AVIFAUNAL IMPACT ASSESSMENT FOR THE NOBLESFONTEIN WEF EXPANSION

For

Terramanzi Group (Pty) Ltd

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Prepared By:

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(p) any other information requested by the competent authority	None received at the time of compiling the report.
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.	No protocol for avifaunal assessment has been gazetted for a development of this capacity. The Avifauna Protocol listed in Government Gazette 43110 Published in Government Notice No. 320 of 20 March 2020 applies to onshore wind energy generation facilities where the electricity output is 20 MW or more.

1 INTRODUCTION

1.1 Background

The operational Noblesfontein Wind Energy Facility ('WEF') received approval and environmental authorisation for the construction of 44 turbines with a maximum capacity of 132 MW and associated infrastructure in February 2012 (DEFF Ref. No. 12/12/20/1993/1).

The original project description included up to 44 wind turbines with a total generating capacity of 132 MW using turbines with a generating capacity of up to 3 MW. However only 41 of the 44 authorised wind turbines generators (Vestas V100 rated at 1.8 MW each with an 80 m hub height) have been installed to-date, with a total installed capacity of 73.8 MW. The client now seeks to install two of the remaining three turbines, bringing the total number of installed turbines up to 43 (of the 44 turbines authorised).

As the original project description detailed the use of turbines with a generating capacity of up to 3 MW each, the remaining three authorised turbines would generate a total output of up to 9 MW. To capitalise on the improvements to wind turbine technology that have been made over the last decade, the client proposes that two wind turbines with a rating of between 4 MW and 5.6 MW generation capacity each (with a total output of up to 10 MW) be installed. A Basic Assessment (National Environmental Management Act of 1998 as amended) process is being undertaken for the construction of two wind turbines and associated infrastructure (including an overhead power line and substation). Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus') has been appointed by Terramanzi Group (Pty) Ltd ('Terramanzi') to provide an impact assessment of the changes associated with the proposed development as they relate to avifauna.

The project description relevant to the proposed development are summarised as follows:

- Upgrade of 3 wind turbines from 3 MW specifications (with a total output of 9 MW) to 2 wind turbines of between 4 MW and 5.6 MW specifications (with a total output up to 10 MW);
- Each turbine will be a steel tower with a maximum height of up to 137.5 m and will include a nacelle (gear box) with three rotor blades;
- Each rotor blade will have a maximum length of up to 82 m in length with a total rotor diameter of up to 165 m;
- Rotor swept area ('RSA') per turbine up to a maximum of 21 382.5 m^2;
- Total turbine height will be a maximum of up to 220 m;
- Maximum sound output will be up to 104.9 dB;
- Grid connection overhead power line of approximately 470 m in length;
- Upgraded road of approximately 1.0 km in length, including the construction of approximately 380 m of novel roadway; and
- Substation with a footprint of approximately 0.53 ha.

The location of the two proposed turbines is towards the north of the northern existing and operational turbine string that includes turbines 1 - 6 (Figure 1).

1.2 Terms of Reference

As the proposed development has a total electrical generation capacity of below 20 MW no specific avifaunal theme protocol has been prescribed by National Gazette, No. 43110 of 20 March, 2020. Therefore, this assessment has been conducted according to the National Environment Management Act, 1998 (Act 107 of 1998), EIA Regulations, 2014, as amended, and adheres to the precautionary principle and risk-averse approach applicable to projects that pose a risk to biodiversity and ecosystems.

The report has been compiled under the following terms of reference and provides:

- A review of existing site-specific data and literature related to the impacts of WEFs on avifauna;
- An assessment of all impacts related to the proposed development specification changes with comparisons to the impact assessments of the original authorisation; and
- Measures to ensure avoidance, management and mitigation of impacts associated with the proposed changes.

1.3 Project Team

Dr. Owen Davies is a Professional Natural Scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and obtained his doctoral degree from the Percy FitzPatrick Institute of African Ornithology, a DST-NRF Centre of Excellence at the University of Cape Town. Owen has been involved in avifaunal monitoring activities for renewable energy projects since 2013. Extensive field research has given Owen experience in the techniques required for conducting biological surveys on a variety of taxa including observations, physical trapping and identification of small terrestrial birds, raptors, bats, small mammals, rodents, snakes, reptiles, scorpions and fish. He is also qualified to conduct observations and acoustic monitoring of marine mammals in the offshore environment. Data collection in a diversity of habitats and ecosystems, combined with formal training in field skills such as off-road driving, enables Owen to conduct ecological surveys across southern Africa. In addition, his skills in data analysis and scientific writing at the PhD level enable him to produce high quality assessments and reports.

Craig Campbell is an Ecologist at Arcus. He graduated with a Degree in Conservation Ecology from Stellenbosch University, South Africa. He is registered as a Professional Natural Scientist, in the field of Ecological Sciences (SACNASP). Since 2013, Craig has had extensive experience in ecological baseline studies, biodiversity monitoring surveys and due diligence on several renewable energy and other projects in South Africa, Mozambique, Portugal and Turkey. He has a sound background in management and ecology, and also focusses on project design & layout, GIS mapping, report compilation and stakeholder engagement.

Ashlin Bodasing is a Technical Director at Arcus Consultancy Services South Africa (Pty) Ltd. Ashlin is a registered EAP. Having obtained her Bachelor of Social Science Degree (Geography and Environmental Management) from the University of Kwa-Zulu Natal; she has over fourteen experience in the environmental consulting industry in southern Africa. She has gained extensive experience in the field of Integrated Environmental Management, environmental impact assessments and public participation. She has also been actively involved in a number of industrial and infrastructural projects, including electricity power lines and substations; road and water infrastructure upgrades and the installation of telecommunication equipment, green and brown field coal mines, as well as renewable energy facilities, both wind and solar. Ashlin has excellent Project Management experience and has gained major project experience in the development of Environmental Impact Assessments, Environmental Management Plans and the monitoring of construction activities. Her areas of expertise include project management, environmental scoping and impact assessments, environmental management plans, environmental compliance monitoring and environmental feasibility studies. Experience also includes International Finance Corporation Performance Standards and World Bank Environmental Guidelines environmental due diligence reviews. She has worked in Mozambique, Namibia, Botswana, Lesotho and Zimbabwe.

1.4 Assumptions and Limitations

Information regarding the baseline avifaunal community included data obtained from the South African Bird Atlas Project 2 (SABAP2) and only limited interpretation of these data can be made regarding the species diversity and densities in the area as this area has been relatively poorly sampled. This is not considered to be a major limitation as recent fatality data for the adjacent operational wind energy facility was used to inform the assessment and it is assumed that this reflects estimates of site-specific impacts on avifauna.

Similarly, baseline data collection for the impact assessment associated with the original authorisation was conducted prior to the publication of various best practice guidelines applicable today. This is not considered to be a significant limitation as updated information was collected during the operational phase that included carcass searching and fatality estimates that included searcher efficiency and carcass persistence rates. The updated operational phase monitoring followed recent best practice guidelines[1] and presented data and calculations determining the realised impact of a wind energy facility on the site. These results were used to inform this impact assessment and as they represent relevant site-specific information regarding impacts to avifauna, the confidence in the resultant impact assessments is considered to be much higher than most impact assessments conducted around the country where fatality data for the site does not exist.

This impact assessment was not accompanied by a site visit by the author of this report; however, this is not considered to be a significant limitation amember of the Arcus team visited the site as recently as March 2021 and produced and site sensitivity verification report.

2 METHODOLOGY

In carrying out this assessment, Arcus conducted a literature review on impacts of wind energy developments on avifauna with a focus on the relationship between turbine size and avifaunal fatality as well as the latest birds and wind energy best practice guidelines (relevant literature cited within the text with references to be found in the footnotes).

In addition to the above literature review, the following reports were considered to provide context for the impact assessment:

- Environmental Authorisation (DEFF REF 12/12/20/1993/1);
- Avisense Consulting (2011) Karoo Renewable Energy Facility – Avian impact assessment;
- Bioinsight (2018). Noblesfontein Wind Farm – Operational phase bird monitoring. Third year of operation. Final Monitoring Report (Year 3) 2014/2017; and
- Bioinsight (2020). Noblesfontein Wind Farm – Operational phase bird monitoring. Fifth year of operation. Final Monitoring Report (Year 5) 2014/2019.

A site sensitivity verification reports is included as Appendix A.

3 ORIGINALLY AUTHORISED IMPACT ASSESSMENT FINDINGS

The Noblesfontein WEF was subjected to an EIA process in 2010/2011, including the compilation of an Avifaunal Impact Assessment (Avisense Consulting 2012). The application was authorised by the DEA in February 2012 (DEFF Ref: 12/12/20/1993/1). The authorisation prescribed the implementation of a bird monitoring programme prior to the construction of the project that should continue during the operation of the energy facility. Avisense Consulting (2012) concluded that the main negative impact is likely to be on the

[1] Jenkins, A.R., van Rooyen, C.S., Smallie, J.J., Harrison, J.A., Diamond, M., Smit-Robinson, H.A. & Ralston, S. 2015. Best-Practice Guidelines for Assessing and Monitoring the Impact of Wind-Energy Facilities on Birds in Southern Africa. Third Edition. BirdLife South Africa.

resident and breeding populations of Verreaux's Eagle *(Aquila verreauxii)* and Martial Eagle *(Polemaetus bellicosus)*, seasonal influxes of Ludwig's Bustard *(Neotis ludwigii)* and the resident population of Blue Crane *(Anthropoides paradiseus)* through disturbance/displacement and/or collision mortalities with turbines and ancillary power infrastructure.

Pre-construction avifaunal monitoring was undertaken by Bio3 between April 2012 and February 2013 (Bio3/Savannah Environmental 2013). The monitoring programme included walked transects, vantage point monitoring, water body surveys and nest surveys. Eight species of concern were highlighted in the study area, including Blue Crane, Ludwig's Bustard, Martial Eagle, Verreauxs' Eagle, Black Harrier *(Circus maurus)*, Black Stork *(Ciconia nigra)*, Black-winged Lapwing *(Vanellus melanopterus)*, Lanner Falcon *(Falco biarmicus)* and Secretarybird *(Sagittarius serpentarius)*. The analysis of the data indicated that the most common species was Verreaux's Eagle, most likely due to the nesting identified in the surrounding area. Blue Crane were localised mostly to the north of the WEF and Ludwig's Bustard were not considered to have high collision risk due to their low-risk flight behaviours.

Table 1: Summary of relevant impact assessments and indication of changes due to the proposed development

Phase	Impact	Significance Without Mitigation	Significance with Mitigation	Significance with mitigation will change due to proposed development (Y/N)
Construction	Disturbance	M	M	N
	Habitat Loss	M-H	M	N
Operational	Disturbance	M-H	M	N
	Mortality (Collision)	M-H	M	N

4 CURRENT IMPACTS ON AVIFAUNA

BioInsight conducted post-construction monitoring at the operational Noblesfontein WEF that included walked transects, vantage point monitoring, water body surveys, nest surveys and carcass searching for the first three years of operation, between November 2014 and December 2017 (BioInsight 2018). BioInsight resumed carcass searching for the fifth year of operations in December 2018 which continued until November 2019 (BioInsight 2020). These data remain highly relevant to inform the impact assessment.

The results from the post-construction monitoring programmes showed Verreaux's Eagle activity was largely concentrated towards the south and east of the Noblesfontein WEF with lower levels of activity recorded towards the north during the first and second year of monitoring. During the third year of monitoring (but not during the previous years) Verreaux's Eagle flights were recorded in the area of the operational turbines 1 – 6. A Rock Hyrax *(Procavia capensis)* colony, the preferred prey species of Verreaux's Eagle, is known to be present in this area however no observed hunting behaviour within 1000 m from the turbines was recorded despite flights of 40 to 50m in height being recorded (BioInsight 2018).

The carcass searching efforts recorded Verreaux's Eagle fatalities that had occurred during the first five years of operation, but these fatalities were concentrated at the south-eastern extent of the WEF. These findings correspond to the original impact assessment (Avisense Consulting 2012) which concluded that Verreaux's Eagle are the most likely to be affected by the development as well as the higher levels of Verreaux's Eagle activity recorded in the southern and eastern portions of the WEF during pre-construction and construction monitoring.

No Martial Eagle fatalities were recorded and only low numbers of flights and observations of this species were recorded during pre-construction and construction phase monitoring (BioInsight 2020). The Martial Eagle flights that were observed occurred in the north of the WEF.

Overall collision fatality estimates for all birds calculated for the Noblesfontein WEF from five years of operational monitoring data fall within the range of fatality estimates at other WEFs in South Africa (4.6 ± 2.9 birds per turbine per year, n = 14; adjusted)[2]. However recorded fatalities of Verreaux's Eagle indicates that the operational Noblesfontein WEF is possibly resulting in more significant negative impacts being imposed on the local population of this species and that interventions in the form of adaptive management and appropriate mitigation measures are required to reduce the impact (BioInsight 2020).

5 POTENTIAL EFFECTS OF THE PROPOSED DEVELOPMENT ON CURRENT IMPACTS AND RISKS TO AVIFAUNA

The overhead power line is relatively short (< 0.5 km) and unlikely to result in a significant negative impact to avifauna following the implementation of mitigation measures. Similarly the substation is relatively small and positioned alongside an existing substation and existing transmission infrastructure and a railway, the substation is therefore unlikely to contribute additional significant negative impacts on avifauna above those that are already present on the site.

The primary consideration relevant to the proposed development is the potential effects that the proposed changes to turbine specifications (i.e. turbine dimension and number) may have on the collision risk posed to avifauna compared to the original authorisation. Particularly in relation to the current impacts of the operational Noblesfontein WEF as well as the improved general understanding of WEF impacts on avifauna obtained since the initial impact assessment was conducted.

5.1 Updates to our Understanding of Wind Energy Facility Impacts to Avifauna

5.1.1 Avifaunal Fatalities

A recent study[2] investigating the diversity of avifauna fatalities caused by wind turbines at 20 WEFs across South Africa reported that most carcasses found were of raptors (36%), followed by passerines (30%), waterbirds (11%), swifts (9%), large terrestrial species (5%), pigeons and doves (4%) and other near-passerines (1%). Jackal Buzzard was the species most often killed, reflecting its widespread distribution and relatively high abundance among resident raptors. The most species of conservation concern reported as turbine fatalities also were raptors. Black Harrier, Verreaux's Eagle, Martial Eagle and fatalities of four other eagle species have also been recorded at WEFs across the country, highlight the importance of properly siting WEFs outside of eagle territories[2]. The proposed location of the turbines considered are outside of the core territories of eagles in the area, as indicated by the distance from nearest nests and low recorded flight activity.

[2] Perold, V.; Ralston-Paton, S.; Ryan, P. (2020). On a collision course? The large diversity of birds killed by wind turbines in South Africa. Journal of African Ornithology, 91, 228-239. DOI: 10.2989/00306525.2020.1770889

5.1.2 Effects of Turbine Number and Dimensions on Risks to Avifauna

Conflicting results on the effect that turbine specifications have on avifaunal fatalities exist in the published literature. Howell *et al.* (1997)[3] concluded that the evidence from the Altamont Pass in California (United States of America) did not support the hypothesis that the RSA of turbines contributes proportionally to avian mortality, i.e. that larger RSA resulted in more mortalities. Barclay *et al.* (2007)[4] compiled wind turbine and fatality data from 33 sites in North America to test the hypothesis that wind turbine size and height influenced fatality rates of birds. They concluded that while it may be expected that as rotor-swept area increased, more animals would be killed per turbine their analyses indicated that this was not the case and rotor-swept area was not a significant factor. In addition they found no evidence that taller turbine towers are associated with increased bird fatalities and that the per-turbine fatality rate for birds was constant with tower height.

Krijgsveld *et al.* (2009)[5] conducted a study in the Netherlands which "*indicated that collision risk of birds with larger multi-MW wind turbines is similar to that with smaller earlier-generation turbines, and much lower than expected based on the large rotor surface and high altitude-range of modern turbines*". Smallwood (2013)[6] estimated fatalities at wind energy facilities across North America to "*test whether the trend toward installing larger wind turbines might reduce fatality rates, or whether variation in fatality rates could be explained by other methodological, environmental, or turbine design factors*" and concluded that "*adjusted fatality rates correlated inversely with wind-turbine size for all raptors as a group*", i.e. lower fatality rates were estimated at wind energy facilities with larger turbines. Everaert (2014)[7] studied the impact of bird collisions at eight land-based wind energy facilities in Belgium (with a total of 66 wind turbines) and concluded that "*no significant relationship could be found between the number of collision fatalities and the rotor swept area of the turbines*".

De Lucas *et al.* (2008)[8] showed a correlation between hub height and mortality for Griffon Vulture, indicating that differential impacts and risks may be experienced depending on the flight characteristics of the species present in the area.

It must be noted that even though older studies may refer to 'modern turbines' the technology has advanced at such a rapid pace that even turbines considered to be at the larger end of the scale in these studies are significantly smaller than those that are currently available on the market. Similarly, Loss *et al.* (2014)[9] argued that Smallwood (2013) failed to distinguish between lattice and monopole turbines, stating that as monopole turbines comprise the vast majority of all wind turbines installed in North America, it is important to separately estimate mortality and assess correlates of mortality for this turbine type.

Loss *et al.* (2014) sought to provide the first mortality estimates specific to monopole turbines and included data from 68 studies, their findings supported a positive relationship between bird collision mortality and turbine hub height. Part of their explanation for why their studied showed different results was the fact that lattice turbines were excluded from

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[3] Howell, J.A. 1997. Avian Mortality at rotor swept area equivalents Altamont Pass and Montezuma Hills, California. Report for Kenetech Wind Power.

[4] Barclay R.M.R, Baerwald E.F and Gruver J.C. 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. Canadian Journal of Zoology. 85: 381 – 387.

[5] Krijgsveld, K.L., Akershoek, K., Schenk, F., Dijk, F. and Dirksen, S. 2009. Collision risk of birds with modern large wind turbines. Ardea 97(3): 357–366.

[6] Smallwood, K.S. 2013. Comparing bird and bat fatality rate estimates among North American Wind-Energy projects. Wildlife Society Bulletin 37(1):19–33.

[7] Everaert, J. 2014. Collision risk and micro-avoidance rates of birds with wind turbines in Flanders, Bird Study, 61:2, 220-230

[8] De Lucas, M., Janss, G.F.E., Whitfield, D.P., Ferrer, M., 2008. Collision fatality of raptors in wind farms does not depend on raptor abundance. J. Appl. Ecol. 45, 1695–1703.

[9] Loss S.R., Will, T., Marra, P.P. 2013. Estimates of bird collision mortality at wind facilities in the contiguous United States. Biological Conservation 168 201–209.

their analysis. Lattice turbines are relatively small and have relatively high per-turbine mortality rates as the lattice structure may attract perching birds and raptors which may skew the results and conclusions of previous studies. Loss *et al.* (2014) conclude that "*the projected trend for a continued increase in turbine size coupled with our finding of greater bird collision mortality at taller turbines suggests that precaution must be taken to reduce adverse impacts to wildlife populations when making decisions about the type of wind turbines to install*".

A more recent study by Thaxter *et al.* (2017)[10] conducted meta-analyses that included 88 bird studies containing information from 93 onshore wind energy facilities and related collision rate to species-level traits and turbine characteristics to quantify the potential vulnerability of 9 538 bird species globally. They found a strong positive relationship between wind turbine capacity and collision rate per turbine. *The strength of this relationship, however, was insufficient to offset the reduced number of larger turbines required per unit energy generation.* They concluded that **to minimize bird collisions, wind farm electricity generation capacity should be met through deploying fewer, large turbines, rather than many smaller ones.**

5.1.3 Effects of Turbine Layout and Best Practice Guidelines for Wind Energy and Avifauna

Since the original monitoring was completed, BirdLife South Africa ('BLSA') have released species-specific guidelines for the impact assessment, monitoring, and mitigation of impacts of WEFs on Verreaux's Eagle[11]. These guidelines prescribe increased monitoring effort at vantage points and specialist nest searches amongst other recommendations and highlight the importance of the mitigation hierarchy that seeks to first avoid impacts through considered turbine placement and layout. The guidelines indicate areas that represent elevated risk to Verreaux's Eagle which should be avoided such as ridge tops, cliffs, steep slopes, escarpment edges, core territories and areas near nests. The guidelines recommend 3 km nest buffers around nests should be considered to be of high sensitivity and no turbines should be placed within these areas, and while these buffers may be reduced based on rigorous monitoring and under no circumstances should the buffer be less than 1.5 km around all nests. More recent data[12] however indicates that a 3 km buffer is inadequate and that a precautionary buffer of 5.2 km is more appropriate, which may be reduced to a minimum of 3.7 km based on rigorous monitoring.

5.2 Relevance and Implications

5.2.1 Turbine Number and Dimensions

The number of turbines proposed is reduced from three turbines in the current authorisation to two turbines. The hub height will increase from 80 m up to a maximum of 137.5 m and blade diameter will increase from 50 m to a maximum of 82 m. The total RSA will increase from 23 562 m^2 for the three authorised turbines to a maximum of 42 765 m^2 for the two proposed turbines, this translates to an 81.5% increase in total RSA.

This does not, however, directly translate into an 81.5% increase in collision risk and the conclusions of Thaxter *et al.* (2017; generation capacity should be met through fewer larger

[10] Thaxter, C.B., Buchanan, G.M., Carr, J., Butchart, S.H.M., Newbold, T., Green, R.E., Tobias, J. A., Foden, W. B., O'Brien, S. and Pearce-Higgins, J.W. 2017. Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment. Proc. R. Soc. B.28420170829.

[11] Ralston-Paton, S. 2017 Verreauxs' Eagle and Wind Farms Guidelines for impact assessment, monitoring, and mitigation. BirdLife South Africa, Johannesburg, South Africa.

[12] Murgatroyd, M., Bouten, W. and Amar, A. 2021. A predictive model for improving placement of wind turbines to minimise collision risk potential for a large soaring raptor. Journal of Applied Ecology 58 (4) 857-868 https://doi.org/10.1111/1365-2664.13799

turbines rather than many smaller ones) must be considered together with the site-specific species at risk, the topography, observed flight behaviour data collected on site and the potential utilisation of the area under consideration.

The reduction in the number of turbines from three to two translates into 33% fewer obstacles in the landscape and fewer spinning blades. The increased hub height translates into an increase in maximum blade tip height, however this also translates into an increase in the minimum blade tip height from 30 m to 55 m. The increase in the minimum blade tip height is relevant here as it may reduce the collision risk to smaller passerine species such as displaying larks as well as to Verreaux's Eagle. While Verreaux's Eagle flight activity near the proposed turbine locations was generally low, the flights that were recorded in this area were at low altitude, between 40 – 50 m, a height that would be within the RSA of the smaller authorised turbines but below the RSA of the proposed turbines. The known colony of Rock Hyrax in the vicinity of turbines 1 – 6 (BioInsight 2018) may also predict the flight behaviour of Verreaux's Eagle along this particular turbine string as they have a habit of flying at low heights and at high speed over rocky terrain while foraging for this type of prey (pers. obs.). It is therefore likely that an increase in minimum blade tip height at this specific location would reduce the probability of Verreaux's Eagle collision.

5.2.2 Turbine Layout

The most cost effective approach to mitigating impacts is to study the area and identify landscape and biological features that may be associated with risk[13,14]. The area under consideration for the proposed development has been extensively studied and the landscape and biological features associated with the risks have been used to inform the layout.

Turbine layout in the context of the surrounding landscape is also an important consideration when assessing the potential impact to avifauna and the probability of collision fatalities occurring. The proposed positions of the turbines are outside of 3 km nest buffers recommended by the Verreaux's Eagle Guidelines and also outside of the larger 5.2 km nest buffers recommended by Murgatroyd *et al.* (2021). The closest known Verreaux's Eagle nest is approximately 5.7 km from the nearest proposed turbine location (Figure 2). Low levels of flight activity have been recorded near the proposed turbine location during pre-construction and post-construction monitoring between 2012 and December 2017 despite apparent prey availability, possibly as a result of the fact that no nests are located nearby and more efficient foraging areas exist elsewhere.

The Verreaux's Eagle fatalities that have previously been recorded are in the south-east of the development and were recorded at turbines within approximately 2.5 km from an active nest and in areas of elevated flight activity.

As the location of the turbines proposed are in the north, in an area with lower flight activity and outside of a 5.2 km buffer applied to the nearest known nest locations, the probability of Verreaux's Eagle collisions occurring at these turbines is reduced.

6 UPDATED IMPACT ASSESSMENTS

It must be noted that the original impact assessment considered the development as a whole rather than the specific impacts associated with the construction and operation of these remaining turbines alone. The contribution of the proposed development to the overall impacts of the facility as a whole was therefore assessed against the development

[13] U.S. Fish and Wildlife Service. 2013. Eagle conservation plan guidance. Module 1 – Land-based wind energy (version2).

[14] Bennun, L., van Bochove, J., Ng, C., Fletcher, C., Wilson, D., Phair, N., Carbone, G. 2021. Mitigating biodiversity impacts associated with solar and wind energy development. Guidelines for project developers. Gland, Switzerland: IUCN and Cambridge, UK: The Biodiversity Consultancy.

of the remaining turbines as originally authorised. Where the probability or severity of the impact is likely to be reduced by the proposed development when compared to the original authorisation this was elaborated on in the text, even if the reduction was insufficient to alter the overall impact significance rating.

6.1 Construction Phase

6.1.1 Disturbance

No change.

This impact considers disturbance associated with noise, movement and temporary occupation of habitat during the building process. The impact is short-term and transient in nature and will be highly localised. The *individual contributions* of the construction of the remaining turbines to the *overall* impact of the WEF will therefore be low. The proposed development will reduce the disturbance during construction slightly compared to the authorised impact as fewer turbines will be constructed. The reduction in disturbance associated with the proposed development will nevertheless not reduce the *overall* original impact significance rating of medium following mitigation.

6.1.2 Habitat Loss

No change.

This impact considers the destruction of habitat for priority species, either temporary – resulting from construction activities peripheral to the built area, or permanent – the area occupied by the completed development. As relatively few turbines remain to be installed the *individual contributions* of the construction of the remaining turbines to the *overall* impact of the WEF will be low. The proposed development will reduce the habitat loss associated with construction slightly compared to the authorised impact as fewer turbines will be constructed requiring fewer turbine bases, pads and laydown areas. The reduction in habitat loss associated with the proposed development will nevertheless not reduce the *overall* original impact significance rating of medium following mitigation.

6.2 Operational Phase

6.2.1 Disturbance

No change.

This impact considers disturbance associated with noise and movement generated by daily operational and maintenance tasks as well as the operation of the turbines themselves causing the displacement of avifauna and priority species from the area, adjustments to commuting routes and associated energetic costs or otherwise affecting nesting success or foraging efficiency. The *individual contributions* of the remaining turbines to the *overall* impact of the WEF will be low. The proposed development will reduce the number of turbines that require maintenance and reduce the number of moving obstacles in the landscape (such as spinning blades). The position of the proposed turbines is suitably distant from any identified nests and therefore direct disturbance to nests is unlikely. Existing data indicates that the area under consideration does not represent preferred commuting routes or foraging areas for species such as Verreaux's Eagle as indicated by the low levels of activity observed. The increase in minimum blade tip height associated by the proposed development may further reduce the effects of disturbance for avifauna foraging or hunting at lower flight heights. The reduction in disturbance associated with the proposed development will nevertheless not reduce the *overall* original impact significance rating of medium following mitigation.

6.2.2 Mortality

No change.

This impact considers fatalities of priority species resulting from collisions with turbines and power lines or the electrocution of avifauna on new power infrastructure. The overhead power line is relatively short (< 0.5 km) and is unlikely to have a significant impact on priority species following mitigation as it is located away from the flatter areas preferred by species such as Blue Crane and Ludwig's Bustard, the latter a collision prone species for which mitigation measures such as bird flight diverters are ineffective[15]. The substation is unlikely to have a significant impact on avifauna as priority species are unlikely to enter the substation yard.

The position of the remaining turbines is outside of the core territory of eagles, suitably distant from known nests and in an area where low flight activity of priority species has previously been recorded. The *individual contributions* of the remaining turbines to the *overall* impact of the WEF will therefore likely be low following mitigation. The proposed development will reduce the number of turbines and therefore reduce the number of obstacles and spinning blades on the landscape compared to the original authorisation. The proposed development will increase the rated capacity, hub height, rotor diameter and total RSA from the specifications considered in the original authorisation and studies (referenced above) have shown a positive relationship between these specifications and avifaunal mortality. However, there is a suggestion that the strength of this relationship is insufficient to offset the reduced number of larger turbines required per unit energy generation and that site-specific features should be considered to help determine the appropriate type of turbines to install in an area. As outlined above, in this instance the proposed development is preferred over the original authorisation as the reduction in the number of turbines and the increase in minimum blade tip height is likely to reduce the probability of collisions for species such as Verreaux's Eagle based on the flight behaviour observed and expected when utilising this part of the landscape. The reduction in mortality associated with the proposed development will nevertheless not reduce the *overall* original impact significance rating of medium following mitigation.

6.3 Decommission Phase

The impacts associated with the decommissioning of the WEF are unlikely to exceed those assessed for the construction phase. The proposed development will likely have a slightly reduced impact during this phase compared to the existing authorisation as fewer turbines need to be decommissioned and fewer pads need to be rehabilitated.

6.4 Cumulative Impacts

The proposed development will likely have a slightly reduced contribution to the cumulative impact of the existing and surrounding developments as each potential impact is likely to be slightly reduced from those identified for the existing authorisation.

7 EFFECT ON MITIGATION MEASURES

The proposed development presents an opportunity to prescribe updated mitigation measures from those in the original authorisation that must be implemented based on an improved understanding of impacts WEFs pose to avifauna, by defining unambiguous thresholds that trigger action.

[15] Shaw, J., Reid, T, Gibbons, B., Pretorius, M. Jenkins, A., Visagie, R., Michael, M. and Ryan, P. 2021. A large-scale experiment demonstrates that line marking reduces power line collision mortality for large terrestrial birds, but not bustards, in the Karoo, South Africa. The Condor. 10.1093/ornithapp/duaa067.

Steps should be taken to ensure that Verreaux's Eagle's primary prey (i.e. Rock Hyrax), does not become more abundant as a result of the wind farm construction, by ensuring that excavated rocks are removed from site, and any animal carcasses found on site should be promptly removed.

An additional post-construction carcass searching programme covering the turbines considered by this assessment must be implemented immediately upon commissioning of the turbines.

A threshold of zero Verreaux's Eagle and Martial Eagle fatalities associated with the turbines considered by the assessment must be adopted. Should it be reasonably determined that one or more fatalities of these species can be attributed to turbine collision then the operation of the turbine(s) responsible must be halted until additional mitigation measures such as observer and/or radar assisted shut-down-on-demand, blade painting (or any future appropriate mitigation measures that may be available at the time) are implemented. Only once additional mitigation measures are implemented can the operation of the turbine responsible be resumed.

All spans of overhead power lines to be constructed require the installation of appropriate markings or bird flight diverters to reduce the probability of collisions occurring.

All pylons associated with overhead power lines must be of a bird-friendly design that incorporates suitable perches to reduce the probability of electrocutions occurring.

8 EFFECT ON CURRENT ENVIRONMENTAL AUTHORISATION CONDITIONS

An additional post-construction carcass searching programme covering the turbines considered by this assessment must be implemented immediately upon commissioning of the turbines (i.e. when blades start spinning) to determine their realised impacts and for potential mitigation implementation.

The Environmental Authorisation must include a condition that mitigation measures such as observer and/or radar assisted shut-down-on-demand and blade painting (or any future appropriate mitigation measures that may be available at the time) must be implemented should fatalities exceed threshold levels of zero Verreaux's Eagle or Martial Eagle fatalities.

The Environmental Authorisation must include a condition that if a Verreaux's Eagle or Martial Eagle fatality is located and the cause of the mortality can reasonably be attributed to a turbine, then that turbine must cease operation until appropriate mitigation measures are implemented, following which the operation of that turbine can be resumed.

9 ADVANTAGES AND DISADVANTAGES OF THE PROPOSED DEVELOPMENT

The advantages of the proposed development include a reduction in the number of turbines to be constructed and a reduction in the number of spinning blades and obstacles on the landscape compared to the existing authorisation. The increase in hub height and particularly the associated increase in minimum blade tip height are also considered to be advantages when compared to the existing authorisation, as the observed and expected flight behaviour of Verreaux's Eagle in this area is primarily low-level flight while hunting for Rock Hyrax. A further advantage is associated with the reduction in the number of turbines to be construction which includes a reduction in the area of disturbance and clearing required for turbine bases, pads and temporary laydown areas.

The disadvantages of the proposed development include an increase in total RSA and increase in maximum blade tip height over the specifications included in the original authorisation. However, the site-specific context of the proposed turbine locations in relation to the topology of the area and the utilisation of the area by avifauna, particularly

Verreaux's Eagle, suggests that the advantages are likely to outweigh the disadvantages in this instance.

10 CONCLUSION

The proposed development is unlikely to result in an increase the overall impact significance to avifauna identified by the existing authorisation. The proposed development may reduce the probability and/or severity of the impacts identified in the original authorisation, however the degree to which the impacts may be reduced is insufficient to reduce the existing impact significance ratings.

Therefore from an avifaunal perspective the proposed development considered by this assessment **can proceed** without unacceptable impacts to avifauna, provided mitigation measures are adhered to.

APPENDIX A – SITE SENSITIVITY VERIFICATION

TERRESTRIAL ANIMAL (AVIAN) SPECIES SITE SENSITIVITY VERIFICATION REPORT

for the

PROPOSED NOBLESFONTEIN WIND ENERGY FACILITY EXPANSION, NORTHERN PROVINCE

The National Gazette, No. 43110 of 20 March, 2020: "National Environmental Management Act (107/1998) Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of sections 24 (5) (a) and (h) and 44 of the Act ('the Regulations'), when applying for Environmental Authorisation" includes the requirement that a Site Sensitivity Verification must be produced. The outcome of the Initial Site Sensitivity must be provided in a report format which:

a) Confirms or dispute the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;

b) Contains a motivation and evidence of either the verified or different use of the land and environmental sensitivity; and

c) Is submitted together with the relevant reports prepared in accordance with the requirements of the Environmental Impact Assessment Regulations, 2014 as amended.

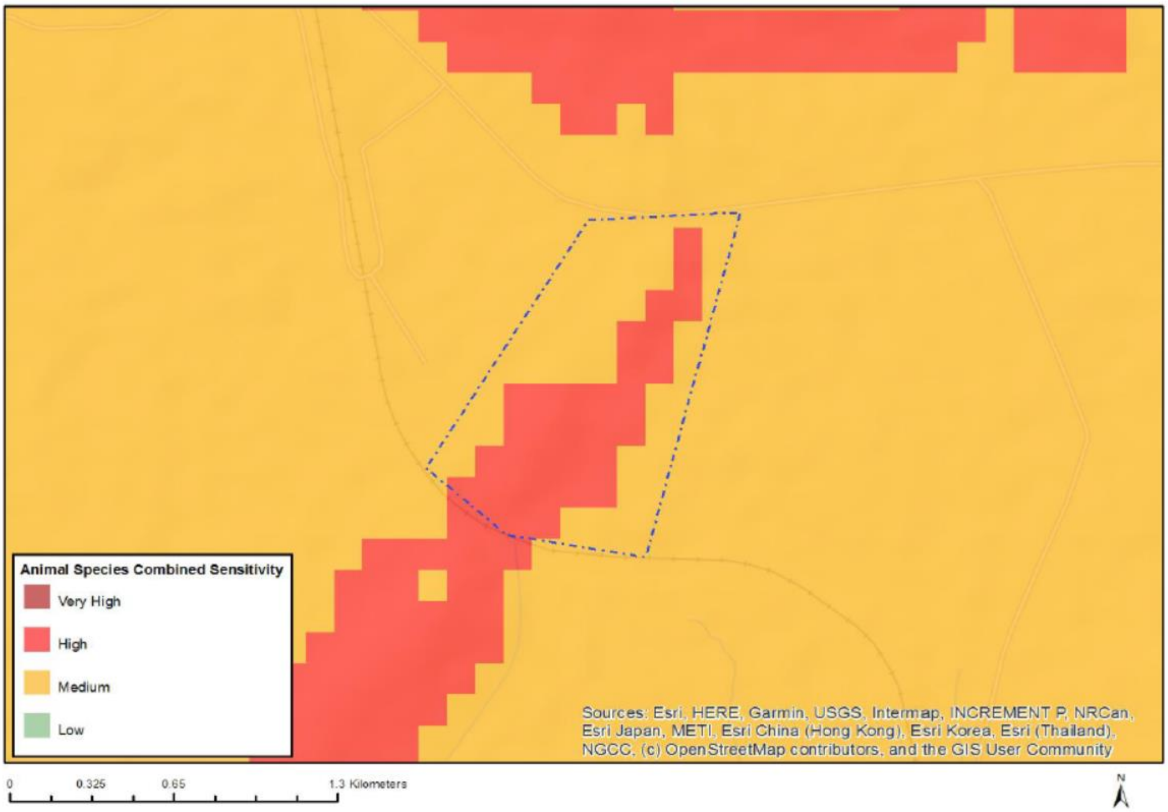
This initial site sensitivity report is produced to consider the **animal theme, specifically to address the avifauna**, and to address the requirements of a) to c) above.

Initial Site Verification

Based on the DFFE screening tool report[1], the Noblesfontein WEF development footprint contains areas of high sensitivity due to the presence of Verreaux's Eagle in the immediate area (Figure 1).

[1] https://screening.environment.gov.za/

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Sensitivity	Feature(s)
High	Aves-Aquila verreauxii
Medium	Mammalia-Bunolagus monticularis
Medium	Aves-Neotis ludwigii

The baseline environment for birds at the proposed development site was defined utilising a desktop study of the relevant pre-construction impact assessment [2] of the operational Noblesfontein Wind Energy Facility ("WEF"). This information was examined to determine the existing impacts to birds, including their potential habitats, which may be sensitive to the proposed Noblesfontein WEF Development.

Outcome of the Initial Site Verification

The impacts identified in the assessment included Disturbance and Habitat Loss during the construction phase, and Disturbance and Mortality (Collision) during the operational phase. All impacts were listed as "Medium-High" before mitigation and "Medium" after mitigation, with the exception of Disturbance during the construction phase, which was listed as "Medium" both before and after mitigation. Additionally, it was noted that the areas surrounding the locations or habitats most frequently used by Verreaux's Eagles (*Aquila verreauxii*) and Martial Eagles (*Polemaetus bellicosus*) should be considered as being highly sensitive. Additionally, a site visit was conducted in March 2021 to assist the avifaunal specialist to confirm the areas of sensitivity identified by the DFFE screening tool report and the relevant assessment of the operational Noblesfontein WEF.

In the specialist's opinion, the high sensitivity rating identified by the DFFE screening tool report is largely in line with the initial findings, with particular relevance to the Verreaux's Eagle, as illustrated in the original pre-construction impact assessment report. However, by implementing appropriate mitigation measures, the overall sensitivity for the general bird community on site can be regarded as medium. This was also confirmed by the site visit, whereby it was determined that

[2] Avisense Consulting (2012). Karoo Renewable Energy Facility. Avian Impact Assessment

the area is still likely to be considered as having a high sensitivity for Verreaux's Eagles (due to the observation of suitable habitat, prey sources and nesting individuals), but is unlikely to be of a significant concern for other priority species occurring in the area, due to minimal nesting locations and bird observations being observed in the development footprint. As such, it is not foreseen for the relevant impact ratings, as previously identified, to change during the new Basic Assessment process. The environmental sensitivity input assumed will be taken forward and considered in an avifauna impact assessment report and appropriate layout and development restrictions can be implemented as required.

It must also be noted that the DFFE screening tool report identified the avifauna (wind) theme as low sensitivity and based on the protocol, no reporting is required as the proposed development will be less than 20 MW. This is disputed by the specialist and should rather be a high sensitivity. The reporting will therefore consider the terrestrial animal species specialist assessment and will follow the requirements of Appendix 6 of the Environmental Impact Assessment Regulations, as promulgated.

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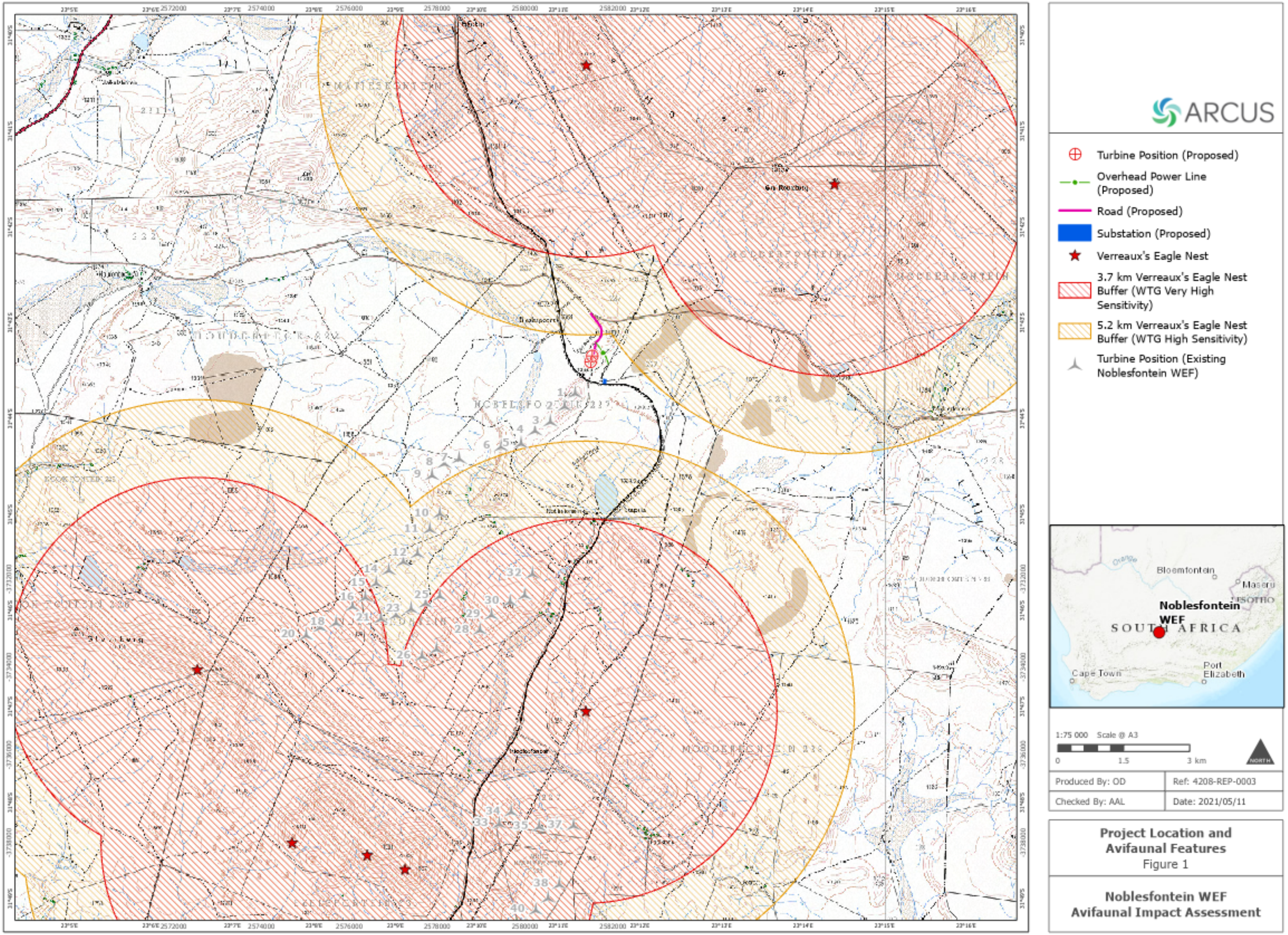

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