CUMULATIVE EFFECTS ASSESSMENT (CEA)

SUEZ Wind Energy BOO Wind Power Plant 1.1. GW – SWE North

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EXECUTIVE SUMMARY

This report presents the findings of the analysis of the potential cumulative effects on birds of wind farms in development by Suez Wind Energy (SWE) (the Project) near the Gulf of Suez, Egypt. The analysis identifies priority bird Valued Environmental Components (VECs) (IFC 2013) and a preliminary list of other VECs. High-level mitigation and monitoring actions that will be adopted are presented as well.

Additional actions that SWE and other developers in the study area will undertake or support to address their contribution to the cumulative effects of their developments together with others in the region are also presented within the report.

The Gulf of Suez is the center for Egypt's oil and gas industry, and the focal region for the development of wind farms in Egypt. The area has high wind power generation potential (Wind Atlas) and it is estimated that the western side of the Gulf of Suez could host about 20,000 MW installed capacity of wind farms (Mansour & Eisa 2014). The government of Egypt is targeting the development of wind farms providing about 13,500 MW by 2022 (NREA 2015). But the Gulf of Suez is also an area of international significance for migratory birds (Grontmij 2010; Hilgerloh et al. 2011; BirdLife International 2018a).

To determine priority bird VECs for the Projects, the approach that was followed was originally modelled on the Tafila Region Wind Power Projects Cumulative Impact Assessment (IFC, 2017), and has been modified to the local conditions and data available through a previous Cumulative Effects Analysis that was undertaken for the Lekela (West Bakr) 250 MW (TBC, 2018), AMEA Power (Amunet) 500 MW WPPs (ECO Consult 2022) and IPH (ECO Consult 2023). Similarly, a staged screening of the list of preliminary bird species was undertaken, to develop a final list of priority bird VECs that were likely to be at greatest overall risk from the Projects. The data used in the process included all the data that was originally available for the aforementioned CEA's in addition to all recent data collected in the region up to 2023, including SWE's on-site assessments that were carried out in spring and autumn 2022 and 2023.

The process has identified 13 species, which had an Overall Risk of Major or Moderate, are considered priority bird VECs for the Projects. Some of these were already identified by the Lekela CEA and all within the IPH CEA. Whilst peak counts have been updated for two species there are no changes to risk status from the IPH document.

In step 5, mitigation measures and monitoring actions are proposed, and to be adopted by SWE and other projects that are proposed. The measures will be considered collectively and collaboratively by all the wind energy developers across the region. This mitigation and monitoring actions focus on the potential impacts to the 13 priority VECs are based on industry good practice while building on the already existing experience of adaptive management at operational wind farms along the Gulf of Suez.

1. INTRODUCTION

1.1 Acknowledgement

This CEA is an update to the recently disclosed CEA for the Infinity Power Holding (IPH) Wind Power Plant. Additions to the data set are provided by work undertaken during migration seasons at the proposed SWE Plot 1 and Plot 2 however, given the additional data does not change the situation in a regional context the large majority of this document is taken directly from this work. This allows consistency in both assessment approach and an output and adds the recent survey work for this site to the regional output.

1.2 Scope and objectives

A Cumulative Effects Analysis (CEA) is a multi-layered analysis approach that aims at identifying and analyzing the impacts of a set of projects on a pre-defined set of ecological elements, habitats and species. The CEA comes into context for Suez Wind Energy (SWE) (the Developer) wind farm (the Project) since it is located in an area that includes multiple wind farms while being also located along a major bird migratory flyway, namely the Rift Valley Red Sea flyway.

The CEA follows a series of multi-layered steps that would eventually identify the potential cumulative impacts of the projects of concern in order to eventually provide monitoring and mitigation measures that would be applied through an adaptive management approach. These steps would follow the approach that was developed under the Cumulative Effects Assessment for the Tafila Region Wind Power Projects in Jordan (IFC, 2017).

This analysis represents the initial steps in understanding potential cumulative effects to MSBs of wind farm development by SWE and other operations in the Gulf of Suez, Egypt. It aims to identify priority Valued Environmental Components (VECs) which are most at risk from the combined impacts of all the existing and potential wind developments identified within the study area, building on the CEA that was undertaken by Lekela Power Ltd. For West Bakr 250MW (TBC, 2018), AMEA Power for Amunet 500MW project (ECO Consult, 2022) and IPH Project. Most importantly, this CEA integrates the avifaunal in-flight monitoring assessments that were undertaken at SWE Plot 1 and 2 during spring and autumn 2022 and 2023 migratory seasons. This analysis also proposes mitigation, monitoring and other management actions for projects operating within the study area to address potential impacts to the identified priority VECs.

1.3 The Geographic Boundaries

The Project is split into two Project sites: Plot 1 and Plot 2. Each plot is discussed separately below:

Plot 1

The Project is located in the Ras Gharib Local Governmental Unit of the Red Sea Governorate of Egypt, approximately 174 km to the southeast of the capital city of Cairo. The nearest town is Ras Gharib which is located 18 km to the southeast of the Project area. The Project is located within a Strategic Area that has been allocated by the New and Renewable Energy Authority (NREA) for wind farm development projects (shown in Figure 1). The Strategic Area has a total planned capacity of 1,500MW and covers 300 km2, with the SWE Plot 1 Wind Farm proposed to occupy approximately 135.0 km2 of this (Figure 1).

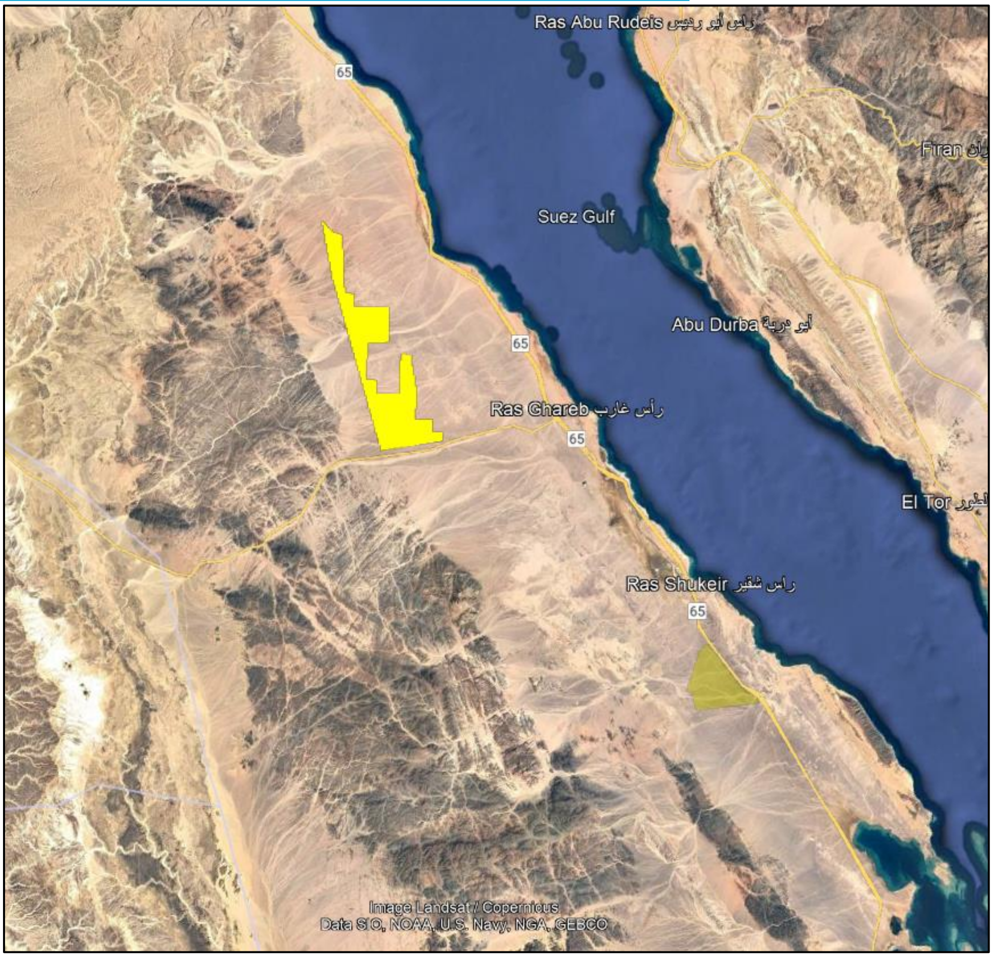

Figure 1: SWE Egypt Plot 1 location in the Gulf of Suez (showing Plot 2 to south)

Plot 2

The Project is located in the Ras Gharib Local Governmental Unit of the Red Sea Governorate of Egypt, approximately 305 km to the southeast of the capital city of Cairo. The nearest town is Ras Shukeir which is located 8.5 km to the southeast of the Project area.

The Project is located within a Strategic Area that has been allocated by the New and Renewable Energy Authority (NREA) for wind farm development projects (shown in Figure 1). The Strategic Area has a total planned capacity of 1,500MW and covers 300 km^2 with the SWE Plot 2 windfarm proposed to occupy approximately 52 km^2 of this (Figure 2).

Figure 2: SWE Egypt Plot 2 location in the Gulf of Suez (showing Plot 1 to north)

The key projects considered within the area include the following sites which are shown in Figure 3:

1. Red Sea Wind Energy (RSWE) 500MW Wind Farm (under development)
2. Lekela Egypt 250MW Wind Farm (WBWF) (operational since 2021)
3. SWE Wind Farms (current development)
4. AMUNET 500MW Wind Farm (under development)
5. NIAT 500MW Wind Farm (under development)
6. Infinity Power Holding Wind Power Plant 200MW (under development)
7. Ras Gharib Wind Energy (RGWE) 250MW Wind Farm (operational since 2019)

Data was also used from other governmental projects developed directly by the New and Renewable Energy Authority (NREA).

All the above sites are not the exclusive list of consulted references. The CEA process also included scientific and grey literature and other wind energy projects (e.g. promoted by NREA). All of them are in the reference list at the end of this document but also in the appendix; specifically under the Step 2 "*Reference for highest seasonal count in the area*".

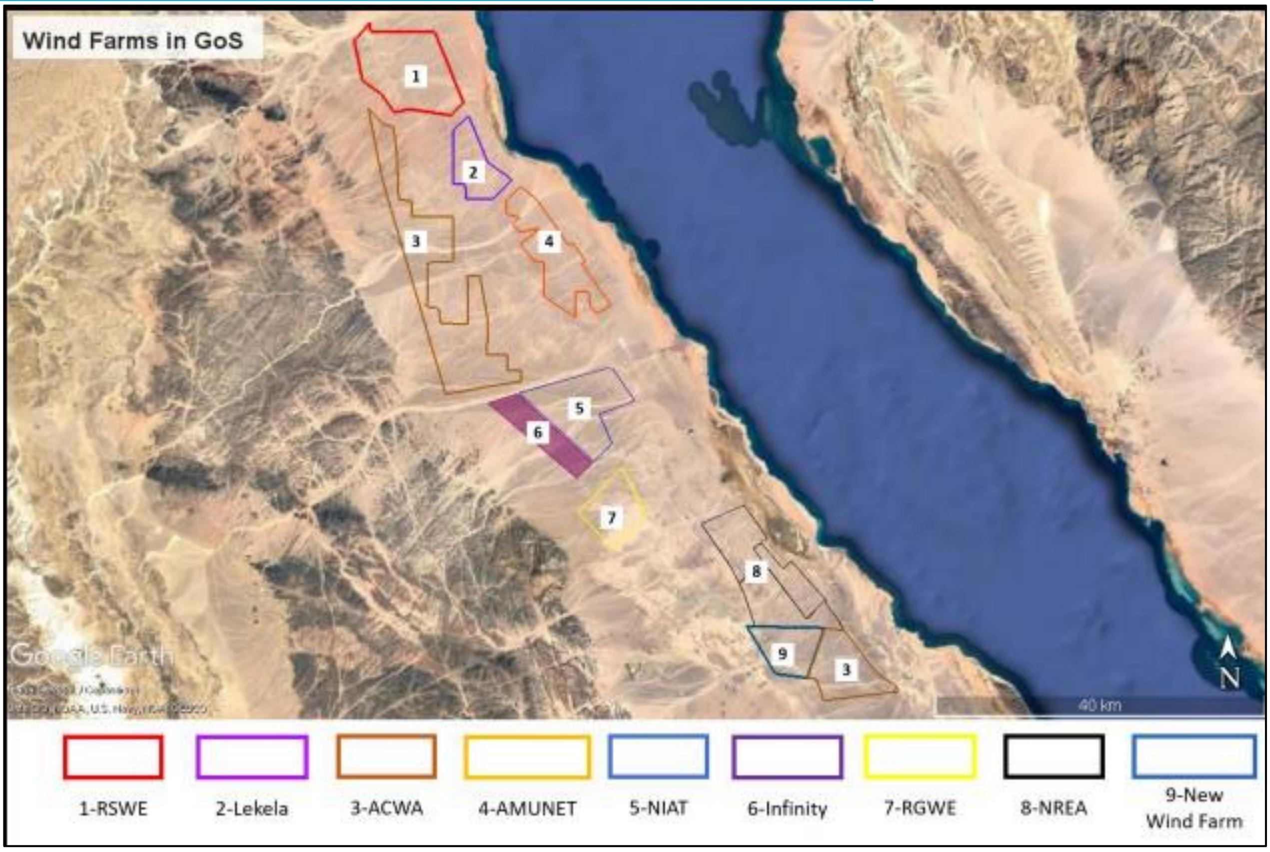

Figure 3: Projects in the Region

Being located by the western coastline of the Gulf of Suez, the project site is located along the Red Sea/Rift Valley Flyway, which is one of the most important migration flyways for migratory soaring birds in the world with over 1.5 million soaring birds migrating through it twice a year (Birdlife, 2020). The flyway links the European breeding grounds with the African wintering areas of for a total of 37 migratory species. Regular migration monitoring along the western coast of the Gulf of Suez where the project is located has shown that there is a significant difference in the level of use of the area during migration seasons. Research has shown that this part of the flyway is used by much larger numbers of birds during spring migration in comparison with autumn migration seasons.

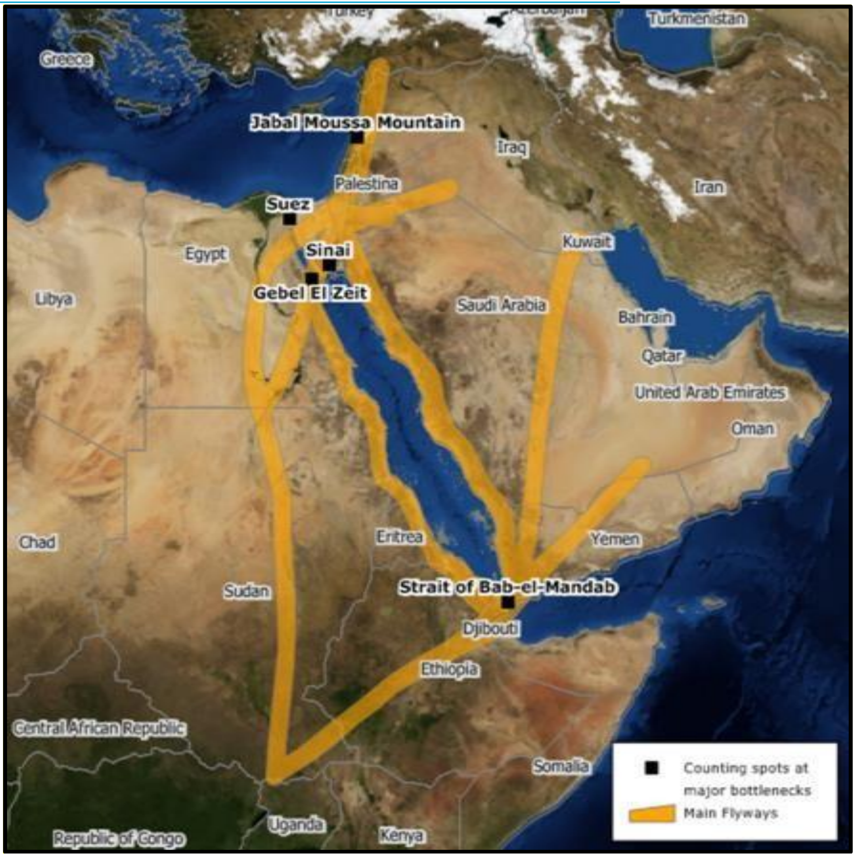

Figure 4: Main routes used by migratory soaring birds as part of the Red Sea/Rift Valley Flyway (BirdLife, 2020)

1.4 The Temporal Scope

The different wind farms in the study area are in varying stages of development. Some have been operational for a few years while others have started operating less than a year while others are in the pre- construction preparation phase.

2. IDENTIFICATION AND SCREENING OF VECS

VECs are defined as attributes, both environmental and social, that are considered important in assessing the risks that a project or suite of projects poses to the environment. Identification of VECs was undertaken as part of wider local projects by previous authors and restricted to birds via a desk-based exercise using published and grey literature. Priority VECs were selected through an iterative process in consultation with the stakeholders. For each VEC group and/or potential impact, the following elements were discussed and were reviewed in the literature:

- Sensitivities
- Available data sources
- Activities and/or drivers other than wind projects
- Data ownership and access

3. THE APPROACH

The framework is based on internationally accepted approaches to risk assessment practices to identify priority VECs and aligns with the EBRD Performance Requirement 6: Biodiversity Conservation and Sustainable

Management of Living Natural Resources Guidance Note 2022, and International Finance Corporation's (IFC's) Guidance Note 6 (GN6) applicable to other lenders. This framework for birds has two objectives: to identify those species at highest risk from the potential impacts of developments in the study area, and to propose mitigation, monitoring and other management activities to address risks to those species. This framework follows a five-step process, as follows.

- Step 1: develop a preliminary list of potential VECs, comprising species potentially at risk fromdevelopments in the study area, because they are either known or predicted to occur in the study area.
- Step 2: determine the relative 'Sensitivity' of the species, being a combination of the vulnerability of the species and Importance of the population recorded in the study area relative to the appropriate Unit of Analysis (UoA), i.e. the flyway population or global distribution. Species which were determined to have negligible sensitivity were dropped from analysis before proceeding to Step 3. Species where the flyway population comprised <1% of the global population, and for which any impact would be negligible forthe species at a global level, were also dropped at this stage.
- Step 3: determine the Overall Risk to the species from the cumulative effects of wind farm developmentswithin the study area, being a combination of the sensitivity, as identified in Step 2; and cumulative Likelihood of Effect (LoE) rating for each species. Those species with an Overall Risk of Major or Moderate are considered to be priority bird VECs for the project.
- Step 4: identify thresholds for fatalities for each priority bird VECs, by setting the point at which further loss is considered a risk to long-term viability of the population. Threshold setting takes into account species-specific biological and demographic parameters, the cumulative risk associated with WPPs, and the likely effects of external stressors on the population defined by the UoA.
- Step 5: proposes a range of mitigation, monitoring and management actions, to avoid fatalities of priority bird VECs, and to accurately estimate priority bird VEC fatalities to facilitate compliance with thresholds and inform adaptive management responses.

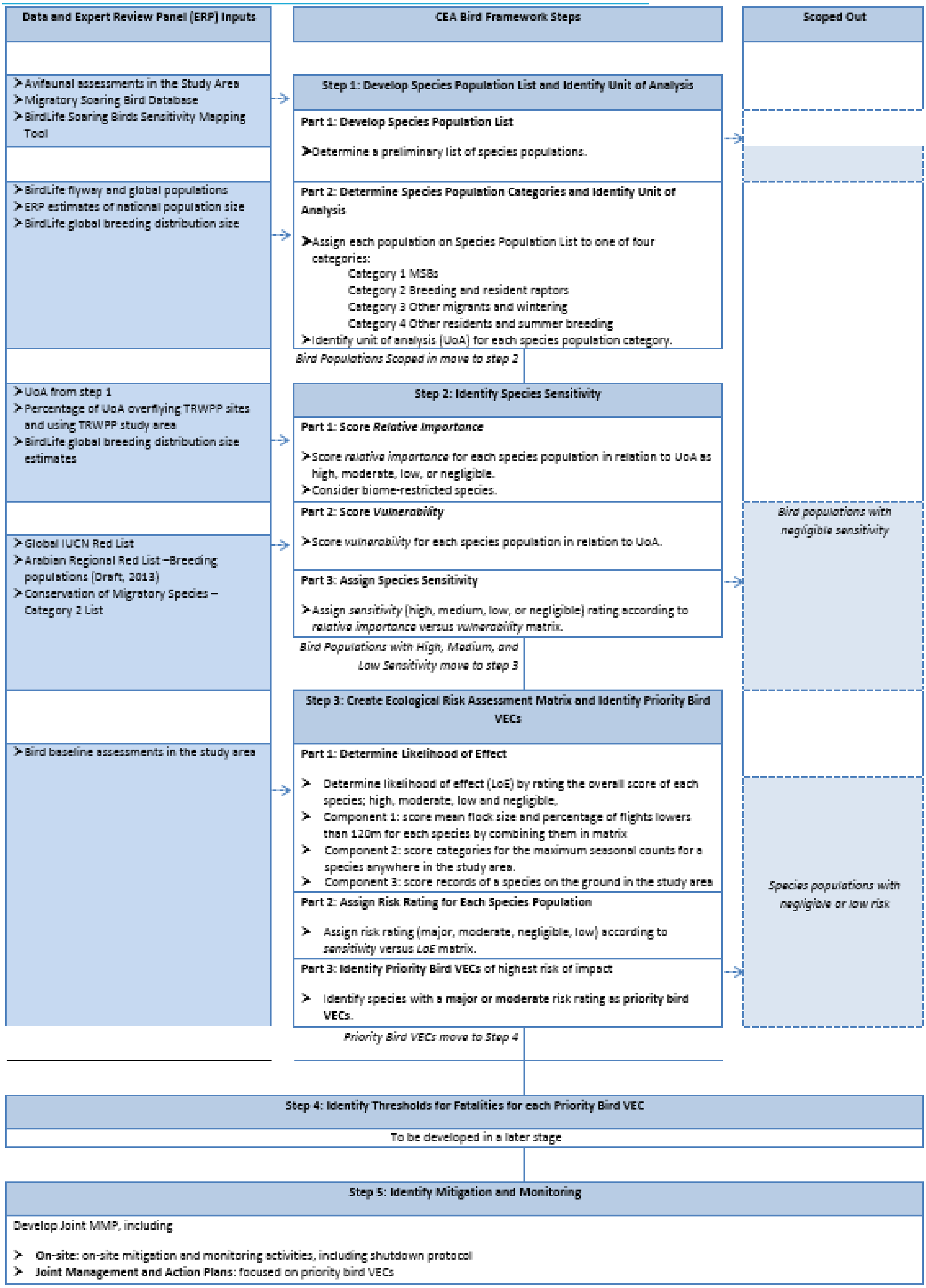

Figure 5: Process for identification of priority VECs

4. THE APPLICATION

4.1 Step1: Develop Species Population List and Identify Unit of Analysis

The purpose of step 1 is to identify all bird species or populations that could potentially be at risk from the cumulative effects within the study area and to determine a relevant UoA by which any effects on each species or population should be measured. A species population list of all bird species known or likely to be present in the study area was compiled from:

- Infinity 200 MW spring 2021 and 2023, and autumn 2021 avifaunal assessments (2021) a total of 3 seasons
- NIAT 500MW spring and autumn 2021 avifaunal and biodiversity assessments (2021) a total of 2 seasons
- AMUNET 500MW spring and autumn avifaunal and biodiversity assessments (2020 – 2021) a total of four seasons.
- RSWE 500 MW spring and autumn avifaunal and biodiversity assessments (2019 – 2021) a total for 4 seasons
- SWE spring and autumn avifaunal and biodiversity assessments (2022 – 2023) a total for four seasons
- Lekela 250MW Wind Farm (2015 – 2021) a total of 8 seasons
- RGWE 250MW Wind Farm (2018 – 2021) a total of 7 seasons
- CEA for Lekela Wind Farm (2015-2018) involving 8 seasons
- CEA for RSWE Wind Farm (2019-2021) involving four seasons
- RCREEE Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP) for Wind Power Projects in the Gulf of Suez (RCREEE 2018);
- SWE 1.5 GW projects in the Plots #1 and #2 north and south to Ras Gharib.
- The Migratory Soaring Bird Database (BirdLife International 2018b), filtered by species mapped as occurring in the project area;

All the above seven sites are not the exclusive list of consulted references. The CEA process also included scientific and grey literature. All of them are in the reference list at the end of this document but also in the appendix; specifically under the Step 2 "Reference for highest seasonal count in the area".

In addition, we consulted the post-construction fatality monitoring reports available for West Bakr, and some of the NREA projects. We discussed in the bird monitoring report how useful the information it was in order to inform the magnitude of the impacts on bird species by the turbines. The main study on OHTLs by Nature Egypt was not available, just the global final results. As for the wind energy, the full report was not available but allowed us to know about the qualitative impacts in the region and was considered when evaluating the potential impacts and risks of Infinity 200MW.

These species were then allocated to one of three categories, and an appropriate Unit of Analysis (UoA) determined for each category:

- Category 1: Migratory Soaring Birds (as per BirdLife International 2018b), with the UoA being the Rift Valley / Red Sea flyway population. Data on populations of these species were sourced from Grontmij (2009), supplemented with information from Porter (2006) as needed.
- Category 2: Breeding and resident raptors, including species that were recorded at the study area and are known from literature to be breeding in the study area and its vicinity.

- Category 3: Other migrants and wintering species, with the UoA being the global breeding range extent (taken from BirdLife International 2023) as no national, regional or flyway-level estimates were available to allow a definition of a smaller UoA.

- Category 4: Other resident species, with the UoA being the same as for Category 2 species.

Step 1 previously produced a species population list for the region of 192 bird species. An addition 6 species have been added following the SWE Plot 1 and 2 surveys, see Table 1.

Table 1: Species Population List of Potential Bird VECs

Order	Number of Potential VECs
Accipitriformes (diurnal birds of prey)	30
Anseriformes (waterfowls)	8
Apodiformes (swifts, treeswifts and hummingbirds)	3
Bucerotiformes (hornbills, hoopoe, wood-hoopoe)	1
Charadriiformes (shorebirds)	44
Ciconiiformes (storks)	4
Columbiformes (pigeons and doves)	3
Coraciiformes (kingfishers and allies)	5
Falconiformes (falcons and caracaras)	10
Galliformes (ground-feeding birds)	2
Gruiformes (cranes, crakes and rails)	5
Passeriformes (perching birds)	65
Pelecaniformes (ibis, herons and pelicans)	14
Podicipediformes (grebes)	1
Pteroclidiformes (sandgrouses)	2
Strigiformes (nocturnal birds of prey)	1
Suliformes (cormorants, gannets and boobies)	1

4.2 Step 2 – Identify species sensitivity

The purpose of Step 2 is to determine the sensitivity of each species or population identified in Step 1 based on its vulnerability at a national, regional, or international scale, depending on the UoA, and the relative importance of the study area to the population. Sensitivity as considered here relates to the species population present in the study area, and combines two components:

- Relative Importance for each MSB species population was defined as an estimate of the proportion of the Rift Valley/Red Sea flyway population migrating through wind power projects within the study area. Owing to the practical difficulties of monitoring the entire Flyway, the population estimate for a species is given as the maximum seasonal count recorded at any of the Middle East bottleneck sites during the period of documented migration monitoring (Porter, 2006) recorded in the study area, and for other migrants and for resident species the global breeding range (sourced from Birdlife International species accounts), with ratings as per Table 2 and Table 3Table 3 respectively. For the population recorded in the study area, we have taken this number to be the maximum count recorded in any season for any survey.

- Vulnerability, for each species population, was scored using international and/or regional guidance on conservation status appropriate to its UoA and evidence of its vulnerability to wind farms. International guidance was applied to migrant and wintering species populations (categories 1 and 3) and regional guidance to the resident and summer breeding species populations (categories 2 and 4), see Table 4.

These two factors are combined in a matrix to determine to overall species sensitivity, see Table 5Table 5. Species with a negligible sensitivity were not progressed to Step 3. Additionally, we discounted species where the estimated flyway population was <1% of the total estimated global population to reflect the very low importance of the Rift Valley / Red Sea flyway population at a global level: this removed five additional species that were rated above a negligible sensitivity (*White-tailed Sea Eagle Haliaeetus albicilla, Griffon Vulture Gyps fulvus, Cinereous Vulture Aegypius monachus, Hen Harrier Circus cyaneus and Red Kite Milvus milvus*).

Note that no further species require adding to the assessment process due to data from SWE sites correlating with other regional sites and no significant numbers of new species of importance have been added to the local context.

Table 2: Relative importance scoring for migratory soaring birds

Relative Importance	Maximum total count for a species within a single season from any one project in the study area as a percentage of flyway population
Negligible	≤ 1%
Low	>1% and ≤ 5%
Moderate	>5% and ≤10%
High	>10%

Table 3: Relative importance scoring for other migrants and resident species

Relative Importance	Global resident or breeding range (km²) – extent of occurrence
Negligible	> 10,000,000
Low	> 100,000 and < 10,000,000
Moderate	> 50,000 and < 100,000
High	< 50,000

Table 4: vulnerability scoring criteria

Vulnerability rating	Migratory soaring birds (and other species where an SVI has been designated)	Other migrants and resident species
Negligible	LC on IUCN Global Red List, and SVI of 6 or below	LC on IUCN Global Red List
Low	VU or NT on IUCN Global Red List and SVI 6 or below; LC on IUCN Global Red List and SVI of 7 or 8; or CMS Category 2 Species and SVI of 6 or below	NT on IUCN Global Red List
Moderate	VU or NT on IUCN "Global" Red List and SVI of 7 or 8; LC on IUCN Global Red List and SVI of 9 or 10; or CMS Category 2 Species and SVI of 7 or 8	VU on IUCN Global Red List
High	CR or EN on IUCN Global Red List; VU or NT on the IUCN Global Red List and SVI of 9 or 10; or CMS Category 2 Species and SVI 9 or 10	CR or EN on IUCN Global Red List

Table 5: Sensitivity matrix

Sensitivity		Relative Importance			
		Negligible	Low	Moderate	High
Vulnerability	Negligible	Negligible	Negligible	Low	Low
	Low	Negligible	Low	Low	Medium
	Moderate	Low	Low	Medium	High
	High	Low	Medium	High	High

Step 2 produced a list of 34 avian species with their sensitivity being low or above, which means 164 species populations were scoped out as a result, see Table 6.

Table 6: Scoring at Step 2 for species sensitivity rates as Low, Moderate and High

Species	Vulnerability	Relative Importance	Sensitivity
Yellow-billed Stork *Mycteria ibis*	Moderate	Negligible	Low
White-eyed Gull *Larus leucophthalmus*	Low	Low	Low
Black-winged Pratincole *Glareola nordmanni*	Low	Low	Low
Black Stork *Ciconia nigra*	Moderate	High	High
White Stork *Ciconia ciconia*	Moderate	High	High
Common Crane *Grus grus*	Moderate	High	High
Dalmatian Pelican *Pelecanus crispus*	High	Negligible	Low
Great White Pelican *Pelecanus onocrotalus*	Moderate	High	High
European Honey-buzzard *Pernis apivorus*	Moderate	Low	Low

Species	Vulnerability	Relative Importance	Sensitivity
Egyptian Vulture *Neophron percnopterus*	High	Low	Moderate
Cinereous Vulture *Aegypius monachus*	High	Negligible	Low
Lappet-faced Vulture *Torgos tracheliotos*	High	Negligible	Low
Black Kite *Milvus migrans*	Low	Moderate	Low
Bonelli's Eagle *Aquila fasciata*	Moderate	Negligible	Low
Tawny Eagle *Aquila rapax*	High	Negligible	Low
Steppe Eagle *Aquila nipalensis*	High	High	High
Eastern Imperial Eagle *Aquila heliaca*	High	Low	Moderate
Golden Eagle *Aquila chrysaetos*	Moderate	Negligible	Low
Verreaux's Eagle *Aquila verreauxii*	Moderate	Negligible	Low
Greater Spotted Eagle *Clanga clanga*	High	High	High
Lesser Spotted Eagle *Clanga pomarina*	Moderate	Moderate	Moderate
Booted Eagle *Hieraaetus pennatus*	Moderate	High	High
Short-toed Snake-eagle *Circaetus gallicus*	Low	Moderate	Low
Eurasian Buzzard *Buteo buteo*	Low	Moderate	Low
Long-legged Buzzard *Buteo rufinus*	Low	High	Moderate
Levant Sparrowhawk *Accipiter brevipes*	Negligible	High	Low
Montagu's Harrier *Circus pygargus*	Moderate	Negligible	Low
Pallid Harrier *Circus macrourus*	Moderate	Moderate	Moderate
Saker Falcon *Falco cherrug*	High	Negligible	Low
Cyprus Warbler *Sylvia melanothorax*	Negligible	High	Low

4.3 Step 3 – Ecological Risk Assessment and Identification of Priority Bird VECs

Step 3 aims to identify priority bird VECs from the 34 sensitive species remaining from Step 2. This is done by combining each species' sensitivity rating with an estimated site-specific risk (the Likelihood of effect: LoE) to identify the species which are most at risk of significant impacts from wind farm developments in the study area. Based on the baseline bird data available, Likelihood of Effect comprised of three components:

- **Component 1.** A score for the combined effect of the percent of individuals recorded flying below 200 m and mean flock size, see Table 7. These are birds which are potentially at risk of collision with turbines or could collide with transmission lines. We took the percent of individuals recorded flying below 200 m for the spring season as the data for autumn are negligible numbers except for the Eurasian Honey Buzzard *Pernis apivorus* and the Great White Pelican *Pelecanus onocrotalus*. For species with no data for the percent of records <200 m, we scored these as having 50% of records <200 m. Mean flock size was derived from the average flock sizes reported during each survey period: no weighting was applied as not all surveys covered the full migration period for all species, and flocking behavior might vary throughout this period. Larger flocks were considered to be at greater risk of multiple fatalities due to the higher numbers present and the reduced ability for individuals in the flock to see and avoid turbines or power lines. For species with no data on mean flock size, we conservatively scored these as having a maximum flock size equal to the maximum count recorded in a season (as per Component 2, below: i.e. equivalent to all individuals passing in a single flock). For species with values for both variables, the resulting matrix score was increased by one if the variability (taken as the standard deviation of all reported values for that species) of the percentage of flights <200 m was in the top two quartiles (i.e. the top 50% of values). We added this additional step to account for situations where flight height behavior was very variable and the average value was less valid as a risk predictor;

- **Component 2.** The maximum total count for a species within a single season from any one project in the study area to reflect the fact that species with higher counts in the study area are more likely to be affected by wind developments: and,

- **Component 3.** Whether or not that species had been recorded on the ground within the study area, irrespective of the numbers of individuals involved (species with records of landing scored 1, those without 0). Those species recorded on the ground must pass through the collision risk zone, and hence are at greater risk of collision than those species for which landing on the ground has not been recorded.

- These three components were summed to arrive at a final LoE score for each species (theoretical range 2- 10), which was separated into quartiles to derive a LoE rating for that species, see Table 9. This LoE rating was then combined with the Sensitivity rating from Step 3 to derive an Overall Risk rating from the project, see Table 10 species which had an Overall Risk of Major or Moderate were considered Priority bird VECs for the study area.

For the step 3 given the low global numbers recorded in autumn, a common pattern across all the projects; we have only considered the spring migration data.

Table 7: Matrix for scoring mean flock size and percentage of flights less than 200m for each species

Mean flock size	Percentage of flights < 200m			
	0-25	26-50	51-75	76-100
< 10	1	1	2	2
10–50	1	2	2	3
51-100	2	2	3	4
> 100	2	3	4	4

Table 8: Score categories for the maximum seasonal counts for a species in the study area

Maximum season count	
Range	Score
0-10	1
11-1,000	2
1,001-10,000	3
> 10,000	4

Table 9: Likelihood of Effect rating based on overall score for each species evaluated at Step 3

Likelihood of Effect (LoE)	
Overall Score (based on quartiles)	Level of Effect
≤2	Negligible
>2 and ≤3	Low
>3 and ≤6	Medium
>6	High

Table 10: Overall risk matrix

Overall risk		Likelihood of Effect (LoE)			
		Negligible	Low	Medium	High
Sensitivity	Low	Negligible	Minor	Minor	Moderate
	Medium	Minor	Minor	Moderate	Major
	High	Minor	Moderate	Major	Major

Step 3 identified 13 species with an Overall Risk of Major or Moderate from the project, and these species considered priority VECs for this analysis, see **Error! Reference source not found.**.

Within Table two species assessments required an update based on the most recent data from the SWE project. The Spring 2023 seasons confirmed new peak counts for White Stork (Plot 2) and Steppe Eagle (Plot 1). Whilst peak counts have changed this does not lead to a change in overall assessment for these species is required, with both species remaining Major overall risk. Assessment for these species.

Table 11: Scoring and Rating Details for the 11 Species Identified as Priority VECs

Species	IUCN Red List Status	SVI	Vulnerability	Highest Count	Flyway Population	% of UoA	Relative Importance	Sensitivity	% flights <200m	Mean flock size	Landing in Area	LoE	Overall Risk
Black Stork *Ciconia nigra*	LC	10	Moderate	6,738	19,500	34.6	High	High	57	14	Yes	High	Major
Booted Eagle *Hieraaetus pennatus*	LC	9	Moderate	858	3,169	27.1	High	High	20	1	No	Low	Moderate
Common Crane *Grus grus*	LC	10	Moderate	12004	35,000	34.3	High	High	0	136	No	High	Major
Great White Pelican *Pelecanus onocrotalus*	LC	10	Moderate	31,001	70,000	44.3	High	High	18	339	Yes	High	Major
Steppe Eagle *Aquila nipalensis*	EN	9	High	18,793	37,500	50.1	High	High	57	7	Yes	Medium	Major
White Stork *Ciconia ciconia*	LC	10	Moderate	221,558	450,000	49.2	High	High	79	1,295	Yes	High	Major
Black Kite *Milvus migrans*	LC	8	Low	9589	132,700	7.2	Moderate	Medium	51	9	Yes	High	Moderate
Egyptian Vulture *Neophron percnopterus*	EN	10	High	395	4,335	8.7	Low	Medium	46	1	No	Medium	Moderate
Greater Spotted Eagle *Clanga clanga*	VU	9	High	341	2,180	15.6	High	High	52	1	No	Medium	Moderate
Pallid Harrier *Circus macrourus*	NT	8	Moderate	100	1,505	6.6	Moderate	Medium	100	1	No	Medium	Moderate
Steppe Buzzard *Buteo buteo v.*	LC	7	Moderate	82,540	1,250,000	6.6	Low	Low	37	23	Yes	High	Moderate
Honey Buzzard *Pernis apivorus*	LC	7	Low	35,423	1,000,000	3.5	Low	Low	23	90	No	High	Moderate
Eastern Imperial Eagle *Aquila heliaca*	VU	9	High	73	2,125	3.4	Low	Medium	8	1	No	Medium	Moderate

4.4 Step 4 – Identification of thresholds for fatalities for each priority bird VECs

Step 4 aims to identify thresholds for fatalities for each priority bird VECs, by setting the point at which further loss is considered a risk to long-term viability of the population. Threshold setting takes into account species-specific biological and demographic parameters, the cumulative risk associated with WPPs, and the likely effects of external stressors on the population defined by the UoA. As mentioned earlier, this step has not been performed at this stage and is planned in the near future and will be included in a reviewed version of this report once another two migratory seasons have been completed and assessed against the updated tip height.

Step 4 has two parts: Part 1 identifies, for each priority bird VEC, a threshold number of fatalities appropriate in the study area for maintaining or attaining the long-term viability of the population. Part 2 explains the threshold system and the actions triggered as a consequence of passing thresholds. These actions are summarized as a decision tree in Figure 4 The decision tree forms the basis of the adaptive management framework, described in detail in step 5.

<u>Part 1: Threshold-Setting Process</u>

The Tafila approach was followed in the threshold-setting process, which was originally guided by related concepts within European and U.S. legal frameworks, specifically criteria underpinning “Favorable Conservation Status” (EC Habitats Directive, Council Directive 92/43/EEC) and “Optimal Sustainable Population” (pursuant to 16 USCS § 1362). Thresholds were assessed for each priority bird VEC relative to the population size determined by their UoA.

For each priority bird VEC, the annual number of fatalities that could be sustained without compromising long-term viability was determined using a simple “Potential Biological Removal” (PBR) analysis, see below. This annual fatality estimate was then compared with the annual number of fatalities predicted from the effects of principal external stressors on the population, in particular illegal killing, power-line electrocution, and the taking of live birds[1]. When this fatality estimate exceeded the PBR level, an annual threshold of zero fatality threshold targets was applied. When the PBR level was not exceeded, the expertise of the authors of the conservation status of the population was used to assess whether the results was (a) sufficiently close to the PBR to imply no WPP-related mortality was possible without an adverse effect on the population or (b) sufficiently below the PBR level to indicate that some WPP-related mortality was possible without an effect on population viability. When the results of this effort were best described by (a), a zero fatality threshold target was applied to the species. When it was best described by (b), a more complex population viability analysis (PVA) was conducted to inform the setting of an appropriate annual fatality threshold target.

PBR analysis is a simple, robust, and precautionary test developed for situations in which information on species population biology is limited (see Wade, 1998; Neil and Lebreton, 2005; Dillingham and Fletcher, 2011). It uses species-specific biological and demographic parameters, specifically adult survival rate and year of first breeding, to calculate an annual rate of human-caused mortality that if realized would likely result in a non-viable population in the long term. It should be highlighted that no cumulative collision risk estimate could be obtained since not all wind farm projects in the study area have performed a Collision Risk Modelling and the SESA has indicated that such modelling is difficult to provide valid estimates in the geographical area of the Gulf of Suez.

However, information has been gathered from the existing operational WPPs and OHTLs in the region. In addition to performing a CRM, and the lack of a peer-review of the reports, results of the post-construction fatality monitoring may highlight about the current extent (species) and impact (number of fatalities) within the region.

[1] Information on the number of fatalities from external stressors is scarce for both the study area and Egypt as a whole, and typically relates to “incidental” reports of fatalities and their apparent causes. To address this information gap and make it possible to incorporate external stressors into an assessment of the viability of each population, the ERP identified principal stressors for the priority bird VECs and then gave approximate range estimates of the annual number of fatalities attributable to each stressor individually and all external stressors combined. Range estimates for annual fatalities were < 1, ≥ 1 and < 5, ≥ 5 and < 10, > 10 < 100, > 100 < 1000, > 1000 < 10000.

Thus, we have only considered qualitative information about fatalities in the region. One of the representative papers is that from Riad[2] (2022) which collated data from March 2019 to May 2022 form wind farms in the NREA area, recording fifty nine fatalities with wind turbines. The most affected species in order of importance were the White stork, followed by a second group formed by the Black kite, Steppe Buzzard and Honey Buzzard, and all the remaining species: Lesser Spotted and Steppe eagles, Eurasian Sparrowhawk, Montagu´s and Marsh harriers, and Common Kestrel. We cannot forget the lack of systematic fatality searches and corrections for potential biases, nor the systematic review of those species not considered migratory soaring birds.

Primary Threshold Targets

Priority bird VEC populations that were assigned a zero-fatality threshold target are subject to monitoring, mitigation plans and adaptive management designed to minimize the contact of these species with WPPs in the study area, and conservation actions designed to reduce the number of fatalities from other stressors. For these priority bird VECs, an adaptive management response is triggered when there is an elevated-risk situation or a near-miss incident or if a fatality occurs.

Annual Fatality Threshold Targets

Priority bird VECs assigned to an annual fatality threshold target is subject to the same monitoring and mitigation plans and adaptive management as zero fatality threshold populations. For these priority bird VECs, an adaptive management response is triggered when periodic review of the results of post-construction carcass searches shows that the annual fatality threshold target has been exceeded.

Other Threshold Targets: Extreme Events Threshold Targets

In addition to thresholds set for priority bird VECs, thresholds are required to alleviate the risk of multi- fatality events to a small number of populations that are not priority bird VECs. This is particularly relevant to WPPs in the study area because of the potential for flocks of specific nonpriority MSBs to occur in the area. For practical reasons, such as the need for a quick decision in the field to avoid this type of extreme event, thresholds should be set to a standard flock size (regardless of species) and should be broadly informed by PBR levels of flocking species and estimates of external stressor fatality rates.

Adaptive Management

Adaptive management is triggered when target thresholds are exceeded and when new evidence acquired over time shows an increased or decreased risk to a priority bird VEC or an increased risk to a non-priority population. Increased risk to priority birds requires that mitigation and management measures be revised to uphold thresholds and promote the long-term viability of the population. For priority bird VECs that exhibit a decreased risk over time, their primary threshold target may be reassessed, and revised or reassigned to reflect the reduced risk to their long-term population viability. Non-priority populations that exhibit evidence of increased risk may be assigned as priority bird VECs, may have an appropriate threshold determined and may be subject to associated adaptive management response strategies. Adaptive management is a key component of threshold setting within the CEA as it provides a mechanism for dealing with the uncertainty associated with determining priority bird populations and with predicting thresholds for priority bird VECs.

For the OHTLs, the most comprehensive work developed up to now it has been that by Nature Egypt (unpublished) between 2019 and 2021. In 2019 (spring) and 2020 (spring and autumn) the fieldwork took place in the western side of the Gulf of Suez; in 2021 in the Sinai Peninsula side. The most abundant was the White Stork, followed by the Honey and Steppe buzzards. No eagles were reported but four Common Cranes. The study reported 87% of soaring birds but, in our opinion, it is an overestimation given that this group comprises larger species with longer carcass persistence (pers. obs.) compared to smaller species.

Comparing the results of this CEA with those from the PCFM, it seems all match in terms of what species are those at higher risks.

[2] Riad, S. 2022. Egypt. Acad. J. Biolog. Sci., 14(2): 19-33 (2022)

This process is iterative, and the breaching of successive thresholds should be matched by an increase in the measures to protect and promote the viability of priority bird VEC populations.

Adaptive management responses are not limited to exceeded thresholds. Adaptive management may also be triggered in response to other events:

- Evidence of an increased risk to a population from other unrelated sources that indirectly affects the thresholdfor fatalities related to the study area. For example, evidence of increased persecution during the operational phase of the WPPs may lead to re-assigning a priority bird VEC with an *annual fatality threshold target* to a *zero fatality threshold target.*

- A near-miss incident, in which no fatality occurred but monitoring and mitigation protocols failed to alleviate the risk of collision; for example, where a request to shut down a turbine in response to an approaching priority bird was not completed before the bird flew through the rotor-swept area, leading to a review and revision of monitoring and mitigation protocols.

<u>Decision Tree for Thresholds</u>

The decision tree explains the threshold system and actions triggered because of passing a threshold see Figure 6 below. In addition, the decision tree and proposed thresholds from step 4 provide the basis for developing mitigation and monitoring protocols, the adaptive management framework, and joint management and action plans for developers and other stakeholders (see step 5).

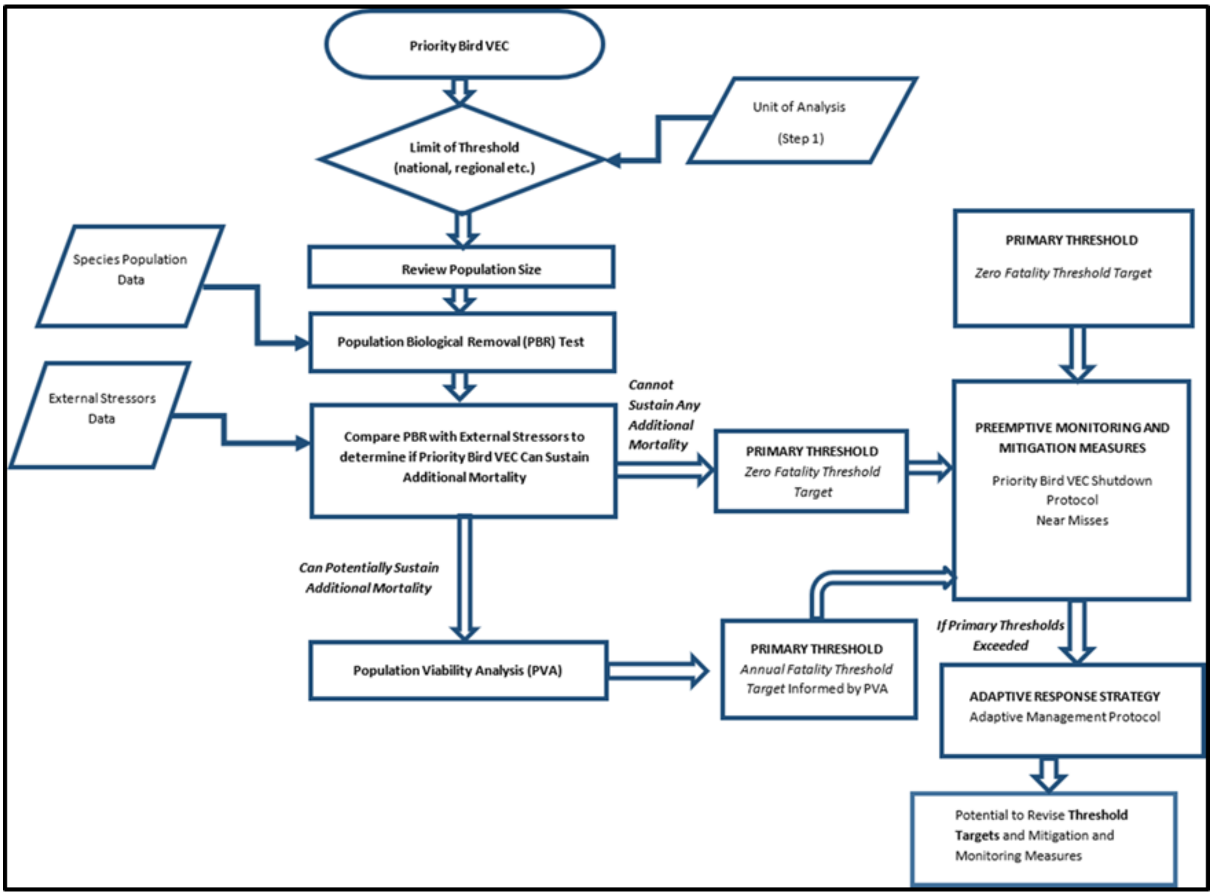

Figure 6: Decision Tree for Priority Bird VECs

Out of the 13 species, nine species were assigned to a zero fatality threshold target as a result of applying the threshold-setting protocol in step 4, while the other three species were given a threshold ranging from 1 to 10 individuals per species, see tables below.

Biological and demographic parameters required to conduct threshold-setting analyses were taken from existing species-specific studies for each priority bird VEC. Parameters derived from studies of populations within the Middle East region were used if existing; otherwise the results of studies from the most appropriate population outside the region were used. Using surrogate parameters from different populations of the same species should provide reasonably similar parameter values, as was the case here. The two populations are similar in other aspects of their biology, e.g., migratory, no migratory populations. For some of the species were no species-specific parameters were available, typical values for raptors of similar mass were used to give an indication of a likely threshold. Adult survival and age of first breeding are related to body mass in raptors (Newton, 1979; Newton et al. 2016); therefore, using surrogate species with similar mass should allow approximate predictions about the amount of mortality these priority bird VEC populations can sustain.

Table 12: Demographic Parameters of Avifauna

Species	IUCN Red List Status	Unit of Analysis	Flyway Population	Demographic Parameters			
				Age at First Breeding	Annual Adult Survival (%)	Recovery Factor Used in PBR	PBR Level Estimate, Annual No. of Fatalities
Black Stork Ciconia nigra	LC	Flyway Population	19,500	3	80%	0.1	102
White Stork Ciconia ciconia	LC	Flyway Population	450,000	3	78%	0.1	2353
Common Crane Grus grus	LC	Flyway Population	35,000	4	89%	0.1	183
Great White Pelican Pelecanus onocrotalus1	LC	Flyway Population	70,000	3	80%	0.1	366
European H. Buzzard Pernis apivorus2	LC	Flyway Population	1,000,000	3	90%	1	75000
Egyptian Vulture Neophron percnopterus	EN	Flyway Population	4,335	5	93%	0.1	10
Steppe Eagle Aquila nipalensis4	EN	Flyway Population	37,500	4	92%	0.1	197
Greater Spotted Eagle Clanga clanga4	VU	Flyway Population	2,180	4	92%	0.1	11
Booted Eagle Hieraaetus Pennatus3	LC	Flyway Population	3,169	4	96%	1	125
Steppe Buzzard Buteo buteo2	LC	Flyway Population	1,250,000	3	90%	1	93750
Pallid Harrier Circus macrourus	NT	Flyway Population	1,505	3	74%	1	59
Black Kite Milvus migrans2	LC	Flyway Population	132,700	3	90%	1	9953
E. Imperial Eagle Aquila heliaca	VU	Flyway Population	2,125	4	96%	0.1	94

- No species-specific biological or demographic parameters available. Analysis uses an estimate of adult survival rate and age of first breeding for the American White Pelican (Johnson and Sloan, 1978).
- No species-specific biological or demographic parameters available. Analysis uses an estimate of adult survival rate and age of first breeding for the red kite Milvus milvus) (Newton, Davis, and Davis, 1989)
- No species-specific biological or demographic parameters available. Analysis uses an estimate of adult survival rate and age of first breeding for the Eastern imperial eagle Aquila heliaca (Katzner et al., 2006)
- No species-specific biological or demographic parameters available. Analysis uses an estimate of adult survival rate and age of first breeding for the Eurasian Sparrowhawk Accipiter nisus (Newton, 1975).

Table 13: Priority VECs – Review of Steps 1-3 and Results of Step 4 Identifying thresholds

Species	IUCN Red List Status	SVI	Vulnerability	Relative Importance	Sensitivity	LoE	Overall Risk	PBR Level (annual fatality estimate)		Non-wind farm fatality estimate			Primary Threshold Target
									Wind farm estimate	Electrocution	Illegal killing	Collection of live birds	
Black Stork Ciconia nigra	LC	10	Moderate	High	High	High	Major	102	0	≥1 and <5	≥1 and <5	≥1 and <5	Zero fatality
White Stork Ciconia ciconia	LC	10	Moderate	High	High	High	Major	2353	>5	> 10 < 100	> 100 < 1000	> 10 < 100	7
Common Crane Grus grus	LC	10	Moderate	High	High	High	Major	183	0	> 10 < 100	> 10 < 100	> 10 < 100	Zero fatality
Great White Pelican Pelecanus onocrotalus	LC	10	Moderate	High	High	High	Major	366	0	> 10 < 100	> 10 < 100	> 10 < 100	Zero fatality
Egyptian Vulture Neophron percnopterus	EN	10	High	Low	Medium	Medium	Moderate	9.6	0	≥1 and <5	≥1 and <5	≥1 and <5	Zero fatality
Steppe Eagle Aquila nipalensis	EN	9	High	High	High	Medium	Major	197	>1 and <5	> 10 < 100	> 10 < 100	> 10 < 100	Zero fatality
Greater Spotted Eagle Clanga clanga	VU	9	High	High	High	Medium	Moderate	11	1	> 10 < 100	≥1 and <5	≥1 and <5	Zero fatality
Booted Eagle Hieraaetus pennatus	LC	9	Moderate	High	High	Medium	Major	125	0	> 10 < 100	≥1 and <5	≥1 and <5	Zero fatality
Steppe Buzzard Buteo buteo	LC	7	Negligible	Low	Low	High	Moderate	93750	>1 and <5	> 10 < 100	≥1 and <5	≥1 and <5	10
Pallid Harrier Circus macrourus	NT	8	Moderate	Moderate	Medium	Medium	Moderate	59	0	> 10 < 100	≥1 and <5	≥1 and <5	Zero fatality
E. Honey Buzzard Pernis apivorus	LC	7	Moderate	Low	Low	High	Moderate	75000	> 10 < 100	> 10 < 100	≥1 and <5	≥1 and <5	10
Black Kite Milvus migrans	LC	8	Low	Moderate	Medium	Medium	Moderate	9953	>1 and <5	> 10 < 100	≥1 and <5	≥1 and <5	10
E. Imperial Eagle Aquila heliaca	VU	9	High	Low	Medium	Medium	Moderate	94	0	> 10 < 100	> 10 < 100	≥1 and <5	Zero fatality

4.5 Step 5 – Identify mitigation and monitoring

This section follows the broad mitigation and monitoring actions that were proposed by the Cumulative Effects Analysis that was undertaken for Lekela and IPH projects. Following the same approach and building on the results of that analysis while adding to it more analysis by the more recent field assessments and literature, the actions follow the same approach and broad lines. These mitigation and monitoring actions focus on the 11-priority bird VECs, as identified in this document, but will, even if indirectly, will provide benefits for other bird species passing through the area of all wind farms. In all cases, mitigation and monitoring actions are based on industry good practice, adapted to be locally-relevant. Mitigation and monitoring actions focus on two areas:

- On-site mitigation and monitoring methods, to minimize collision risk, validate the effectiveness of proposed mitigation methods, allow estimation of residual impacts, and provide information to adapt monitoring and mitigation to prevailing conditions; and,
- Collaborative efforts with other wind farm developers, to minimize the cumulative effects of all the proposed wind farm developments in the study area.

Since these measures have been included in the project's ESIA, which will be submitted for approval, and have already been adopted by existing developers in the study area (such as Lekela, Amunet, RSWE and IPH), we are confident that the conservation and protection of the VECs all across the critical part of the flyway area will be ensured. By adopting best-practice mitigation measures and monitoring actions, SWE will be able to reduce its impact for the identified VECs (see Table 11 and Table 12).

Table 11: Proposed Mitigation Measures and Monitoring Actions for the Project

Action	Measure	Description	Key objective	Responsible entity	Timeframe
Site-specific mitigation actions					
1	Development of appropriate protocols	All actions require clear and detailed protocols that can be followed by all survey teams: this information should be included in the relevant Project documents. Protocols should align with industry good-practice guidelines, and be designed by an ornithologist experienced in assessing bird risk at wind farm developments. This can build on the already available protocols prepared for the implementation of the ATMPthat is already being implemented at the operational wind farms along the Gulf of Suez	Ensure that all actions are undertaken in a consistent manner, and collect appropriate data to make decisions.	Consultant / RCREEE	Approved protocols at least three months prior to commencement of operation
2	Shutdown On-demand	Shutdown on-demand' is an established method to mitigate the risk to birds of colliding with wind turbine rotors. It involves a coordinated team of field observers identifying situations when birds are at risk of colliding with turbines as they move within the wind farm, and initiating a temporary shut-down of one or more turbines.	To minimize the number of collisions between priority bird VECs and wind turbines.	Consultant / RCREEE	Protocols and tested system in place prior to commencement of operation
3	Installation of bird flight diverters on Project power lines	Many bird species are known to collide with power lines (particularly high-voltage lines), and installing bird flight diverters has been shown to lessen this risk. Theconfiguration (type and frequency) of bird flight diverters should be based on industry Good-practice, relying on local examples of successful installation if available.	Minimization of collisions to priority bird VECs with Project power lines	EETC	During power line erection
4	Mitigation effectiveness	Immediate review of process in the event of a recorded mortality for a priority bird VEC, to determine if additional actions could be implemented to further reduce collision risk.	Ensure that all actions are undertaken in a consistent manner, and collect appropriate data to make decisions.	Consultant / RCREEE	Throughout implementation
5	Monitoring of priority VECS in-flight monitoring	'In-flight monitoring' is a bird surveillance program and method that is designed to monitor activity and track the flight paths of Priority Birds[1] and flocks of non-priority Migratory Soaring Birds (MSBs) relative to operational wind turbines. The principal aim of in-flight monitoring is to inform turbine shutdown decisions and to identify 'Elevated Risk Situations'. Similar to shut down on-demand, in-flight monitoring of priority birds follows a protocol that can be developed following the protocols developed as part of the ATMP that is being implemented as part of the operational monitoring of wind farms along the Gulf of Suez	To ensure that shut-down on demand protocols can be initiated with sufficient timeto minimize bird collisions	Consultant / RCREEE	Prior to commencement of operation
6	Carcass search surveys	This involves regular surveys of the area beneath turbines to detect carcasses from individual birds that have collided with turbine blades. Similar surveys are being already implemented, according to best-practice guidelines, in operational wind farmsalong the Gulf of Suez as part of the ATMP and can be applied similarly at the project site. To be carried out in accordance with Post-construction Bird and Bat Fatality Monitoring for Onshore Wind Energy Facilities in Emerging Market Countries – Good Practice Handbook and Decision Support Tool (2023)	To determine the level of observed fatalities due to collisions with turbines and power lines at the wind farm site.	Consultant / RCREEE	On-going for at least the first three years of operation, then reassessment

7	Carcass bias-correction trials	Bias-correction trials aim to convert the observed carcasses to an actual estimate of mortalities, as some carcasses will be removed prior to carcass surveys occurring (carcass removal bias), and searchers will not detect all carcasses present (searcher efficiency bias). Such trials are being already implemented, according to best-practice guidelines, in operational wind farms along the Gulf of Suez as part of the ATMP and can be applied similarly at the project site. To be carried out in accordance with Post-construction Bird and Bat Fatality Monitoring for Onshore Wind Energy Facilities in Emerging Market Countries – Good Practice Handbook and Decision Support Tool (2023)	To determine the correction factor to apply to detected carcasses to estimate true project-related mortality.	Consultant / RCREEE	Annually for three years, then reassessment. Can begin prior to commencement of operation.
8	Review to improve monitoring	Periodic reviews of Actions 1, 2, and 4-8 will be undertaken to improve the effectiveness of monitoring and mitigation actions. This will include:	Adaptive management to reduce risk	SWE	On-going from start of construction

[1] These are bird populations identified by the CEA as least able to tolerate adverse effects on their populations and remain viable in the long-term.

Table 12: Proposed Mitigation Measures and Monitoring Actions for the Study Area

Action	Measure	Description	Key objective	Responsible entity	Timeframe
Actions to be implemented on the level of the study area					
9	Data sharing	All developers to make annual summaries of their respective monitoring and mitigation efforts publicly available to support baseline knowledge, increase Transparency and understanding of the work being undertaken.	Maximize the knowledge base in the region.	All developers	Variable, depending on the data released
10	Joint training of observers	All developers to contribute to the joint training of a pool of skilled bird observers who are able to carry out baseline and monitoring surveys throughout the study area, and adjacent Important Bird Area	Ensure comparable observer standards are maintained across all project sites.	All developers	On-going, with establishment prior to commencement of operation
11	Coordination of observer networks	All developers to co-ordinate in the Project area to site observer networks where these can be of greatest benefit	Maximize the benefits from an extended observer network	All developers	On-going, with establishment prior to commencement of operation
12	Discussion forum	Facilitate / support an annual biodiversity workshop / conference for all wind farms in the Project area, to facilitate knowledge exchange, share experiences and plan cumulative actions….	Improve regional knowledge of priority avian VECs and improve wind farm operations	All developers	Annually

5. NEXT STEPS

The CEA has focused on identifying priority bird VECs and outlining appropriate mitigation and monitoring actions. In order to complete the cumulative effects analysis the following actions are required:

- Share the findings for review and input with stakeholders including (but not limited to): government agencies, RCREEE, wind farm developers, lenders, NGOs (e.g. Nature Conservation Egypt, BirdLife International), environmental impact experts, and ecologists with local expertise.
- It is well documented that avifauna and more specifically MSBs are potentially the taxa that are at the highest risk from the development of wind power projects, however it would be worth expanding the CEA to include taxa other than avifauna to ensure that any additional VECs identified can be included in the future mitigation and monitoring actions of the study area. Determination of non-bird biodiversity priority VECs through stakeholder/expert consultation and potentially additional field work and mapping.

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