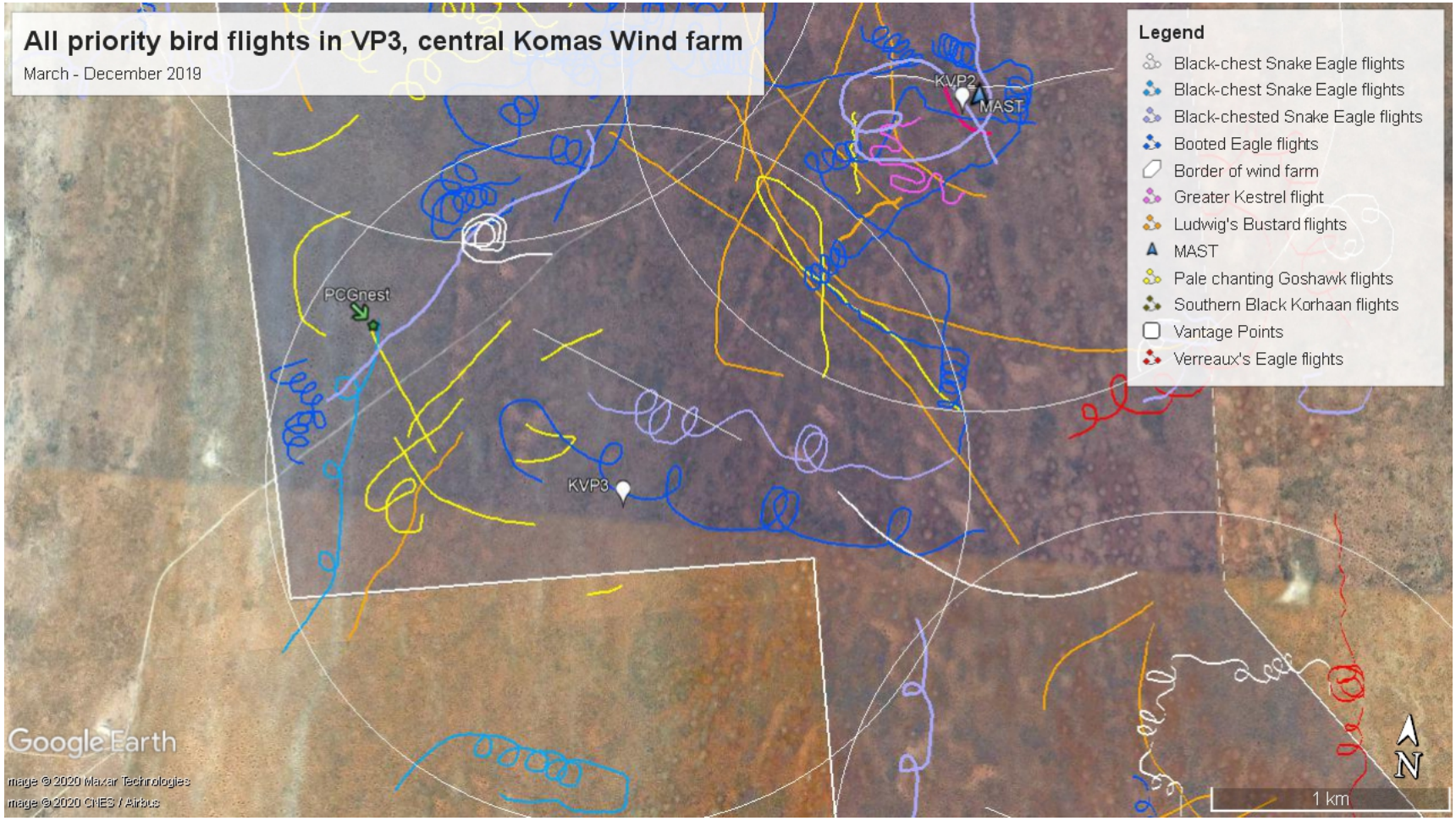


Figure 9: All priority bird flights in VP3 (KVP3 = white balloon) in the central section of the proposed Komas WEF site. Priority species flights were dominated here by *Vulnerable* Ludwig's Bustards (= orange lines) and *Least Concern* snake eagles (= pale blue and white lines), Booted Eagles (= dark blue lines) and Pale Chanting Goshawks (= yellow lines), with an active Chanting Goshawk nest in the north-west of the 1.5 km view shed (= white circle). The overall Passage Rate of these species in VP3 was medium-high at 0.38 birds/hour.

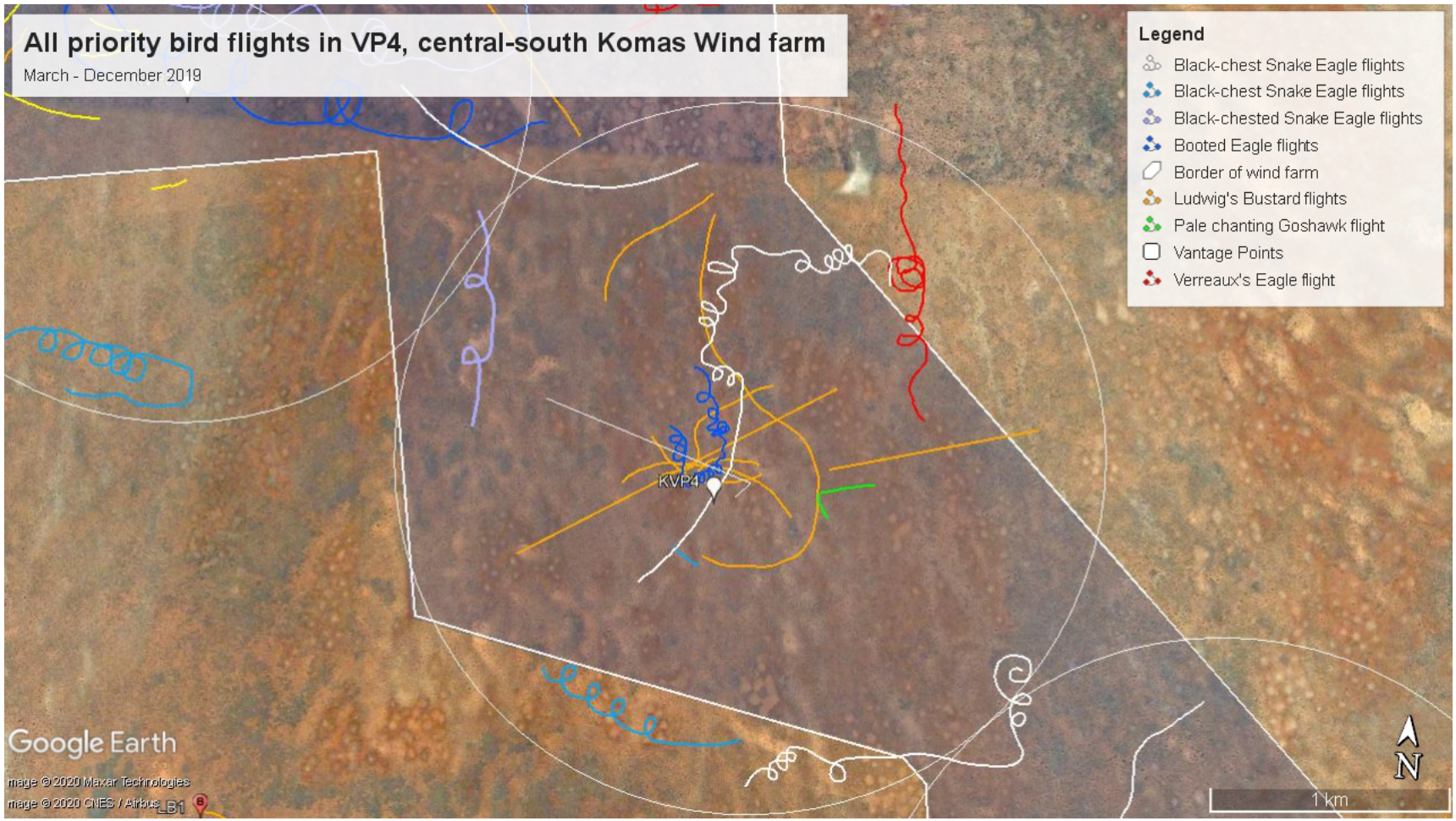


Figure 10: All priority bird flights in VP4 (KVP4 = white balloon) in the central-south section of the proposed Komas WEF site. Our Vantage Point on high ground is shown. Priority species flights were again dominated by *Vulnerable* Ludwig's Bustards (= orange lines) and *Least Concern* Black-chested Snake Eagles (= pale blue and white lines). *Vulnerable* Verreaux's Eagles (= red lines) ventured once into this area. Pale Chanting Goshawks were infrequent visitors (= green line). The overall Passage Rate of these species was medium at 0.30 birds/hour and dominated by the bustards (0.17 birds/hour).

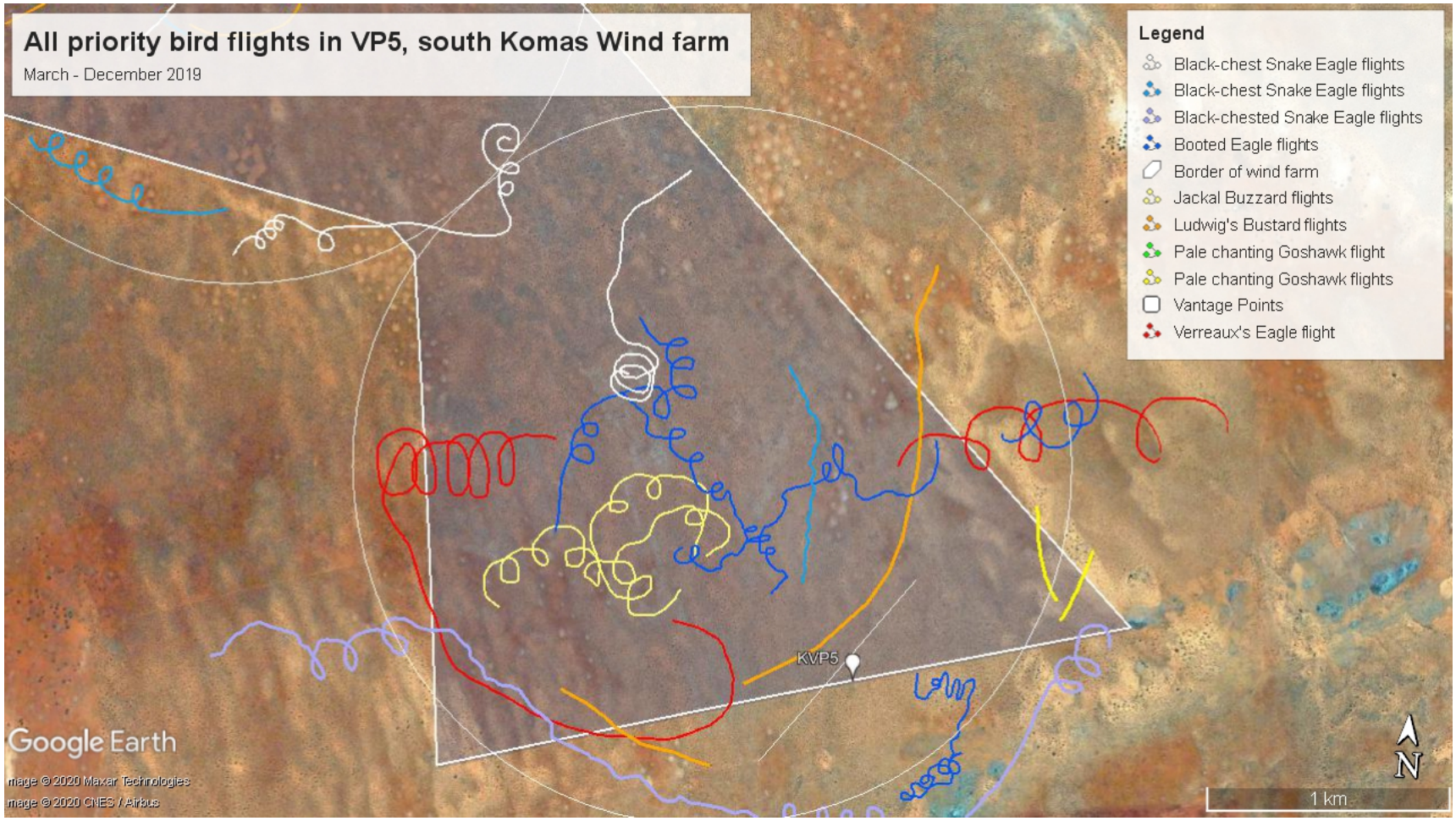


Figure 11: All priority bird flights in VP5 in the most-southern section of the proposed Komas WEF site. Our Vantage Point on high ground is shown (KVP5 = white balloon). Priority species flights were dominated by *Least Concern* Black-chested Snake Eagles (= pale blue and white lines). *Vulnerable* Ludwig's Bustards (= orange lines) and *Vulnerable* Verreaux's Eagles (= red lines) were also present in this area together with Jackal Buzzards (= pale yellow line). The overall Passage Rate of these species was medium at 0.33 birds/hour with no species dominating.

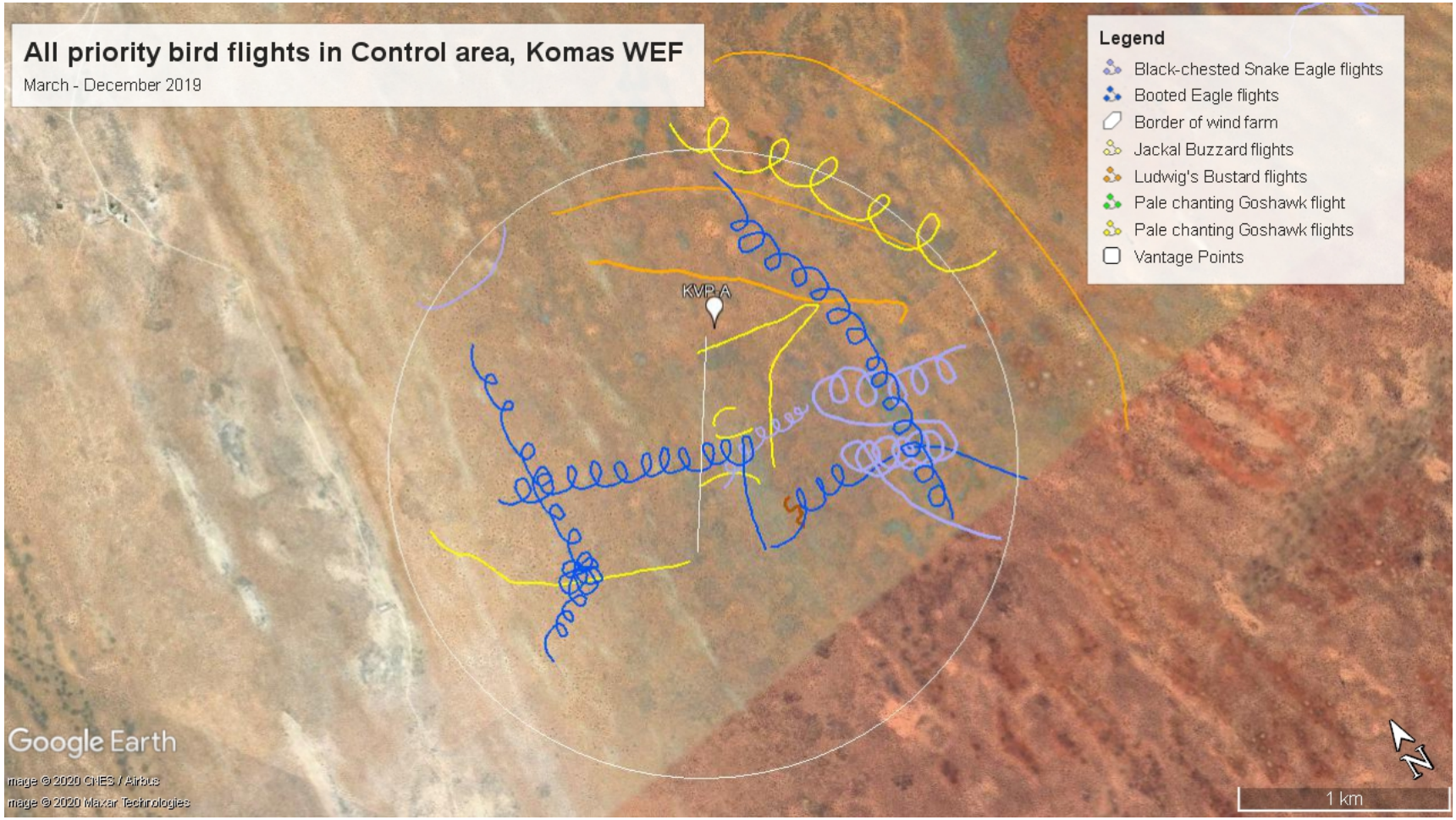


Figure 12: All priority bird flights in the Control site south-west of the proposed Komas WEF site. Our Vantage Point on high ground is shown (KVPA = white balloon). Priority species flights were dominated by *Least Concern* Black-chested Snake Eagles (= pale blue lines). *Vulnerable* Ludwig's Bustards (=orange lines) were also present in this area together with Jackal Buzzards (= pale yellow line). The overall Passage Rate of these species was medium at 0.28 birds/hour with no species dominating.

6.4 Flying heights, paths and risks

Flying heights are possibly a better estimate than Passage Rates of the risk that the collision-prone species face on site (Whitfield & Madders 2006, Band et al. 2007). This arises because any species spending large proportions of time at the rotor-swept heights of 100-m to 300-m (200-m HH with 100-m blades) is more likely to be at risk of being hit by turbine blades, than those passing at low (or high) altitudes (Smallwood et al. 2009). By recording flight-height every 15-seconds for focal birds, we determined the proportion of time spent in the rotor-swept zone by all Red Data species, as a gauge of risk.

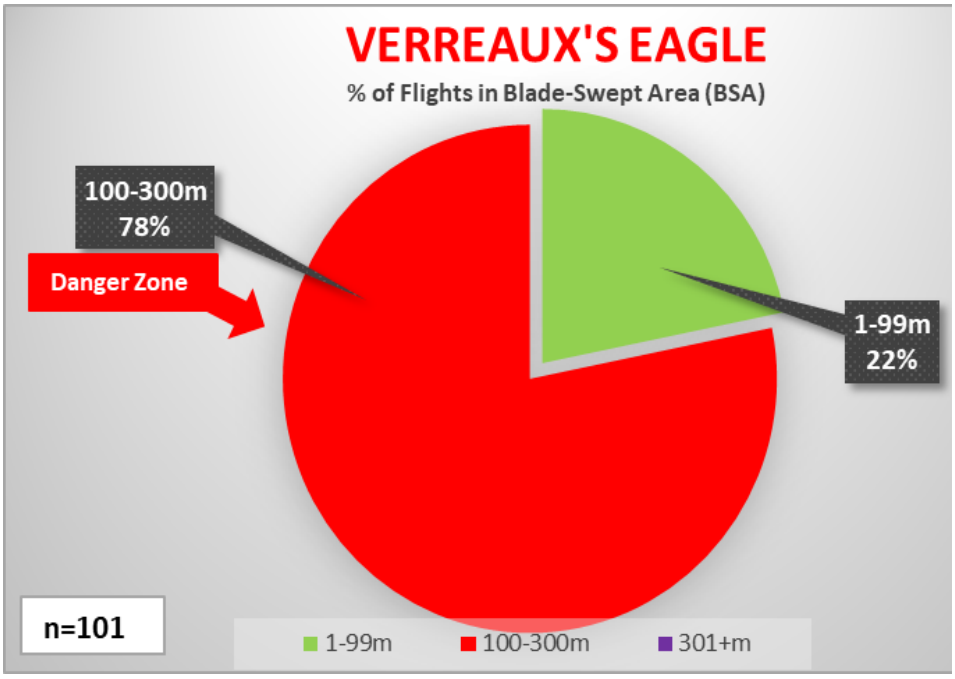


Figure 13: Flying heights of the two main Red Data species (Verreaux's Eagle and Ludwig's Bustards) present in the proposed Komas WEF area.

The eagles flew for 78% of the time in the blade-swept "Danger Zone" (BSA) of 100m–300m for the turbines, with 200-m HH. Data were collected throughout the year – March to Dec 2019 – comprising 25 minutes of observation.

The flight heights recorded (Figures 13) indicate that where Verreaux's Eagles occur in the wind farm site they are potentially at risk for 78% of their flights. No other Red Data species was at risk so often.

Vulnerable Ludwig's Bustards (Photo 4 below) were never seen to fly within the BSA in 155 observations (for 39 minutes of observation). The maximum heights recorded were 40-m, with the majority at 10-20-m, well below the lower tip height of 100-m.

Photo 4: For the more numerous Ludwig's Bustard no flights of the 155 focal samples were above 40-m, and most were between 10 and 20-m in height in the Komas wind farm site.

This suggests that these Red Data species would not face the same dangers from tall turbines as the eagles and may be relatively immune from impacts with turbine blades.

For Black-chested Snake Eagles, flight risk was low at 40% (Figure 14). Booted Eagles would also be at risk over 60% of the time when they are flying in the WEF (Figure 15).

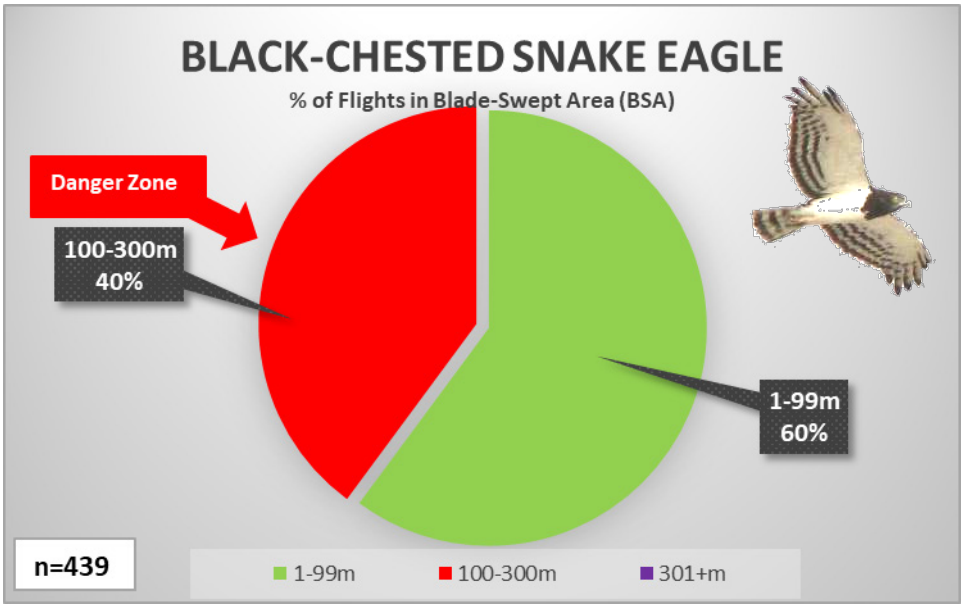
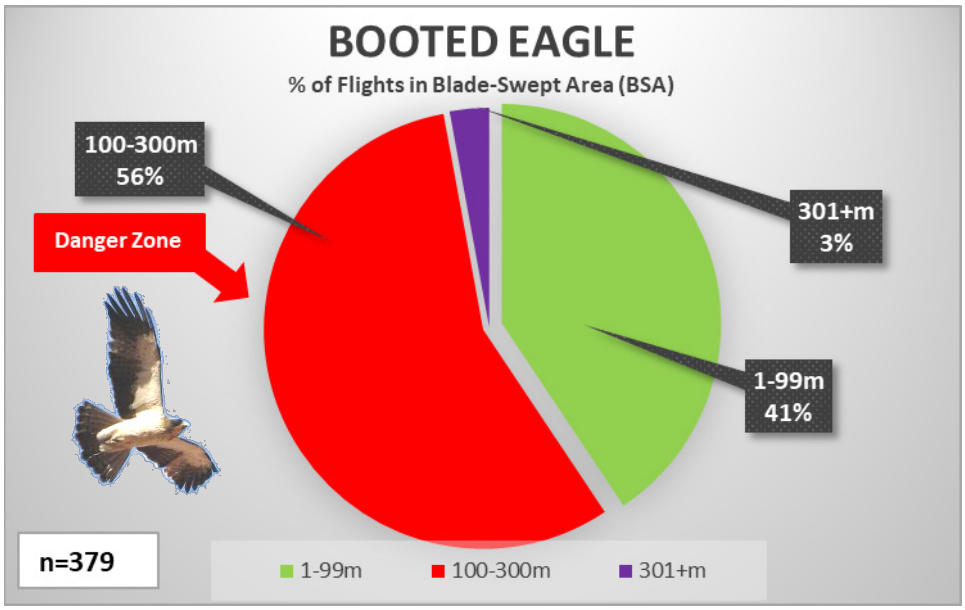


Figure 14: Flying heights of the Black-chested Snake Eagle (left) present in the proposed Komas WEF area. The eagles flew in the blade-swept "Danger Zone" of 100m–300m, 40% of the time. Data were collected throughout the year – March to December 2019 comprising 110 minutes of observation.

Figure 15: Flying heights of the Booted Eagles present in the proposed Komas WEF area. The eagles flew almost 56% of the time in the blade-swept "Danger Zone" of 100m–300m. Data comprised 95 minutes of observation.



These two measures of risk (Passage Rate and proportion of flight within the blade swept area) allow us to determine high- and medium-risk areas based on the frequency of flights for the most at-risk species.

There were four avian risk areas identified in Figure 16:

- **High risk** (red) – There were no areas where two Red Data species overlapped or where numerous flights of any one Red Data species occurred. Where this occurred for Ludwig's Bustards we down-graded them to medium-risk (below) because in the Komas site they never flew within the blade swept area (BSA). **So, there are no high-risk areas identified in the proposed Komas WEF site.**

- **Medium-risk** (orange) – Five areas arose from the overlap of two or more non-threatened priority species, particularly the Black-chested Snake Eagles and Booted Eagles throughout the proposed Komas WEF site. Areas where a low frequency of flights of Red Data Verreaux's Eagles, or flights of Ludwig's Bustards occurred were included as medium-risk because these Red Data species were either infrequently recorded (the eagles) or were never recorded flying in the blade swept area (Ludwig's Bustard).

These are not No-Go areas but, if developed, would require the mitigation measures described below.

The medium-risk areas cover approximately 10.3-km^2 of the 27-km^2 proposed wind farm, or 38% of the entire area.

<u>Important note:</u> The current updated turbine layout avoids the areas identified as medium-risk in the Avifauna Impact Assessment (Figure 17).

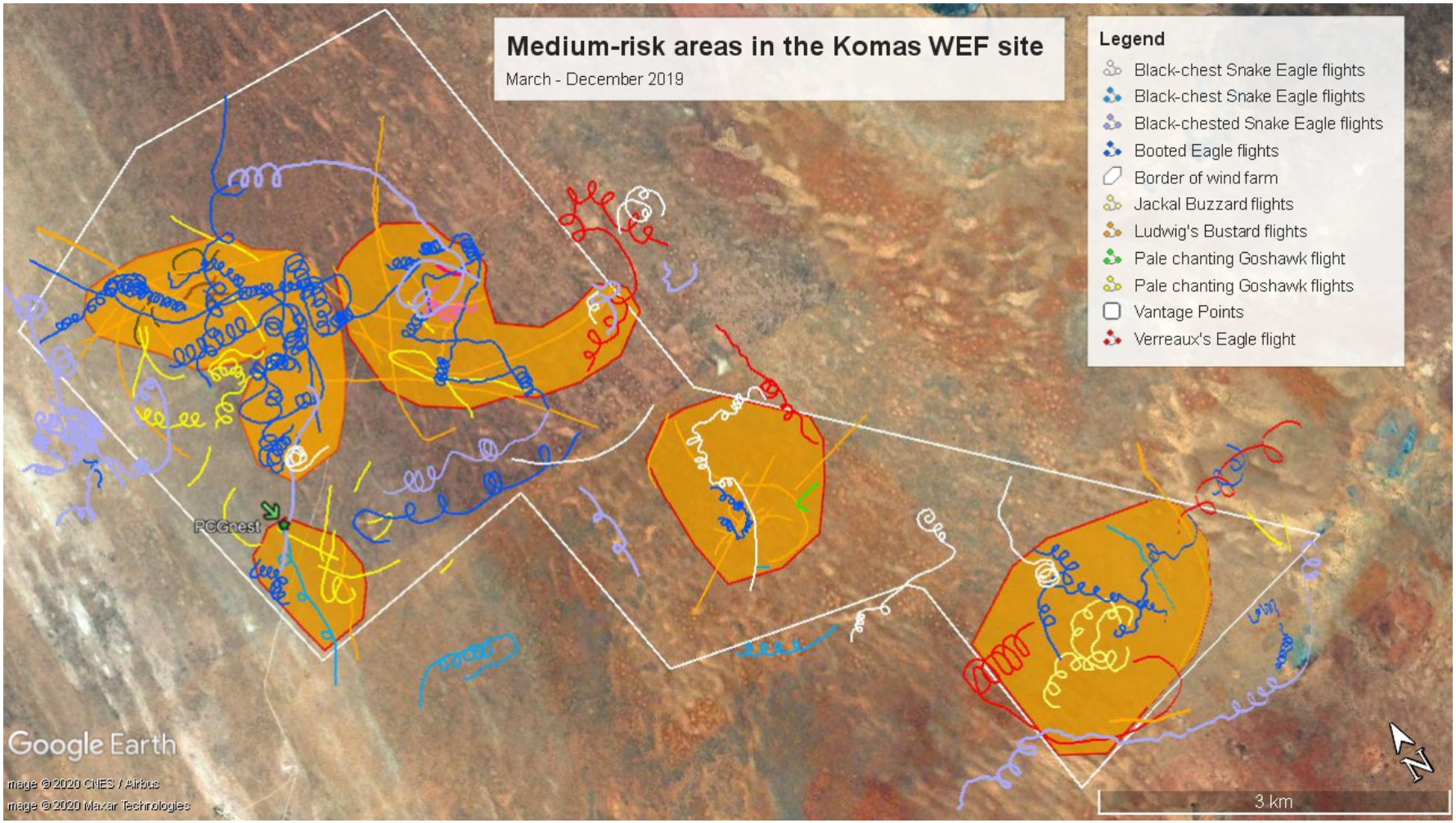


Figure 16: All medium-risk areas for birds in the proposed Komas wind farm site. Medium-risk areas (= orange polygons) are areas of overlap of two or more non-threatened priority species (typically Snake eagles and Booted eagles). Some areas where Red Data Ludwig's Bustards (= orange lines) or Verreaux's Eagles (= red lines) occurred were also designated as medium-risk because either no flights occurred in the blade swept area (Ludwig's Bustards) or flights were infrequent (Verreaux's Eagle). The Passage Rates for all Priority species was highest in the top north-west corner at 0.72 birds/hour (of five priority species). All other areas supported Passage Rates of 0.30 to 0.38 birds/hour.

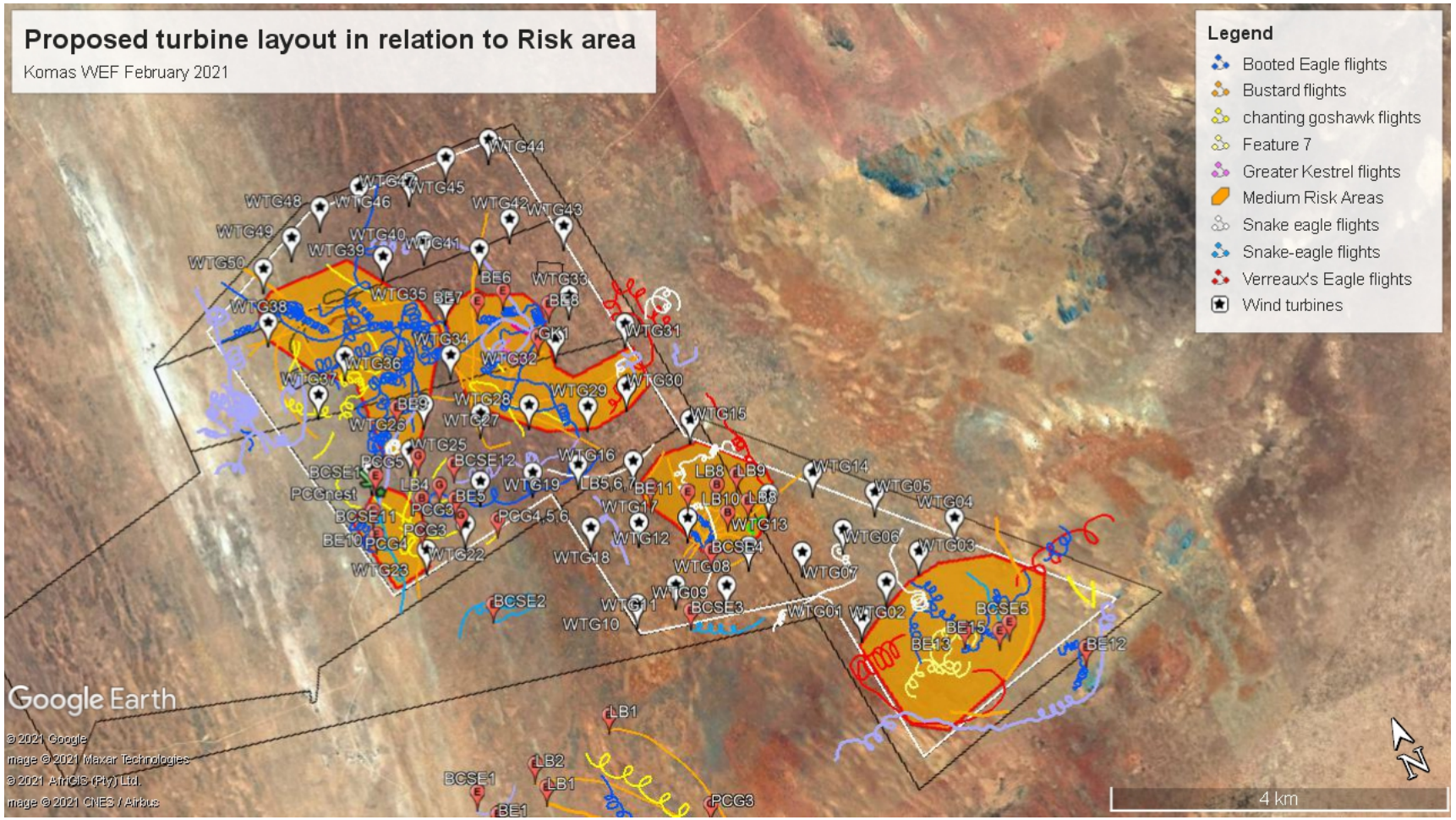


Figure 17: The proposed turbine layout (white pins) in relation to the medium-risk areas (= orange polygons) for birds in the proposed Komas wind farm in January 2021. No turbines occur within the medium-risk areas.

7. ASSESSMENT OF THE IMPACTS

7.1 CSIR ASSESSMENT METHODOLOGY

Below, is the CSIR assessment methodology that was used to assess the potential impacts to avifauna and the significance thereof.

The impact assessment includes:

- the nature, significance and consequences of the impact and risk;
- the extent and duration of the impact and risk;
- the probability of the impact and risk occurring;
- the degree to which impacts and risks can be mitigated;
- the degree to which the impacts and risks can be reversed; and
- the degree to which the impacts and risks can cause loss of irreplaceable resources.

As per the DEFFT Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

The impact assessment methodology includes the following aspects:

- Nature of impact/risk - The type of effect that a proposed activity will have on the environment.

- Status - Whether the impact/risk on the overall environment will be:
    - Positive - environment overall will benefit from the impact/risk;
    - Negative - environment overall will be adversely affected by the impact/risk; or
    - Neutral - environment overall not be affected.

- Spatial extent – The size of the area that will be affected by the impact/risk:
    - Site specific;
    - Local (<10 km from site);
    - Regional (<100 km of site);
    - National; or
    - International (e.g. Greenhouse Gas emissions or migrant birds).

- Duration – The timeframe during which the impact/risk will be experienced:
    - Very short term (instantaneous);
    - Short term (less than 1 year);
    - Medium term (1 to 10 years);

- Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or
- Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).

- Consequence – The anticipated consequence of the risk/impact:
  - Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);
  - Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or
  - Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).

- Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):
  - High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);
  - Moderate reversibility of impacts;
  - Low reversibility of impacts; or
  - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).

- Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):
  - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);
  - Moderate irreplaceability of resources;
  - Low irreplaceability of resources; or
  - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Using the criteria above, the impacts have been further assessed in terms of the following:

- Probability – The probability of the impact/risk occurring:
  - Extremely unlikely (little to no chance of occurring);
  - Very unlikely (<30% chance of occurring);
  - Unlikely (30-50% chance of occurring)
  - Likely (51 – 90% chance of occurring); or
  - Very Likely (>90% chance of occurring regardless of prevention measures).

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure 18).

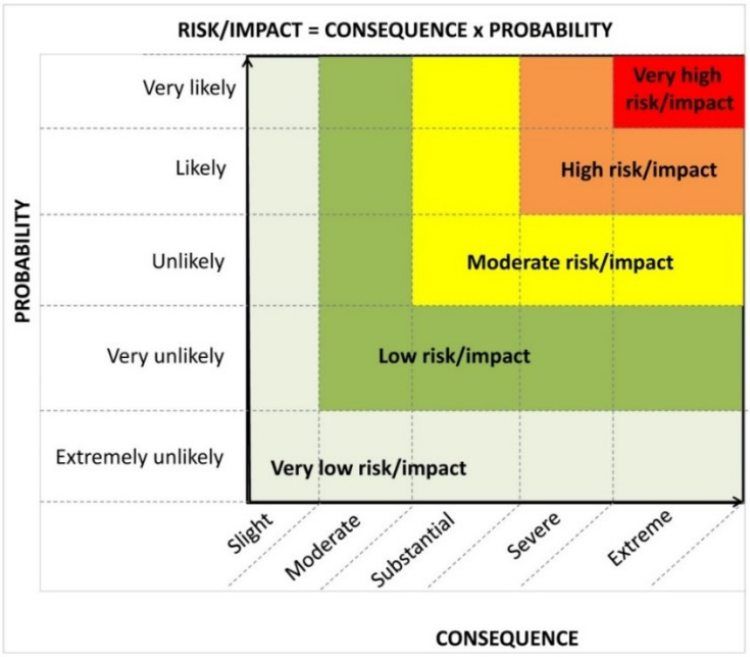


Figure 18. Guide to assessing risk/impact significance as a result of consequence and probability.

- Significance – Will the impact cause a notable alteration of the environment?
    - Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
    - Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
    - Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);
    - High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and
    - Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- Very low = 5;
- Low = 4;
- Moderate = 3;
- High = 2; and
- Very high = 1.

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- Low;
- Medium; or
- High.

7.2 Assessment of impacts to avifauna at the proposed Komas WEF development site during construction, operation and decommissioning phases:

7.2.1 Construction Phase

Nature: Negative due to direct disturbance and loss of foraging habitat around the proposed Komas WEF site for the Red-listed bird groups identified as at risk above.

- The Verreaux's Eagle, Ludwig's Bustard, Booted Eagle and Black-chested Snake Eagle (**VE, LB, BE, BCSE**) recorded on the proposed Komas WEF site are the species most likely to be impacted because of their high likelihood of occurrence and proportion of flights at BSA.

Mitigation for WEF site: Construction

- Mitigate in all medium-risk areas shown in Figure 16, (that is, either add black-blade or shut-down on demand to the turbines in these areas or remove turbines from these areas)

Some of the proposed mitigations above will require further data regarding which turbines are responsible for most avifauna fatalities.

Thus, we recommended that:

(i) Genesis ENERTRAG Komas (Pty) Ltd or the developer implement construction-phase monitoring

7.2.2 Operational Phase

Nature: Negative due to direct impact fatalities caused by avifauna colliding with wind turbines, disturbance and loss of foraging habitat around the proposed Komas WEF site for the Red-listed bird groups identified as at risk above.

The Verreaux's Eagle, Jackal Buzzard and Black-chested Snake Eagle (VE, JB, BCSE) recorded on the proposed Komas WEF site are the raptors species most likely to be impacted because of their high likelihood of occurrence and high proportion of flights at BSA.

Mitigation for WEF site: Operational

- Position the turbines away from all medium-risk shown in Figure 16;
- If turbines are positioned within the medium-risk areas and they are found to kill any Red Data birds either the turbines must be erected with an automatic shut-down on demand system (DT-bird or similar) or they should be erected with a single blade painted black (or with signal red paint) to increase visibility for eagles and other raptors (May et al. 2020). This is subject to CAA approval.
- These mitigations are not necessary for turbines outside the medium-risk areas; however, should specific turbines be found to kill birds (> 1 red data species per year) in the post-construction surveys then these mitigations must be retrospectively applied.

Some of the proposed mitigations above will require further data regarding which turbines are responsible for most avifauna fatalities. Thus, we recommended that: (i) Genesis ENERTRAG Komas (Pty) Ltd implement construction 12-24 months' post-construction monitoring to assess the mortality of birds in the wind farm, through direct observation and carcass searches. This will assist in determining where individual turbine-specific mitigation measures are required to be implemented.
Residual impacts: After mitigation, direct mortality through collision, or area avoidance, by the species identified above may still occur and further research and mitigation measures must be implemented in the case of Red Data species. This can only be undertaken in conjunction with the systematic monitoring programme suggested.

7.2.3 Decommissioning Phase

Nature: Negative due to direct disturbance and loss of foraging habitat around the proposed Komas WEF site for the Red-listed bird groups identified as at risk above.

The Verreaux's Eagle, Jackal Buzzard and Black-chested Snake Eagle (VE, JB, BCSE) recorded on the WEF site are the raptors species most likely to be impacted because of their high likelihood of occurrence.

Mitigation for WEF site: Decommissioning phase: Reduce degree of disturbance and length of disturbance to a minimum during sensitive breeding periods. Habitat can be rehabilitated to its former attractiveness (from a prey point of view) for the raptors. The lack of disturbance should bring the raptors back. We recommended that: Genesis ENERTRAG Komas (Pty) Ltd and implement de-construction-phase monitoring to assess the effects of rehabilitating the wind farm, through direct observation.

7.2.4 Cumulative impacts

Nature: The impact of the Komas WEF proposed in the coastal Succulent Karoo is expected to be negative and arise from disturbance, displacement and collision of birds associated with the wind turbines. The direct potential impact of the nine wind farms (Table 6) was gauged using data released in 2020 by Birdlife South Africa for fatalities at eight wind farms in South Africa (Perold et al. 2020).

Between 4.1 and 4.6 birds per turbine per year, or 2.0 $\pm$ 1.3 birds per MW per year are killed annually. Using the mortality rate of 2.0 birds/MW/year we estimate, that if a total of 1412.7 MW (wind) is generated per year from all wind farms within 50-km, then a minimum **of 2 825 birds**, could be killed annually, of which 36% (1 017 raptors) are likely to be raptors. Since about 20% of these raptors are threatened Red Data species, about **203 threatened raptors are estimated to be killed** (above). Thus, the likely impact varies from medium without mitigation – careful mitigation can reduce this to low levels.

Confidence in findings:

Medium-Low: the mortality data released by Birdlife South Africa allows for the estimation only of the probable mortality, but they may over-estimate avian mortality rates in the dry conditions typical in the western part of South Africa. Passage Rates and occurrence of Collision-prone species are typically low when annual rainfall is low, and mortality is thus expected to fluctuate with weather conditions and increase at times of high rainfall. The mitigation measures suggested to avoid major raptor fatalities is unknown for each of the wind farms in the Cumulative Assessment. Without mitigation measures (i.e. the avoidance of high-use and high-risk areas) the chances of mortality will increase greatly.

Mitigation:

Reducing avian impacts at WEFs is in its infancy in South Africa. Although not enforceable on the applicant, generally recommended measures include (but have to be tailored for the individual wind farms):

- avoiding all migration routes and major flyways in the placement of such facilities;
- Mitigate appropriately if the medium-risk areas at the proposed Komas WEF site are to be developed as below (these are not necessary if turbines avoid all medium-risk areas)
- for each turbine, include shut-down-on-demand or paint one turbine blade black (or signal red) to increase visibility and reduce raptor impacts; (the black-blade is subject to CAA approval)
- mitigations must be tested for efficacy if fatalities exceed one Red Data fatality per year at any turbine.
- employ radar or video detection of collision-prone birds and audible or visual deterrence to deter birds from approaching close to the turbines (both are quite expensive);

We searched for data to populate the Cumulative Impacts table from published and unpublished studies and theses. We sourced data from:

(i) post-construction wind farm data from avian assessments summarised by Birdlife South Africa from 1-2 years' post-construction monitoring (Ralston et al. 2017) (Table 6); and

(ii) Visser et al. (2019) for the only solar-avian fatality assessment from South Africa.

Table 6: Summary of all birds and Red Data raptors killed at six wind farms in South Africa from 2014–2016. From Birdlife South Africa (Perold et al. 2020). The identities of the wind farms were kept anonymous as a condition for the use of the data.

Wind farms	Turbines	Months monitored	Avian fatalities	Adjusted mortality rate*	Adjusted mortality rate*
20	Up to 60	12	848	4.6 birds.turbine^{-1}year^{-1}	2.0 birds.MW^{-1}yeat^{-1}
Main groups		Proportion of all avian fatalities		Ranking	
Raptors (small-medium)		**33%**		1	
Raptors (eagles)		**3%**		6	
Others/unknown		16%		2	
Swifts, swallow and martins		14%		3	
Passerine (small perching birds)		14%		3	
Waders and wetland birds		10%		5	
Red Data raptors as a proportion of all raptors killed		12/61 = **19.7%**			

The national review of post-construction data (Table 6), including data from Western Cape wind farms, indicates that:

- South African wind farms kill about 4.6 birds per turbine per year, similar to the international mean of about 5.25 birds per turbine per year (see Review (Point 5) above).
- Of concern is that 36% of the South African fatalities recorded are raptors (Table 6).
- The equivalent number of fatalities per Megawatt is 2.0 $\pm$ 1.3 birds/MW per year (Perold et al. 2020). Using the average value of **2.0 bird fatalities per MW per year** we can calculate the number of birds likely to be killed per megawatt. Note that this may be a slightly inflated figure because some early wind farms in South Africa did not have stringent mitigation measures, appropriate buffers and sensitive siting of turbines. However, its similarity to internationally derived mortality rates (Loss et al. 2013, Sovacool 2013) implies it is probably robust.
- For solar PV sites the equivalent fatality estimates (based on one farm) was **4.5 birds per MW per year** (Visser et al. 2019).

Table 7. A quantification of impacts to the eight priority species and three main, collision-prone Red Data species likely to be impacted by the proposed Komas WEF during the construction, operational and decommissioning phases and the cumulative impacts

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
AVIFAUNA															
CONSTRUCTION PHASE: Direct impacts															
Operational activities	Direct disturbance and loss of foraging habitat around the proposed Komas WEF site for the priority bird groups identified on site (Verreaux's Eagle, Jackal Buzzard Ludwig Bustard, Booted Eagle and Black-chested Snake Eagle).	Negative	Local	Long-Term	Substantial	Very likely	High	Low	Moderate	No	Yes	▪ If an active nest of Verreaux's Eagle is found a buffer of 3.2 km would be required during the breeding season. ▪ Dust suppression techniques must be implemented on all access roads. ▪ The developer to implement construction phase monitoring to monitor the effect of the construction itself on priority species..	Moderate	3	Medium

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
OPERATIONAL PHASE: Direct impacts															
Operational activities	Fatalities caused by avifauna colliding with wind turbines, disturbance and loss of foraging habitat around the proposed Komas WEF site for the Red-listed and priority bird groups identified as at risk. Outside the wind farm birds may be electrocuted or hit by the internal 33 kV overhead power lines, or with double fences, may be entrapped between them.	Negative	Local	Long-Term	Substantial	Very likely	High	Low	Moderate-High	No	Yes	▪ If turbines are positioned within the medium-risk areas and they are found to kill any Red Data birds either the turbines must be erected with an automatic shut-down on demand system (DT-bird or similar) or a single blade should be painted black (or with signal red paint) for those select turbines to reduce impacts for eagles and other raptors (May et al. 2020); For turbines outside the medium-risk area (as presently likely) these mitigations are not necessary unless > 1 red data bird is found to be killed per year during the post-construction surveys. ▪ 12-24 months post construction monitoring to assess the mortality of birds in the Komas WEF area, through systematic and direct observation and carcass searches.	Moderate	3	Medium

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
DECOMMISSIONING PHASE: Direct impacts															
Direct Impacts															
Decom-missioning activities	Direct disturbance and loss of foraging habitat around the proposed Komas WEF site for the Red-listed bird groups identified as at risk (as noted above)	Negative	Local	Short-Term	Substantial	Very likely	High	Low	Moderate-High	No	Yes	▪ Reduce degree of disturbance and length of disturbance to a minimum during sensitive breeding seasons, but only if breeding red data species are found within 3-5 km radius from the proposed Komas WEF site. ▪ Habitat can be rehabilitated to its former attractiveness (from a prey point of view) for the raptors. ▪ The developer to implement decommissioning phase monitoring to assess the effects of rehabilitating the WEF, through direct observation.	Moderate	3	Medium

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
CUMULATIVE IMPACTS: Direct impacts															
Construction, Operation and Decom-missioning activities	Fatalities caused by collisions with the wind turbines, entrapment in the perimeter fences, collision with the internal 33 kV power lines or electrocution. Disturbance and loss of foraging habitat around the WEF site for the Red-listed bird groups due to the construction, operation and decommissioning of the WEF and associated infrastructure.	Negative	Regional	Long-Term	Severe	Very likely	Medium	Low	Moderate-High	No	Yes	▪ Although not enforceable on the applicant, all wind farms that are killing red data raptors at > 1 red individual per year should be required to implement shut down on demand or black (red) blade mitigation.	High	3	Medium-Low

7.3 Cumulative impacts

Cumulative impacts are defined as "impacts that result from incremental changes caused by either past, present or reasonably foreseeable actions together with the project" (Hyder, 1999, in Masden et al. 2010). In the case of wind farms these apply mainly to the cumulative effect on priority birds of other wind farms.

Thus, in this context, cumulative impacts are those that will impact the general avian communities in and around the proposed Komas WEF development (other wind and solar farms and associated infrastructure [especially power lines]) in the Nama Karoo. This will happen via the same impacts identified here viz: mortality due to collision with the wind turbines, avoidance and displacement. As a starting point, the number of renewable energy developments within a 50-km radius of the site needs to be determined and secondly, to know their impact on avifauna.

Given the general assumption that footprint size and bird impacts are linearly related for wind farms, a starting point in determining cumulative impacts is to determine:

- the number of birds displaced per unit area, by habitat destruction, or disturbed or displaced by human activity;
- the number of birds killed by collision with the turbine blades on site; and
- the number of birds killed by collision with infrastructure leading away from the site.

Eleven renewable energy developments within a 50-km radius of the proposed Komas site are currently proposed (Table 8 shows projects which have received EA, or which have lodged applications with DEFF, but are still in process). Nine of these are wind farms (Figure 19), and the remaining two projects are solar PV facilities. The combined energy output of the eleven "approved" or "in process" sites (with power data) is projected to be approximately 1 412.7 MW of wind energy and 85 MW of solar energy (Table 8).

Table 8: All renewable energy projects within a 50-km radius of the proposed Komas WEF site, and their approval status with the DEFF.

DEA REFERENCE NUMBER	PROJECT TITLE	APPLICANT	EAP	TECHNOLOGY	MEGAWATT	STATUS
12/12/20/2331/1 12/12/20/2331/1/AM1 12/12/20/2331/2 12/12/20/2331/3	Project Blue Wind Energy Facility Near Kleinsee within the Namakwa Magisterial District, Northern Cape Province. (Phase 1-3)	Diamond Wind (Pty) Ltd	Savannah Environmental Consultants (Pty) Ltd	Wind and Solar PV	150 MW Wind 65 MW Solar PV	Approved
12/12/20/2212	Proposed 300 MW Kleinzee WEF in the Northern Cape Province.	Eskom Holdings SOC Limited	Savannah Environmental Consultants (Pty) Ltd	Wind	300 MW	Approved
14/12/16/3/3/2/1046	The proposed Kap Vley WEF and its associated infrastructure near Kleinzee, Nama Khoi Local Municipality, Northern Cape Province.	Kap Vley Wind Farm (Pty) Ltd	Council for Scientific and Industrial Research	Wind	300 MW	Approved
14/12/16/3/3/1/1971	Proposed Namas Wind Farm near Kleinsee, Namakwaland Magisterial District, Northern Cape.	Genesis Namas Wind (Pty) Ltd	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW	Approved
14/12/16/3/3/1/1970	Proposed Zonnequa Wind Farm near Kleinsee, Namakwaland Magisterial District, Northern Cape.	Genesis Zonnequa Wind (Pty) Ltd	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW	Approved
12/12/20/2154	Proposed construction of the 7.2 MW Koingnaas Wind Energy Facility Within The De Beers Mining Area on the Farm Koingnaas 745 near Koingnaas, Northern Cape Province.	Just PalmTree Power Pty Ltd	Savannah Environmental Consultants (Pty) Ltd	Wind	7.2 MW	Approved
12/12/20/1807	Proposed establishment of the Kannikwa Vlakte wind farm.	Kannikwa Vlakte Wind Development Company Pty Ltd	Galago Environmental cc	Wind	120 MW	Approved

DEA REFERENCE NUMBER	PROJECT TITLE	APPLICANT	EAP	TECHNOLOGY	MEGAWATT	STATUS
12/12/20/1721 12/12/20/1721/AM1 12/12/20/1721/AM2 12/12/20/1721/AM3 12/12/20/1721/AM4 12/12/20/1721/AM5	The proposed Springbok Wind Energy facility near Springbok, Northern Cape Province.	Mulilo Springbok Wind Power (Pty) Ltd	Holland & Associates Environmental Consultants	Wind	55.5 MW	Approved
TBA	The proposed Gromis WEF and associated infrastructure near Kleinsee in the Northern Cape Province.	Genesis ENERTRAG Gromis Wind (Pty) Ltd	Council for Scientific and Industrial Research	Wind	200 MW	In process
14/12/16/3/3/1/416	Nigramoep Solar PV Solar Energy Facility on a site near Nababeep, Northern Cape.	South African Renewable Green Energy (Pty) Ltd	Savannah Environmental Consultants (Pty) Ltd	Solar PV	20 MW	In process
Totals	9 Wind energy projects 1412.7 MW 2 Solar energy projects 85 MW					

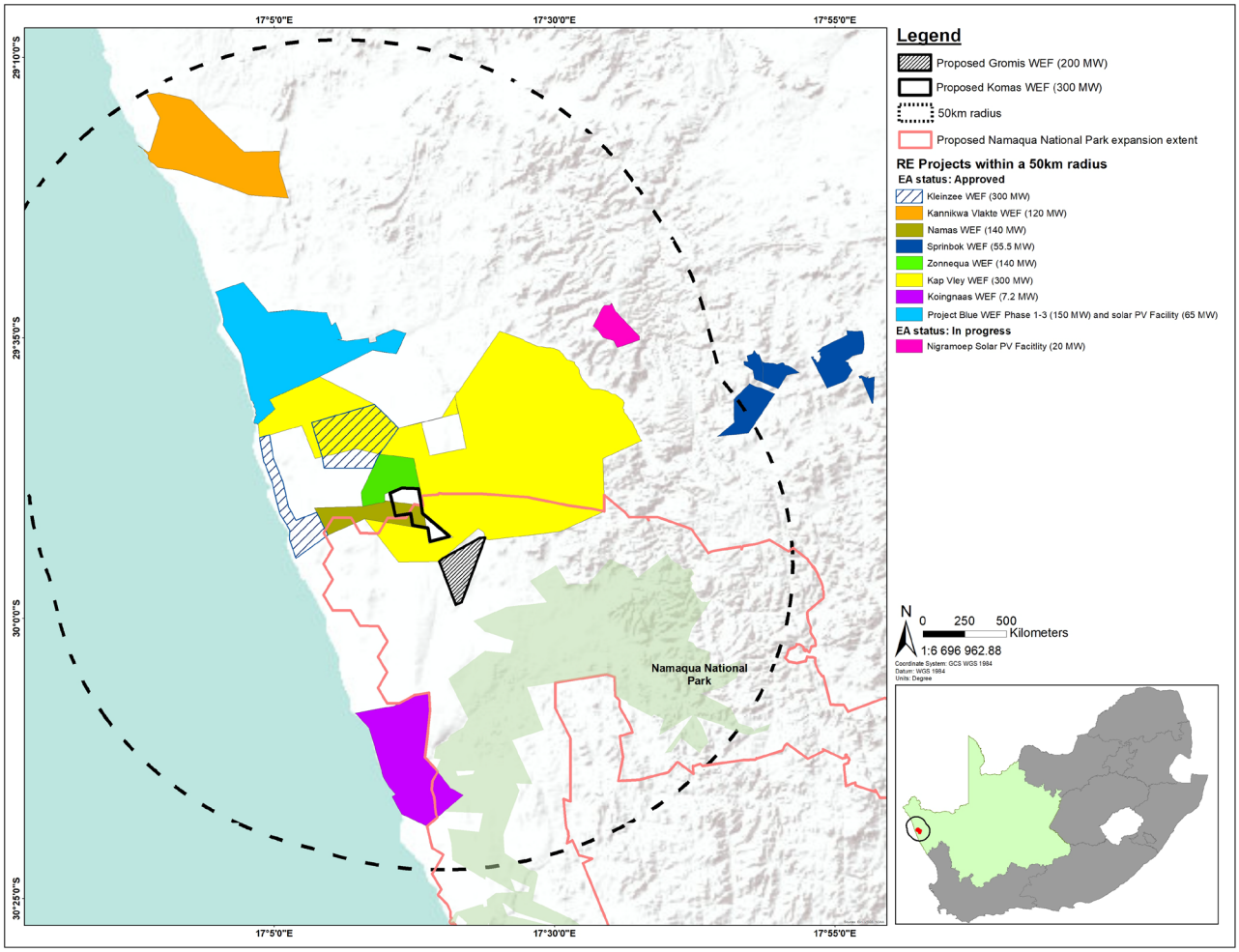


Figure 19: The proposed renewable energy (RE) developments within a 50-km radius of the proposed Komas WEF site. Nine sites comprise wind energy and two sites comprise solar PV sites.

We can estimate the potential cumulative number of fatalities using the known fatalities from Perold et al. 2020. The total power output of all proposed wind farms within 50-km is 1 412.7 MW
The potential <u>average</u> number of fatalities expected therefore is:

- 1 412.7 MW x 2.0 fatalities per MW per year = 2 825 birds per year (wind);
- If 36% of these are likely to be raptors (Table 6), then 1017 raptor fatalities are predicted per year;
- If ~20% of these raptors are Red Data species (Perold et al. 2020) then the cumulative impact is estimated to be **203 threatened raptors killed annually** by the nine wind farms (with power data) within 50-km; and
- Note that because solar farms generally don't kill raptors or Red Data birds (Visser et al. 2019) we have not added any fatalities for the two solar farms.

We believe the lower estimates for the total threatened raptors here are more likely, given the dry conditions that generally occur in this REDZ.

The fatality rates derived from Perold et al (2020) were from areas throughout South Africa but coastal farms had higher fatality rates than more inland areas. Therefore, the confidence in these findings is medium-high.

Thus, the minimum figures of about 2 825 birds, 1017 raptors and 203 threatened raptors per year are probably robust estimates for the cumulative impacts within 50-km of the proposed Komas wind farm site. These are nevertheless high totals, and as other renewable energy farms come on line then these total can only increase.

7.4 The No-Go Alternative

Given that the developers have removed all turbine placements from the areas designated as Medium-risk there is no need for a no-go alternative.

The no-go alternative will result in no additional impacts on avifauna (especially on the Priority bird species) and will result in the ecological status quo being maintained, which will be advantageous to the avifauna. Should the proposed Komas WEF (and other renewable energy projects) not be developed SA will continue its dependence on fossil-fuel instead of turning to green energy which will reduce greenhouse gas emissions and associated climate change which will be a hugely positive move for South Africa. The proposed Komas WEF is located in the Springbok REDZ (REDZ 8) which is earmarked for the development of renewable energy facilities.

7.5 The assessment of alternatives

The applicant provided two Battery and on-site Substation complex site alternatives to be assessed (i.e. Option 1 and Option 2). Option 2 is the preferred avian option since it is (i) closer to the incoming power line and (ii) there are slightly fewer priority bird flights in this area than at Option 1. Option 1 is not fatally flawed and can be implemented; however, Option 2 is the preferred option based on the motivation provided.

8. ENVIRONMENTAL MANAGEMENT PROGRAMME

Given the potential impact of the proposed Komas WEF development, the overall impact on avifaunal species requires systematic monitoring at both the construction- and post-construction phases. This is a recommendation of the Best Practice Guidelines (Jenkins et al. 2015).

The Guidelines suggest an adaptive and systematic monitoring of bird displacement (comparing avian densities before and after construction, particularly for priority collision-prone and Red Data species) and particularly the monitoring of all turbine-related fatalities. The latter must take account of biases introduced by scavengers removing carcasses and observers failing to detect bird remains below the turbines.

The monitoring should include the following (as per BARESG guidelines):

- Post-construction monitoring should be started as the facility becomes operational, bearing in mind that the effects of the WEF facility may change over time;
- Post-construction monitoring can be divided into two categories:
  a) quantifying bird numbers and movements (replicating baseline data collection); and

b) estimating bird mortalities;

- Carcass monitoring should be undertaken by trained observers, willing to cover 4-5 turbines per day in all weathers and over-seen by an ornithologist competent to determine species identification and a manager to collate and analyse each year's data;
- Estimating bird fatality rates includes:
  a) estimation of searcher efficiency and scavenger removal rates;
  b) carcass searches; and
  c) data analysis incorporating systematically collected data from (a) and (b); these biases should then be allowed for in estimating fatality rates;
- A minimum of 30-40% of the wind farm footprint should be methodically searched for fatalities, throughout the year, with a search interval informed by scavenger removal trials and objective monitoring. Any evidence of mortalities or injuries within the remaining area should be recorded and included in reports as incidental finds;
- The search area should be defined and consistently applied throughout monitoring;
- The duration and scope of post-construction monitoring should be informed by the outcomes of the previous year's monitoring, and reviewed annually;
- Post-construction monitoring of bird abundance and movements and fatality surveys should span 2-3 years to take inter-annual variation due to rain into account; and
- If significant problems are found (e.g. if > 1 red data species is killed at an individual turbine per year) or suspected, the post-construction monitoring should continue in conjunction with adaptive management and mitigations – accounting for the risks related to the particular site and species involved.

An assessment guided by these principles is required not only to enact and test the effectiveness of different mitigation measures where significant mortality occurs but allow data to be collected that will benefit the welfare of avifauna at other renewable energy farms. This is also important for a study of cumulative avian impacts for the increasing number of wind farms planned for South Africa.

Management interventions

Where avian fatalities are found to occur to:

(i) Red Data species; or
(ii) at unacceptably high levels, to priority species (e.g. > 1 priority species per turbine year), then the additional mitigation measures detailed above, should be brought into play.

Thus, experiments, for example, with bird deterrent techniques such as black-painted (or signal-red painted) blade mitigation or an alternative mitigation measure as suggested by a competent ornithologist following Birdlife South Africa's guidelines (or the applicable bird guidelines at the time), should be undertaken without delay to reduce fatality rates. The results of these experiments (if appropriate) should also be publicised so that other wind farms, with similar issues, can be informed.

We encourage the developers to release the results of the annual monitoring to Birdlife South Africa, such that South Africa-wide fatality and displacement results can be collated and assessed. Only in this way will the cumulative impacts assessments, currently crudely estimated, be refined, region by region.

9. CONCLUSIONS

The potential impacts to avifauna identified in this Avifauna Impact assessment include:

- Displacement and avoidance of nationally important species by the turbines;
- Loss of habitat for such species due to direct habitat destruction under the turbines;
- Disturbance during construction of the wind turbines and associated infrastructure; and
- Mortality arising from birds colliding with the moving turbine blades or associated infrastructure.

The Avifauna Impact Assessment included pre-construction monitoring of priority avifauna conducted over twelve months. This is in accordance with the Best Practice Guidelines for assessing and monitoring the impacts of wind energy facilities in southern Africa, produced by BirdLife South Africa and the Endangered Wildlife Trust (Jenkins et al. 2015).

- The records of the avifauna specialist which focussed on the proposed Komas WEF site in a particularly dry period, found 58 species in 12 months of monitoring.
- More species (43 and 49 species) were present in spring and summer, following rains, and this brought in more priority (6 and 8 species) and more Red Data species (3 and 3 species) respectively.
- Eight priority collision-prone species occurred over the year of which three were red-listed: Verreaux's Eagle *Aquila verreauxii* (ranked 2nd in top 100 collision-prone species); Ludwig's Bustard *Neotis ludwigii* (ranked 10th); and Southern Black Korhaan *Afrotis afra* (ranked 35th).

South African turbines kill 4.1-4.6 birds per turbine annually of which raptors comprise 36% (Perold et al. 2020). As such they may impact the five species of raptor that frequent the site.

- Both the annual passage rate of all collision-prone species on the proposed Komas WEF site (0.39 birds per hour), and the three Red Data species alone (0.15 birds per hour) were medium-high, increasing the probability of impacts especially for any turbines proposed in frequently used areas by raptors.
- Risk is also increased by the proportion of time priority species spent in the blade swept area (from 100 m to 300 m, for 200 m Hub Height turbines with 100 m blades).
- Priority species flew at these heights 78% of the time (Verreaux's Eagle); 40% of the time (Black-chested Snake Eagle); 56% of the time (Booted Eagle) and 0% of the time (Ludwig's Bustards), thereby increasing risk to the raptors.
- Based on frequent flights of Red Data species or where two or more priority species overlapped, **no areas of high-risk were identified.**
- However, **five areas of medium-risk were found on the proposed Komas WEF site**. These were located through-out the proposed Komas WEF site where the Snake Eagles and Booted Eagles were particularly active (Figure 16).

Important note: The current updated turbine layout avoids the areas identified as medium-risk in the Avifauna Impact Assessment (Figure 17).

The following mitigation measures are proposed for the medium-risk areas (if turbines are located within these areas):

- if turbines are positioned within the medium-risk areas and they are found to kill any Red Data birds either the turbines must be erected with an automatic shut-down on demand system (DT-bird or similar) or a single blade should be painted black (or with signal red paint) for those select turbines to reduce impacts for eagles and other raptors (May et al. 2020)); and

- that construction and post-construction monitoring takes place to ensure that any wind-farm-related fatalities are documented and addressed immediately. The monitoring must be done in accordance with the Best Practice Guidelines (Jenkins et al. 2015) or the relevant Avifauna monitoring guidelines at the time.

The cumulative impacts of nine other proposed WEFs within 50 km of the proposed Komas WEF were assessed, and a minimum of 2 800 bird fatalities are estimated annually from these proposed facilities. Approximately 203 of these are estimated to be priority Red Data raptors per year.

The applicant provided two Battery and on-site Substation complex site alternatives to be assessed (i.e. Option 1 and Option 2). Option 2 is the preferred avian option since it is (i) closer to the incoming power line and (ii) there are slightly fewer priority bird flights in this area than at Option 1. Option 1 is not fatally flawed and can be implemented; however, Option 2 is the preferred option based on the motivation provided.

The potential impacts to birds associated with the proposed Komas WEF and associated infrastructure were assessed to be negative and of moderate significance before and after mitigation. It is therefore recommended that the proposed Komas WEF and associated infrastructure be authorised, provided the proposed mitigation measures included in section 7 of this report are adhered to.

All the conditions for inclusion in the Environmental Authorisation (EA) are captured in the mitigation table (Table 7) above.

Note to DEFF: the black-blade mitigation was tested by May et al (2020) https://doi.org/10.1002/ece3.6592 over 7.5 years: they found that the black bladed turbines significantly reduced raptor deaths, relative to unpainted controls by 100%. That is no more birds were ever killed by the black blade turbines. The turbines without the black blade continued to kill eagles at the same rate as before (6 birds per year). There is no other operational mitigation for turbines that is (i) as successful or (ii) as cost-effective.
Civil Aviation already allows the use of signal red, and SAWEA are in the process of writing a position paper on this.

Report by Dr R E Simmons / M Martins

January 2020,
revised 23 December 2020
revised 18 February 2021
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APPENDIX 1: SPECIALIST DECLARATION FOR DEFF

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Basic Assessment for the proposed Komas Wind Energy Facility and associated infrastructure near Kleinsee in the Northern Cape Province

Kindly note the following:

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

Departmental Details

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

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

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

Details of Specialist, Declaration and Undertaking Under Oath

1. SPECIALIST INFORMATION

Specialist Company Name:	Birds & Bats Unlimited			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	5	Percentage Procurement recognition	80%
Specialist name:	Dr Rob Simmons			
Specialist Qualifications:	PhD, MSc, (BSc Hons)			
Professional affiliation/registration:	Honourary Research Associate UCT, Member of Birds and Renewable Energy Specialist Group (Birdlife SA/EWT)			
Physical address:	8 Sunhill Estate, Trigg Road, Sunnydale			
Postal address:	As above			
Postal code:	7975			
Telephone:	0827 800 133			
E-mail:	Rob.Simmons@uct.ac.za			

2. DECLARATION BY THE SPECIALIST

I, _____Robert Simmons_____, declare that –

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

Signature of the Specialist

Birds & Bats Unlimited

Name of Company:

22 October 2020

Date

Details of Specialist, Declaration and Undertaking Under Oath

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

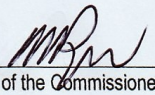
Signature of the Specialist

Birds & Bats Unlimited

Name of Company

22 October 2020

Date



Signature of the Commissioner of Oaths

23 Oct. 2020

Date

HENDRIK EDUARD SOLOMON POTGIETER
COMMISSIONER OF OATHS
PRACTISING ATTORNEY,
CONVEYANCER, NOTARY
2ND FLOOR, 144 LONGMARKET STREET
CAPE TOWN

Details of Specialist, Declaration and Undertaking Under Oath

APPENDIX 2: ALL BIRD SPECIES RECORDED AT THE PROPOSED KOMAS WEF SITE

List of all bird species seen over 12 months in the KOMAS WEF, and a Control site (April to December 2019). Those in **bold** are Collision-prone species and Red Data species are shown in **red**. More occurred in September than any other month.

Species List : KOMAS WEF March 2019 (Autumn)	Species List : KOMAS WEF July 2019 (Winter)	Species List : KOMAS WEF October 2019 (Spring)	Species List : KOMAS WEF December 2019 (Summer)		
					Namaqua Dove
Bokmakierie	**Black-chested Snake Eagle**	Alpine Swift	Namaqua Dove	Barn Swallow	Namaqua Sandgrouse
Alpine Swift	Bokmakierie	**Black-chested Snake Eagle**	Namaqua Sandgrouse	**Black-chested Snake Eagle**	Namaqua Warbler
Bokmakierie	Cape Bunting	Black-eared Sparrow-lark	**Pale Chanting Goshawk**	Bokmakierie	**Pale Chanting Goshawk**
Cape Bunting	Cape Clapper Lark	Bokmakierie	Pied Crow	**Booted Eagle**	Pied Crow
Cape Clapper Lark	Cape Crow	**Booted Eagle**	Red-faced Mousebird	Cape Bunting	Red-backed Shrike
Cape Crow	Cape Long-billed Lark	Cape Bunting	Rock Martin	Cape Clapper Lark	Rock Kestrel
Cape Long-billed Lark	Cape Penduline Tit	Cape Clapper Lark	Rufous-eared Warbler	Cape Crow	Rufous-eared Warbler
Cape Sparrow	Cape Sparrow	Cape Crow	**Southern Black Korhaan**	Cape Long-billed Lark	**Southern Black Korhaan**
Cape Turtle Dove	Cape Turtle Dove	Cape Long-billed Lark	Southern Double-collared Sunbird	Cape Penduline Tit	Southern Double-collared Sunbird
Chat Flycatcher	Chat Flycatcher	Cape Penduline Tit	Spotted Thick-knee	Cape Sparrow	Southern Fiscal
Grey Tit	Dusky Sunbird	Cape Sparrow	White-necked Raven	Cape Turtle Dove	Speckled Mousebird
Grey-backed Cisticola	Grey-backed Cisticola	Cape Turtle Dove	White-throated Canary	Chat Flycatcher	Speckled Pigeon
Jackal Buzzard	**Jackal Buzzard**	Chat Flycatcher	Yellow Canary	Chestnut-vented Warbler	Spotted Flycatcher
Karoo Lark	Karoo Lark	Chestnut-vented Tit-babbler	Yellow-bellied Eremomela	Common Quail	Spotted Thick-knee

Karoo Long-billed Lark	Karoo Prinia	European Bee-eater	**43 SPECIES**	Dusky Sunbird	**Verreaux's Eagle**
Karoo Prinia	Karoo Scrub-robin	**Greater Kestrel**	**6 priority species (2 Red Data)**	**Greater Kestrel**	White-throated Canary
Karoo Scrub-robin	Layard's Titbabbler	Grey Tit		Grey Tit	Yellow Canary
Long-billed Crombec	Long-billed Crombec	Grey-backed Cisticola		Grey-backed Cisticola	**49 SPECIES**
Namaqua Sandgrouse	**Ludwig's Bustard**	Grey-backed Sparrow-lark		**Jackal Buzzard**	**8 priority species (3 Red Data)**
Pale Chanting Goshawk	Malachite Sunbird	Karoo Lark		Karoo Chat	
Pied Crow	**Pale Chanting Goshawk**	Karoo Long-billed Lark		Karoo Lark	
Rock Dove	Pied Crow	Karoo Prinia		karoo Long-billed Lark	
Rock Martin	Rufous-eared Warbler	Karoo Scrub Robin		Karoo Prinia	
Rufous-eared Warbler	**Southern Black Korhaan**	Karoo Thrush		Karoo Scrub-Robin	
Southern Double-collared Sunbird	Southern Double-collared Sunbird	Large-billed Lark		Large-billed Lark	
Speckled Mousebird	Southern Fiscal	Lark-like Bunting		Larklike Bunting	
Speckled Pigeon	Spotted Thick-knee	Layard's Tit-babbler		Layard's Warbler	
White-throated Canary	**Verreaux's Eagle**	Long-billed Crombec		Little Swift	
Yellow Canary	Yellow Canary	**Ludwig's Bustard**		Long-billed Crombec	
29 SPECIES	**29 SPECIES**	Namaqua Dove		**Ludwig's Bustard**	
2 priority species	**6 priority species (3 Red Data)**	Namaqua Sandgrouse		Malachite Sunbird	
		Pale Chanting Goshawk		Namaqua Dove	
		Pied Crow		Namaqua Sandgrouse	
		Red-faced Mousebird		Namaqua Warbler	
		Rock Martin		**Pale Chanting Goshawk**	
		Rufous-eared Warbler		Pied Crow	
		Southern Black Korhaan		Red-backed Shrike	
		Southern Double-collared Sunbird		Rock Kestrel	
		Spotted Thick-knee		Rufous-eared Warbler	
		White-necked Raven		**Southern Black Korhaan**	
		White-throated Canary		Southern Double-collared Sunbird	
		Yellow Canary		Southern Fiscal	
		Yellow-bellied Eremomela		Speckled Mousebird	

TOTAL SPECIES LIST	
Alpine Swift	1
Barn Swallow	2
Black-chested Snake Eagle	3
Black-eared Sparrow-lark	4
Bokmakierie	5
Booted Eagle	6
Cape Bunting	7
Cape Clapper Lark	8
Cape Crow	9
Cape Long-billed Lark	10

Cape Penduline Tit	11	**43 SPECIES**		Speckled Pigeon
Cape Sparrow	12	**6 priority species (2 Red Data)**		Spotted Flycatcher
Cape Turtle Dove	13			Spotted Thick-knee
Chat Flycatcher	14			**Verreaux's Eagle**
Chestnut-vented Warbler	15			White-throated Canary
Common Quail	16			Yellow Canary
Dusky Sunbird	17			**49 SPECIES**
European Bee-eater	18			**8 priority species (3 Red Data)**

List of all bird species seen over 12 months in the KOMAS Control site (March to December 2019). Those in **bold** are Collision-prone species and Red Data species are shown in **red**.

Species List: KOMAS CONTROL March 2019 (Autumn)	Species List: KOMAS CONTROL July 2019 (Winter)	Species List: KOMAS CONTROL October 2019 (Spring)		Species List: KOMAS CONTROL December 2019 (Summer)	
Bokmakierie	**Black-chested Snake Eagle**	**Black-chested Snake Eagle**	**Southern Black Korhaan**	Barn Swallow	**Pale Chanting Goshawk**
Cape Turtle Dove	Bokmakierie	Bokmakierie	Southern Double-collared Sunbird	**Black-chested Snake Eagle**	Pied Crow
Karoo Lark	Cape Clapper Lark	Cape Clapper Lark	Southern Fiscal	Bokmakierie	Red-faced Mousebird
Karoo Long-billed Lark	Cape Crow	Cape Crow	White-throated Canary	**Booted Eagle**	Southern African Shelduck
Karoo Prinia	Cape Long-billed Lark	Cape Long-billed Lark	Yellow Canary	Cape Clapper Lark	**Southern Black Korhaan**
Karoo Scrub-robin	Cape Sparrow	Cape Turtle Dove	**30 SPECIES**	Cape Crow	Southern Double-collared Sunbird
Namaqua Sandgrouse	Cape Turtle Dove	Chat Flycatcher		Cape Long-billed Lark	Southern Fiscal
Pale Chanting Goshawk	Chat Flycatcher	Chestnut-vented Tit-babbler		Cape Sparrow	White-throated Canary
Rock Martin	Chestnut-vented Titbabbler	Common Quail		Cape Turtle Dove	Yellow Canary
Southern Double-collared Sunbird	Grey-backed Cisticola	Grey-backed Cisticola		Chat Flycatcher	**32 SPECIES**
10 SPECIES	Karoo Lark	Grey-backed Sparrow-lark		Chestnut-vented Titbabbler	
	Karoo Prinia	Hadeda Ibis		Grey-backed Cisticola	
	Karoo Scrub-robin	Karoo Lark		Hadeda Ibis	
	Long-billed Crombec	Karoo Prinia		Karoo Lark	
	Ludwig's Bustard	Karoo Scrub Robin		Karoo Long-billed Lark	
	Southern Black Korhaan	Lark-like bunting		Karoo Prinia	
	Southern Double-collared Sunbird	Layard's Tit-babbler		Karoo Scrub Robin	
	Southern Fiscal	**Ludwig's Bustard**		Large-billed Lark	
	Yellow Canary	**Namaqua Sandgrouse**		Layard's Warbler	
	20 SPECIES	**Pale Chanting Goshawk**		Long-billed Crombec	
		Pied Crow		**Ludwig's Bustard**	
		Red-faced Mousebird		Namaqua Dove	
		Rufous-eared Warbler		Namaqua Sandgrouse	
		South African Shelduck			