific EMPr. WildSkies was appointed by Savannah for this purpose.

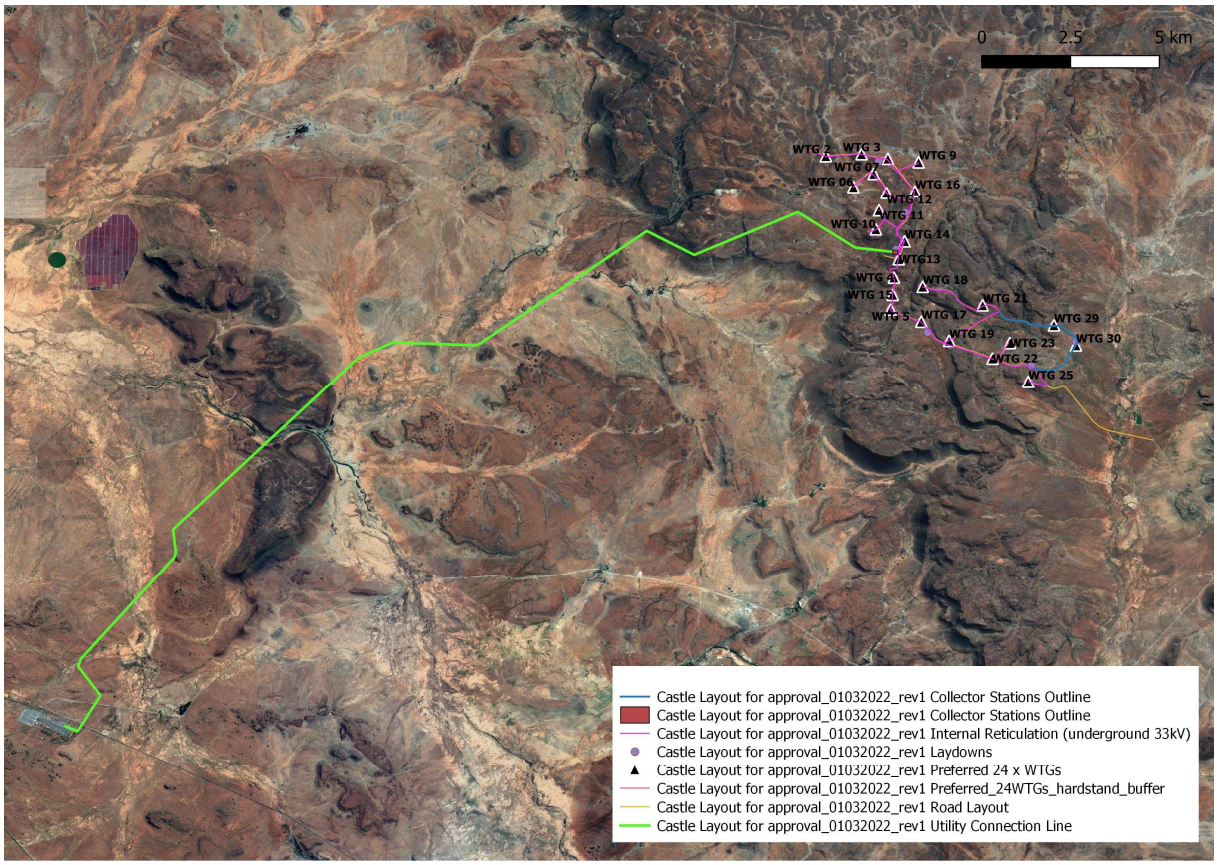


Figure 1. The layout of the Castle Wind Farm.

2. Methodology

The terms of reference that are typical for a study of this nature are:

- The Specialist will review all relevant avifaunal reports to date.
- Conduct desk top based preparation, using available Geographic Information Sources (GIS) data and tools such as Google Earth. This will identify particularly sensitive sections of the proposed facility, which are absolutely essential to see during field work.
- Conduct a site assessment of the study area (i.e. 'ground-truthing'). This will include visiting every turbine position (a 200m radius around each turbine location was assessed), or at least being within site of the location so that the risk of avifaunal interactions can be assessed. The other facility components were also visited where relevant to avifauna (roads & MV cables 150m either side of centre line was assessed; substation – 300m buffer around site was assessed). This was done by driving and walking as much of the proposed site as possible. Due to the very open nature of the vegetation on site, visibility across the landscape was good. Appendix 1 shows the GPS track log from field work. This demonstrates a thorough coverage of the relevant site.

- Compile a report detailing any site specific mitigation measures to address potential impacts of the facility, both during construction and operational phase – with respect to avifauna.

Note: A significant amount of generic information and recommendations can be presented and made in an EMPr regarding general environmental practice (for example construction camps must be tightly managed etc.). This study has not included that information as WildSkies believe that none of these management actions are specific to birds, and are therefore the responsibility of the EAP and perhaps the botanical specialist. This report presents the information that is specific to birds.

3. Findings

Appendix 1 shows the GPS track log of where field work was conducted. Thorough coverage of the site was achieved. Appendix 2 shows photographs of the relevant components of this facility.

3.1. Habitat destruction

Any destruction or alteration of natural habitat will have some negative effect on the various bird species present. However, some species will tolerate this and there will be little impact, so for these species this is not considered to be significant. Red Listed bird species, particularly habitat specialists are typically of most concern with this impact.

The current grid connection power line alignment and WEF layout is acceptable in terms of habitat destruction. No particularly sensitive habitats will be impacted.

As a general principle the following management mitigation is recommended to ensure that the impact on habitat is kept to a minimum:

- All removal and alteration of natural vegetation should be kept to an absolute minimum.
- All disturbed soil areas (including road and hard stand verges) should be compacted sufficiently and rehabilitated correctly with vegetation to avoid increased burrowing of rodents (which in turn could attract raptors and result in turbine collisions).
- These areas should also be effectively rehabilitated with indigenous grass/plant species as soon as possible after construction.
- Underground cabling should follow roads at all times, and not deviate from the road verge (as this would result in additional linear impacts on the habitat).
- All spoil material (soil, rock, tree material) should be removed from site, not piled on site as this results in additional areas of habitat destruction, and also habitat creation for raptors prey.

3.2. Disturbance of birds

All birds on site will be disturbed to some extent during construction. Red Listed breeding species are of particular concern with respect to this impact. No new breeding sites of sensitive bird species were detected during the walk through, which require management or mitigation [several crow nests were recorded on pylons but are not sensitive].

The Verreaux's Eagle pair nesting closest to the WEF site may now be using a nest on the existing power line as an alternate nest. According to another specialist working in the area (Van Rooyen, pers comm) the pair bred successfully on the power line in 2020. The alternate nest location on the power line is approximately 500m further east and closer to the WEF layout. In our view the exsiting no-go buffer should still apply. This alternate nest location is shown in Figure 2.

One large eagle nest was found on the existing Eskom Beta Hydra 400kV power line (at 24.133632/-30.671710). However this is far enough from the proposed power line alignment to be unaffected (approximately 1.7km between nest and alignment), particularly given that these birds are already breeding in an area with multiple existing power lines.

The current power line alignment is far enough from the known Verreaux's Eagle nest close to the WEF to avoid disturbance during construction and operations (see Figure 2).

The current WEF layout is far enough from the known Verreaux's Eagle nests to avoid disturbance during construction and operations (Figure 2).

The current grid connection power line alignment and WEF layout is acceptable.

- However no access by staff, vehicles or machinery closer to any of the nests should be allowed for any reason as this could disturb the eagles.

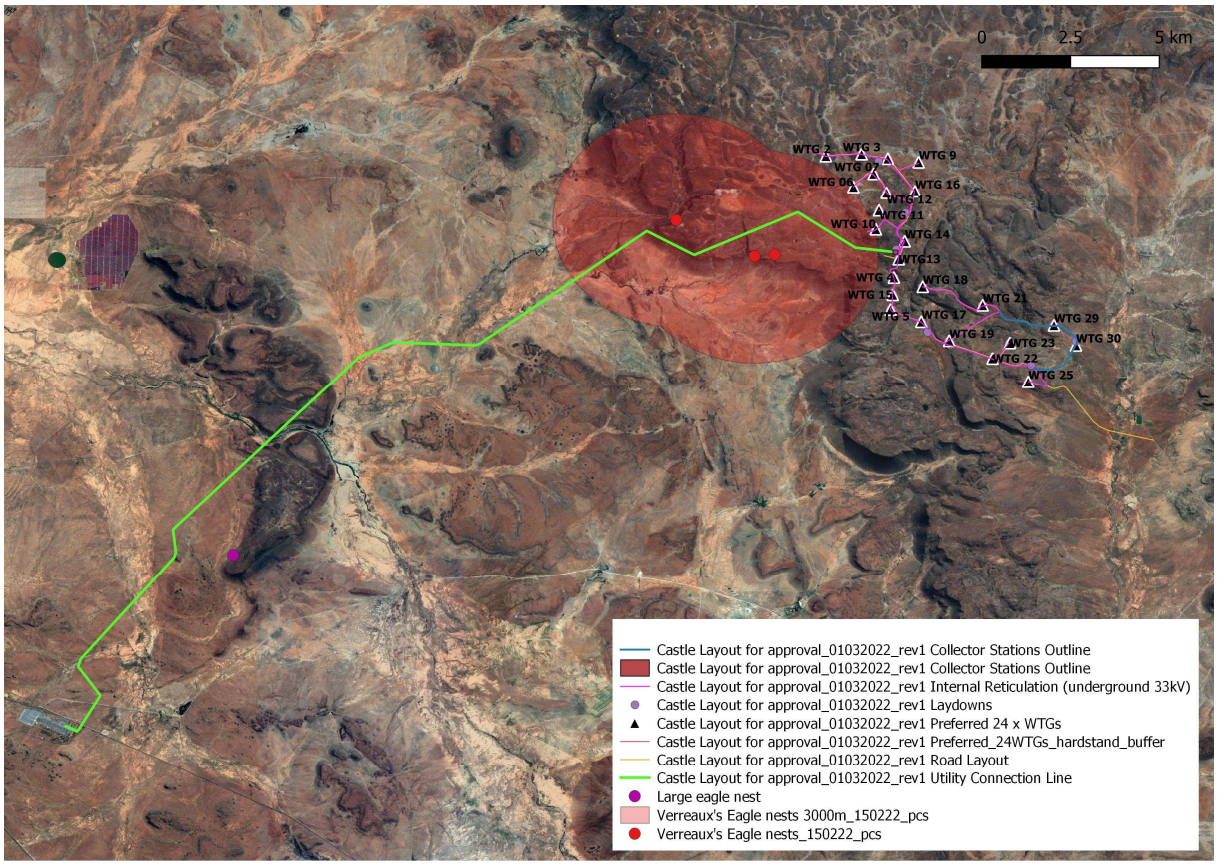


Figure 2. Layout of sensitive bird breeding sites relative to project.

3.3. Electrocution of birds on overhead power lines

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). Electrocution of birds on the proposed overhead power line is a significant risk, due to the presence of large eagles in the area.

The current grid connection power line alignment is acceptable in terms of bird electrocution.

- The final pylon type will only be finalized closer to construction, based on detailed design and Geo-technical investigations. The pylon designs will comply with the latest Eskom-EWT "bird-friendly" guidelines/designs. The pylon designs will be also be finalized in consultation with an avifaunal specialist and/or the EWT Wildlife and Energy Working Groups.

3.4. Collision of birds with overhead power lines

Collision with power lines is one of the biggest single threats facing birds in southern Africa (Shaw 2010a and b; Jenkins *et al*, 2010; van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species occur on the proposed site and will be at risk of collision with the proposed power line.

The current grid connection power line alignment is acceptable in terms of bird collisions.

- In order to mitigate this risk, the full length of the proposed power line must be fitted with an Eskom approved line marking device.
- It is important that these marking devices are installed as soon as the conductors are strung, not only once the line is commissioned, as the conductors and earth wires pose a collision risk as soon as they are strung. The devices should be installed alternating a light and a dark colour to provide contrast against dark and light backgrounds respectively. This will make the overhead cables more visible to birds flying in the area. Note that 100% of the length of each span needs to be marked (i.e. right up to each tower/pylon) and not the middle 60% as some guidelines recommend. This is based on a finding by Shaw (2013) that collisions still occur close to the towers or pylons.

3.5. Collision of birds with turbines

None of the current turbines are in our view in particularly high risk positions. Based on our current understanding of bird-turbine collision risk there is no need for micro siting at this stage. The proposed final layout has already taken into account the identified avifaunal constraints and these are all avoided.

The current WEF layout is acceptable, with the exception of alternate turbine position (Alternate 10) which is currently within the 3km no-go buffer around eagle nests. This position may not be used. This has been removed in the final layout for approval (Figure 1).

When the Castle Wind Farm was originally assessed (2014/2015), no species specific guidance on Verreaux's Eagle nest buffer sizes existed. Our recommendation was that the 2.2km separation between turbines and the Verreaux's Eagle nest was sufficient, since we also did not record high passage rates for the species on site. The project received environmental authorisation on this basis. By the time this current walk through assessment was conducted, a first and second edition of the Verreaux's Eagle best practice guidelines had been produced by BirdLife South Africa (2017, 2021). The first edition guidelines in 2017 recommended a 3km nest buffer was appropriate. We therefore recommended during the 2019 amendment that the previous 2km buffers be increased to 3km. The most recent second edition guidelines now recommend a buffer of 5.2km to be used or for the Verreaux's Eagle Risk Assessment (VERA) model to be run to identify appropriate site specific buffers. Since the wind farm is already authorised, and has already revised its' layout to accommodate larger buffers, we do not recommend further changes to the buffer sizes or the use of VERA. Since the 3km buffer size is now smaller than current best practice and may not achieve full risk avoidance, extensive mitigation will also need to be applied proactively (i.e. from Commercial Operations Date), without waiting for any Verreaux's Eagle collision impacts to occur. This mitigation has been detailed in Section 4. We believe this is a reasonable approach in light of the identified risk and the changing guideline requirements.

Figure 3 shows the facility layout relative to the breeding sites.

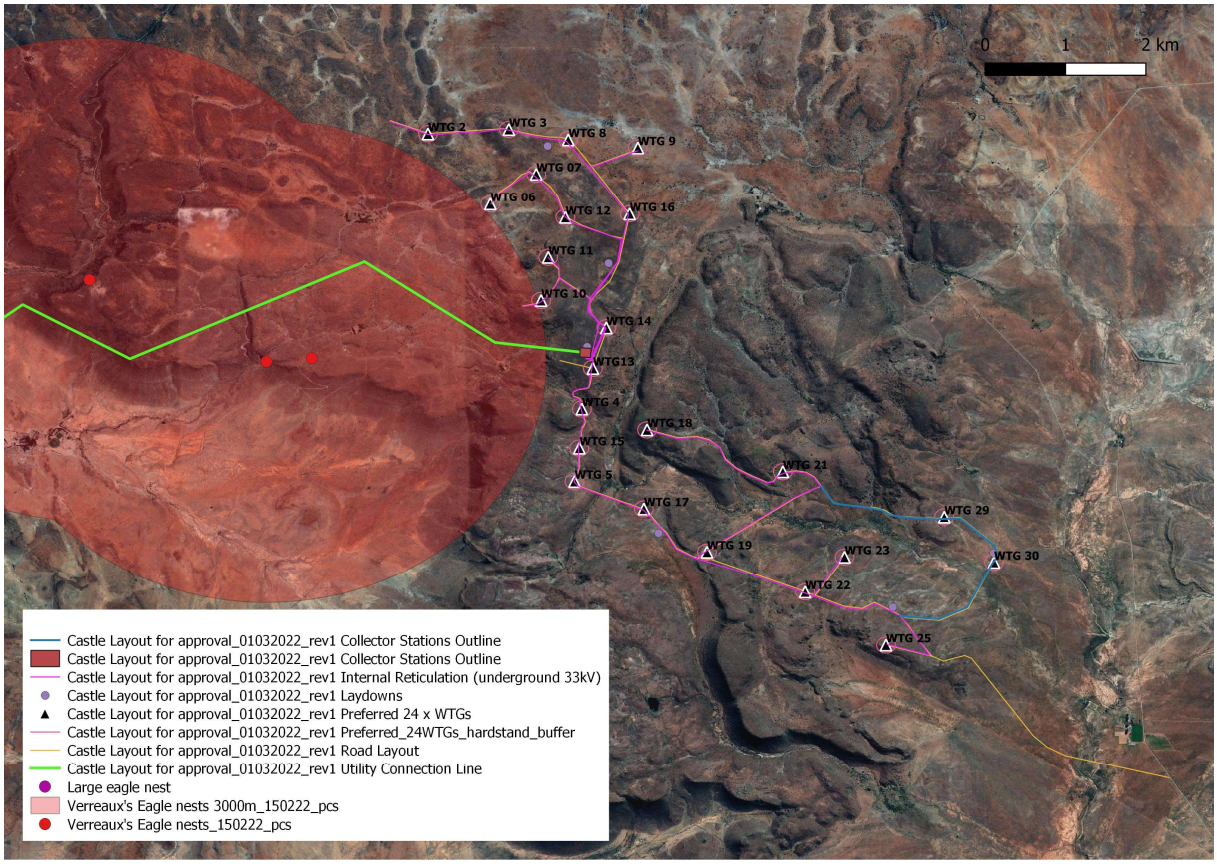


Figure 3. The final WEF facility layout with avifaunal sensitivity mapping.

4. Mitigation measures

The original mitigation recommendations made by WildSkies (2014) were revisited. Those still relevant have been detailed below along with our updated mitigated measures.

- All removal and alteration of natural vegetation should be kept to an absolute minimum.
- All disturbed soil areas (including road and hard stand verges) should be compacted sufficiently and rehabilitated correctly with vegetation to avoid increased burrowing of rodents (which in turn could attract raptors and result in turbine collisions).
- These areas should also be effectively rehabilitated with indigenous grass/plant species as soon as possible after construction.
- Underground cabling should follow roads at all times, and not deviate from the road verge (as this would result in additional linear impacts on the habitat).
- All spoil material (soil, rock, tree material) should be removed from site, not piled on site as this results in additional areas of habitat destruction, and also habitat creation for raptors prey.

- No access by staff, vehicles or machinery closer to any of the nests than the current layout should be allowed for any reason as this could disturb the eagles.
- The final pylon type for the grid connection power line will only be finalized closer to construction, based on detailed design and Geo-technical investigations. The pylon designs will comply with the latest Eskom-EWT "bird-friendly" guidelines/designs. The pylon designs will be also be finalized in consultation with an avifaunal specialist and/or the EWT Wildlife and Energy Working Groups.
- In order to mitigate bird collision risk, the full length of the proposed power line must be fitted with an Eskom approved line marking device.
- It is important that these marking devices are installed as soon as the conductors are strung, not only once the line is commissioned, as the conductors and earth wires pose a collision risk as soon as they are strung. The devices should be installed alternating a light and a dark colour to provide contrast against dark and light backgrounds respectively. This will make the overhead cables more visible to birds flying in the area. Note that 100% of the length of each span needs to be marked (i.e. right up to each tower/pylon) and not the middle 60% as some guidelines recommend. This is based on a finding by Shaw (2013) that collisions still occur close to the towers or pylons.
- Turbine blades should be painted on all turbines according to the latest specification allowed by the CAA. Currently 2 aviation red stripes on tips is permitted. Although this is unlikely to be as effective as solid black, it is acceptable. If however by the time of construction better options are permissible these should be implemented. If this measure is not fully effective in mitigating turbine collisions, the operator will need to apply additional measures as per the Adaptive Management Plan, so it is in their interests to ensure that blade painting is as effective as possible.
- No infrastructure should be built in the sensitive areas identified by this study. 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.
- All power lines linking the turbines and linking turbine strings to the on-site substation should be placed underground.
- It is essential that the Castle Wind Farm does not create favourable conditions for raptor prey mammals in high risk areas. Construction must ensure that road verges, drains and hard stand edges are compacted sufficiently 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.
- The 'during' and post-construction bird monitoring programme outlined by this report (Appendix 3) should be implemented by a suitably qualified and accredited avifaunal specialist. Post construction monitoring should be conducted for at least 2 years and extended if Red Listed species fatalities have been recorded. This monitoring should be done in accordance with the

latest version of the best practice guidelines available at the time (Jenkins et al, 2015; in revision 2021). 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.

- 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 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.

It is important that an Operational Phase Mitigation Plan be in place proactively for the site. We have consolidated this into Table 2 below:

Table 2. Operational Phase Adaptive Management Plan.

Aspect	Trigger	Threshold for action	Corrective Action	Time frame to implement	Measurement
Turbine bird collision fatality	Operational phase bird monitoring records a fatality	Regionally Red Listed species – 1 fatality	Implement further mitigation [this is likely to be either technology or observer led shutdown on demand. If risk has been confined to certain parts of the site these measures will target those areas]	3 Months from fatality record	Ongoing operational phase bird monitoring measures fatalities
Alteration of habitat	Audit at start of operational phase identifies areas with increased raptor prey populations or habitat which will attract raptors into close proximity of turbines 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. The details of this plan cannot be developed at this stage, but the most plausible off sets are likely to address the impact of overhead power lines on birds in the broader area	3 months from report	Evidence of Nett impact on species reduced- measured by ongoing monitoring

5. Conclusions

We hereby confirm that the final project layout conforms with the above recommendations and with all avifaunal sensitivities identified by the various avifaunal studies on the site to date. There are no micro changes to any of the infrastructure required (except for Alternate turbine 10). We recommend that the final layout be approved/authorised.

The mitigation measures recommended in this report must be implemented.

6. References

BirdLife South Africa. 2017. Verreaux's Eagle and Wind Farms: Guidelines for Impact Assessment, monitoring and mitigation. BirdLife South Africa Occasional Report Series.

BirdLife South Africa. 2021. Verreaux's Eagle and Wind Farms: Guidelines for Impact Assessment, monitoring and mitigation. Second edition. BirdLife South Africa Occasional Report Series.

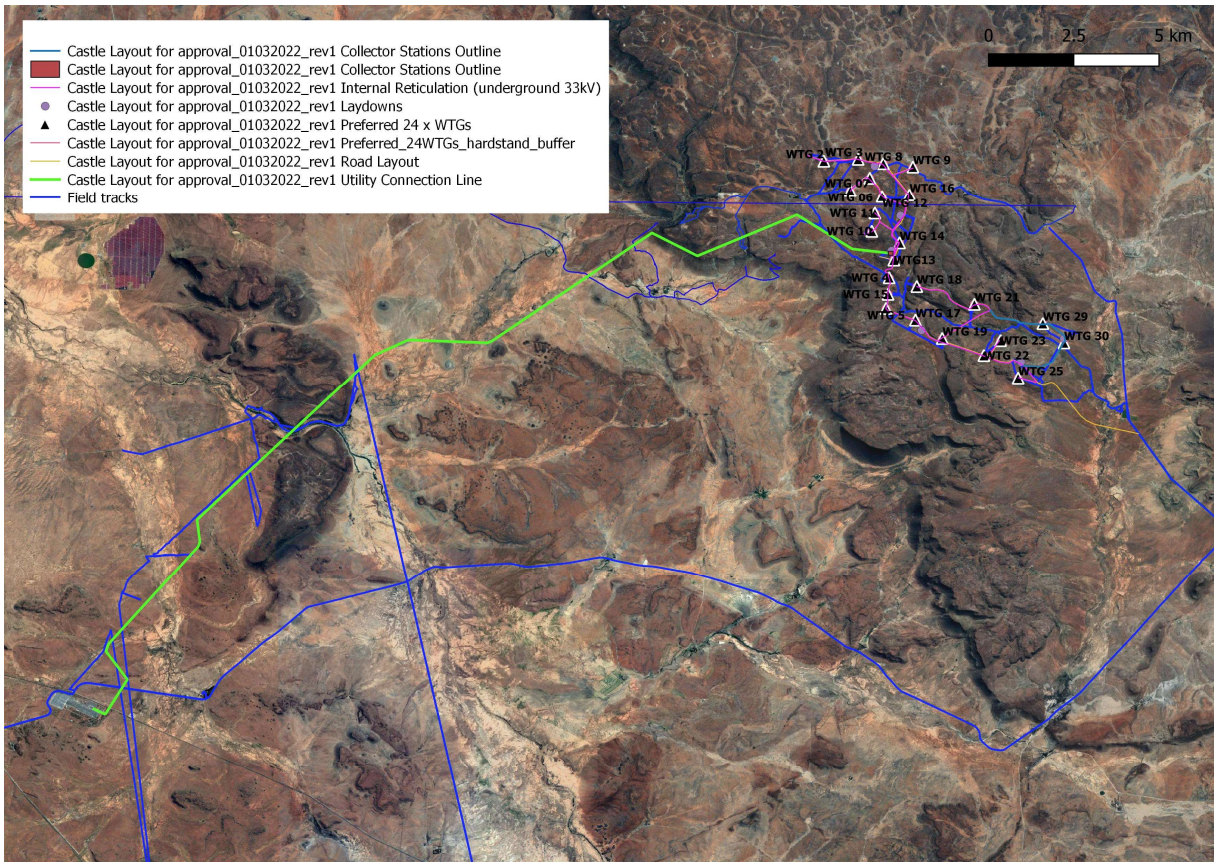
IUCN 2021. IUCN Red List of Threatened Species.

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

Taylor, M. R, Peacock, F., & Wanless, R. 2015. The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho & Swaziland.

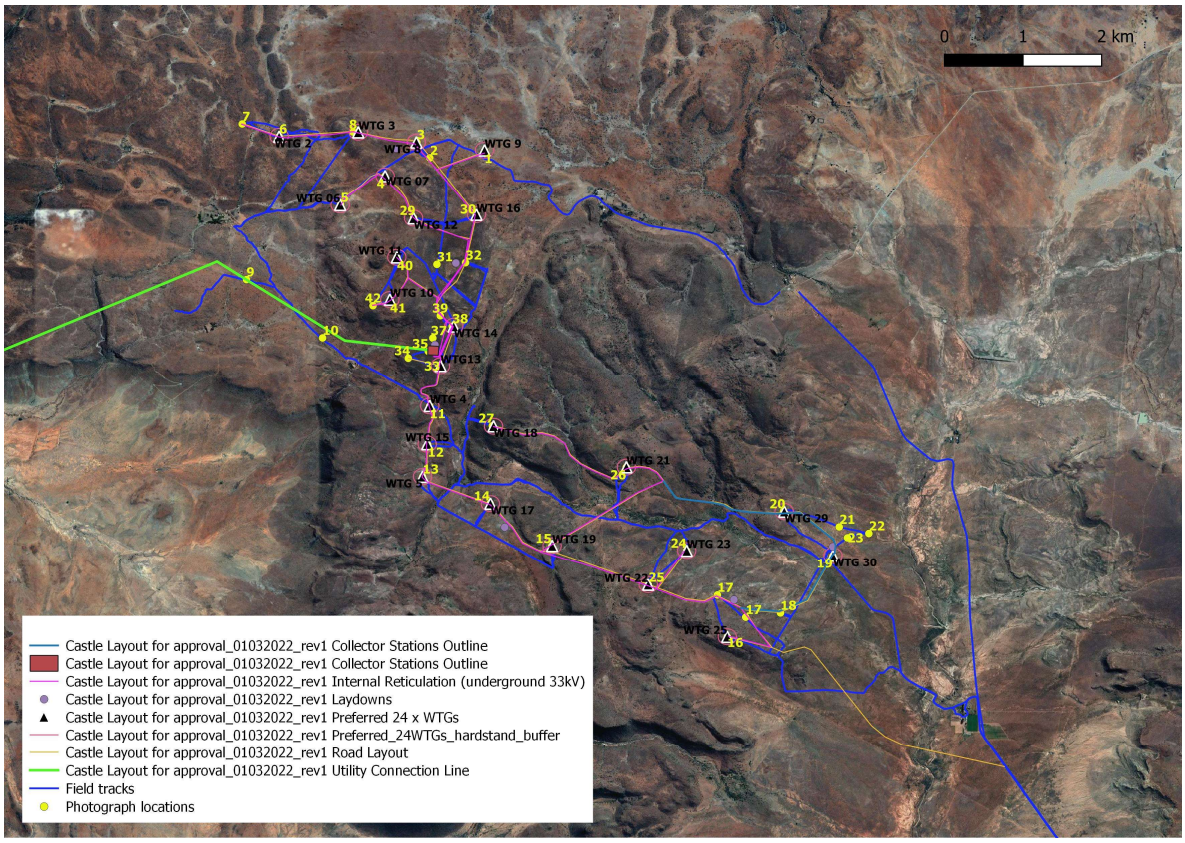
WildSkies, 2014. Castle Wind Energy Facility: Avifaunal Impact Assessment. Unpublished report submitted to Savannah Environmental.

Appendix 1. GPS field tracks from avifaunal walk through.

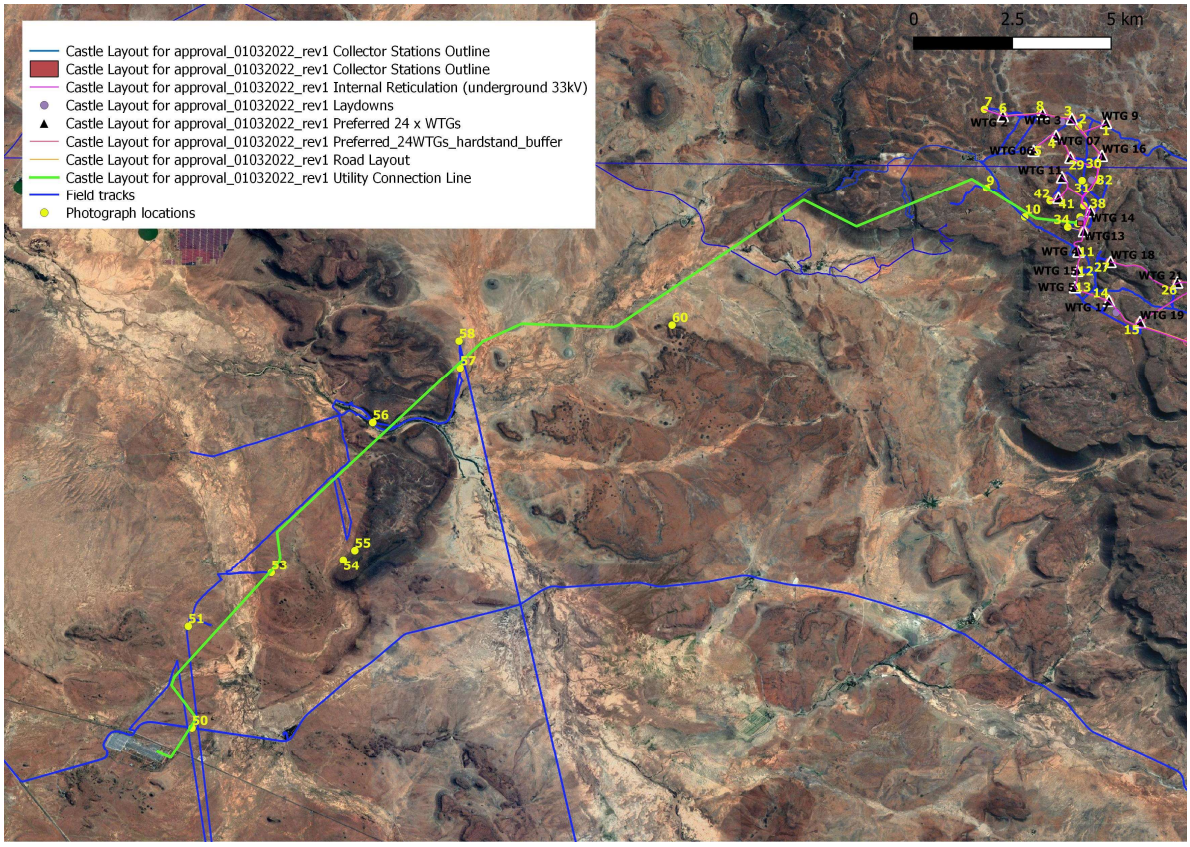


Appendix 2. Site photographs.

Wind farm photograph locations



Grid connection photograph locations



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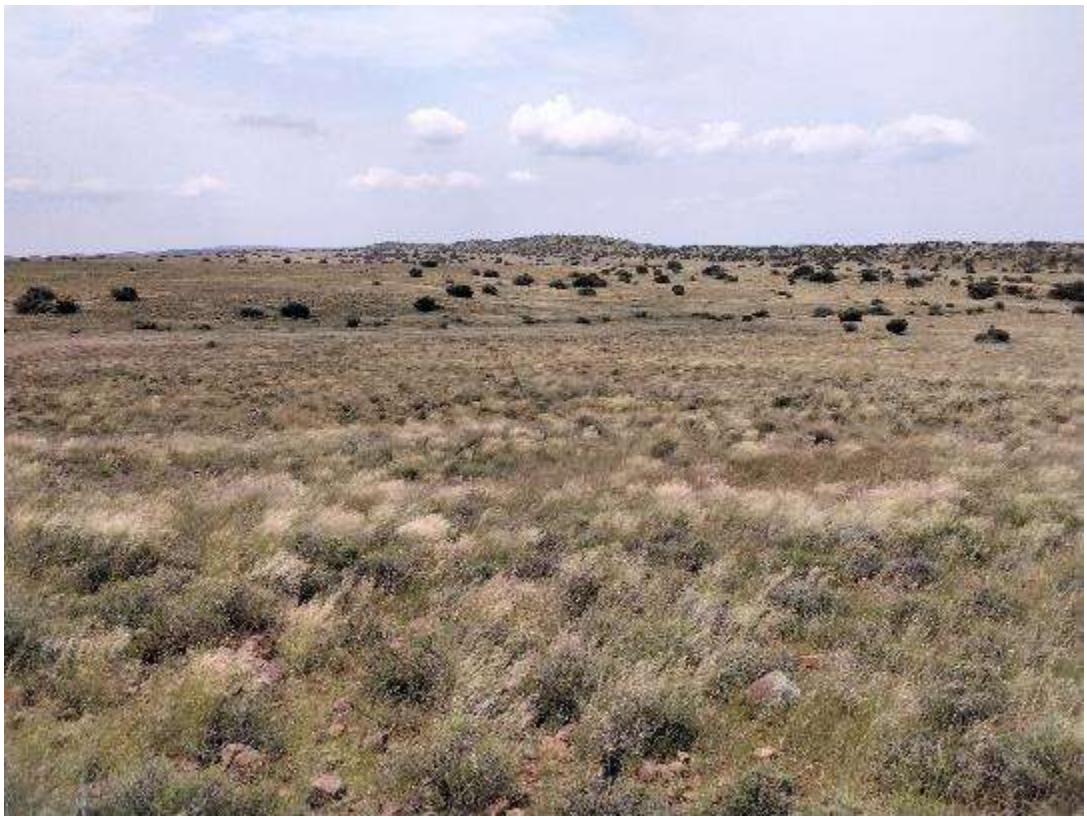

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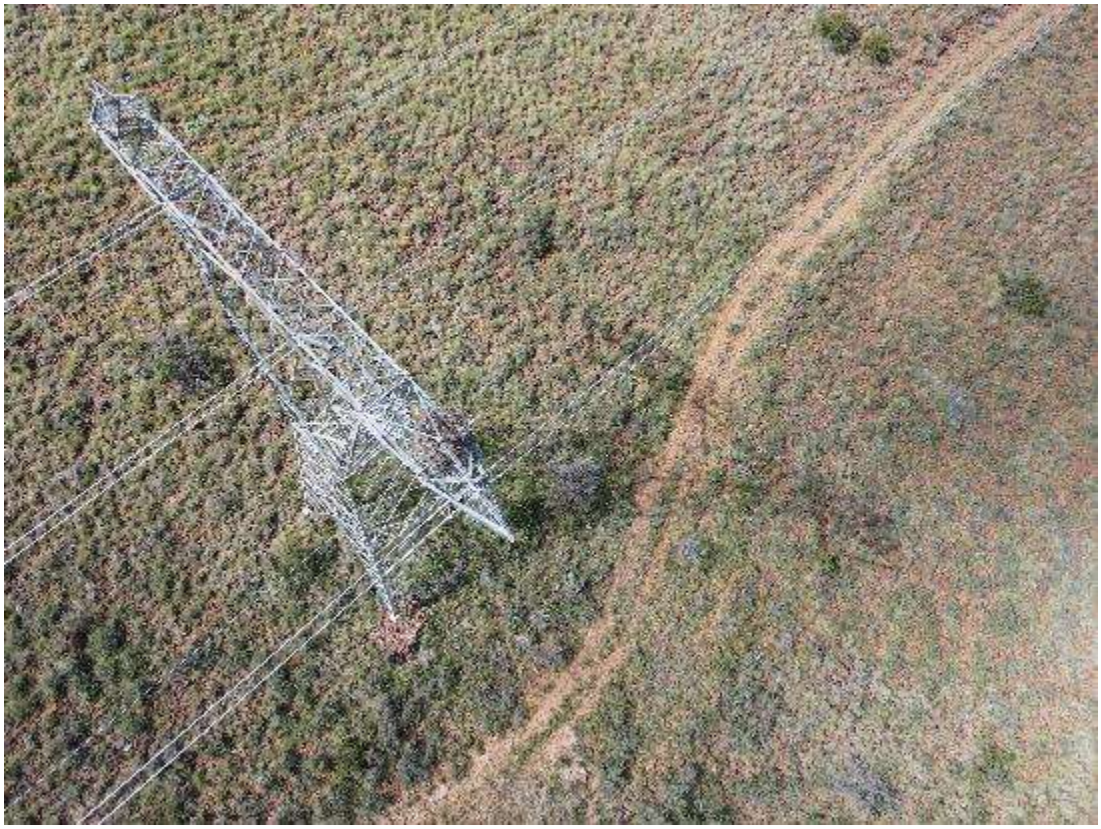

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Appendix 3. During and post construction bird monitoring framework.

The work done to date on the proposed site has established a baseline understanding of the distribution, abundance and movement of key bird species on and near the site. However this is purely the 'before' baseline and aside from providing input into turbine micro-siting, it is not very informative until compared to post construction data. The following programme has therefore been developed to meet these needs. It is recommended that this programme be implemented by the wind farm if constructed. The findings from operational phase monitoring should inform an adaptive management programme to mitigate any impacts on avifauna to acceptable levels.

During construction monitoring

It will be necessary to monitor the breeding status and productivity of the nesting eagles during all breeding seasons during construction. This can be done by 3 specialist visits to the nest site per breeding season, or close enough to observe the birds without disturbing them. Detailed requirements as follows:

- Independent avifaunal specialist to make 3 visits to nest site in each breeding season (May to October) during construction.
- Breeding status & productivity to be determined.
- Any response by eagles to construction disturbance to be documented.

Operational phase monitoring

The intention with operational phase bird monitoring is to repeat as closely as possible the methods and activities used to collect data pre-construction. This work will allow the assessment of the impacts of the proposed facility and the development of active and mitigation measures that can be implemented in the future where necessary. One very important additional component needs to be added, namely mortality estimates through carcass searches under turbines. The following programme has therefore been developed to meet these needs, and should start as soon as possible after the operation of the first phase of turbines (not later than 3 months):

Note that this framework is an interim draft. The most up to date version of the best practice guidelines (Jenkins *et al* 2015, under revision 2021) should inform the programme design at the time.

Live bird monitoring

Note that due to the construction of the wind farm and particularly new roads it may be necessary to update the location of the below monitoring activities from those used pre-construction.

- The walked transects of 1km each that have been done during pre-construction monitoring on the site should be continued.

- The vehicle based road count routes on the site should be continued, and conducted twice on each site visit.
- The focal sites on the site should be monitored. If any sensitive species are found breeding on site in future these nest sites should be defined as focal sites.
- All other incidental sightings of priority species (and particularly those suggestive of breeding or important feeding or roosting sites or flight paths) within the broader study area should be carefully plotted and documented.
- The Vantage Points already established on the overall site should be used to continue data collection post construction. The exact positioning of these may need to be refined based on the presence of new turbines and roads. A total of 72 hours direct observation per Vantage Point should be conducted per year.
- The activities at the control site should be continued

Bird Fatality estimates

This is now an accepted component of the post construction monitoring program and the newest guidelines will be used to design the monitoring program. It is important that in addition to searching for carcasses under turbines, an estimate of the detection (the success rate that monitors achieve in finding carcasses) and scavenging rates (the rate at which carcasses are removed and hence not available for detection) is also obtained (Jenkins *et al*, 2015). Both of these aspects can be measured using a sample of carcasses of birds placed out in the field randomly. The rate at which these carcasses are detected and the rate at which they decay or are removed by scavengers should also be measured.

Fatality searches should be conducted as follows:

- The area surrounding the base of turbines should be searched (up to a radius equal to 75% of the maximum height of turbine) for collision victims.
- All turbines on the wind farm should be searched at least once a week (Monday to Friday).
- Any suspected collision casualty should be comprehensively documented (for more detail see Jenkins *et al*, 2015).
- A team of carcass searchers will need to be employed and these carcass searchers will work on site every day searching the turbines for mortalities.
- It is also important that associated infrastructure such as power lines and wind masts be searched for collision victims according to similar methods.

The most up to date version of the best practice guidelines (Jenkins *et al*, 2015) should inform the programme design at the time.

The above programme should be reported on quarterly to the wind farm operator, who should submit these reports to the DFFE and BirdLife South Africa.