APPENDIX G

Ornithology Study for a Proposed 100MW Wind Energy Project, Kajiado District, Kenya

Report Prepared for

Kipeto Energy Limited

March 2012

Ornithology Study for a Proposed 100MW Wind Energy Project, Kajiado District, Kenya

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1 Executive Summary

Currently the electricity sector in Kenya only reaches an estimated 14 percent of the population. Further electricity generation is therefore necessary in order to reach a greater percentage of the population and support economic growth. The situation is aggravated by the over reliance (approximately 50%) on hydropower which has been often unreliable especially in the dry seasons. The 1999 -2002 drought in the region is an example of periods where lack of water supply greatly affected the power production of the hydroelectric dams which had a crippling effect on the economy. As such, the project will increase the resilience of the Kenya power generation. This experience underscores the need to increase power production and to diversify power sources. The entry of the Kipeto Wind Power Project into the Kenya power scenario will help the country to address power shortage and enhance further economic growth.

In accordance with Kenya's Vision 2030, energy is one of the infrastructural enablers of the three (3) developments pillars, namely the economic, social and political aspects. In addition, the current energy policy objectives in Kenya emphasize the need for energy availability and accessibility at cost effective prices. The policy also supports sustainable socio-economic development while protecting and conserving the environment. The main sources of energy in Kenya are electricity, wood fuel, petroleum and renewable energy. Of the total energy requirements in the country, the bulk (68%) of the country's primary energy consumption comes from wood fuel and other biomass sources which has resulted in one of the highest deforestation rate on the whole Africa continent. This is followed by petroleum at 22%, electricity at 9% and other sources at 1%.

Of the above main sources of energy in Kenya, electricity is crucial for the economic development of the nation. The provision of inexpensive and reliable supply of electricity is the lifeblood of the Kenyan economy. However, today Kenya's electricity supplies are unreliable and expensive. The entry of the Kipeto Wind Power Project into the Kenya power mix will help the country to address power shortage and enhance further economic growth. However, the development power production as projected in the Kipeto Wind Power Project is likely to have site-specific and limited impacts on the bio-physical and social environment of the project area. As a result, an Environmental and Social Impact Assessment (ESIA) Study for the proposed project was carried out in accordance to the Kenya's Environmental Management and Coordination Act (EMCA, 1999).

In accordance with the 2nd Schedule of the Environmental (Impact Assessment and Audit) Regulations of 2003, the project of this nature requires an Environmental Impact Assessment Study. Numerous other laws and regulations have influence on the various aspects and activities of the proposed Kipeto Wind Power Project. Several international conventions and agreements are relevant to this study, including, among others, the Convention on Biological Diversity (CBD); the Convention on the conservation of migratory species of wildlife animals; and the African convention on the conservation of nature and natural resources.

This report presents findings of ornithological assessment of the proposed site which forms part of the main ESIA. This report is the Executive Summary of the ornithological Assessment for proposed Kipeto Wind Power site. The objectives of the Impact Assessment (ESIA) Study were to identify and evaluate the impacts which could arise from the proposed construction and operation of project's activities and provide mitigation measures.

The methodology underlying the preparation of the Study included a multi-stage approach, namely the preparation of a biophysical scoping review. Monthly bird surveys from April to December 2011 and an exhaustive literature review on similar projects were undertaken.

This report assesses the status of birds'dependent on the area in and around the proposed wind-farm development site. It comments on observations of monthly bird activity carried out during surveys over the period April 2011 – December 2011. . A total of 45 survey days were carried out which has provided a comprehensive account of the birds species utilizing the area.

During the study period a total of 130 species was recorded on site. This list includes species observed breeding or utilizing the site for other purposes, also included is the conservation assessment of the species according to International Union for Conservation of Nature (IUCN) Criteria. Regular surveys throughout the seasons including vantage point counts and general transect sampling was undertaken.

Results showed that this development site attracts a varied number of species. Some of the species are specialized to the existing habitats. A substantial number of migrants were observed including Lesser Kestrel. The sensitivity of the area in relation to the species observed and project impacts are discussed.

2 Study Methodology

2.1 Approach

This study involved both desktop search for related projects and Field Surveys to fully understand the consequence of the proposed energy facility. An extensive literature review on similar projects was undertaken; monthly bird surveys were undertaken using standard methods at the proposed site to understand bird habitat interaction and distribution in relation to the proposed wind facility. The potential impacts of the proposed facility were described and quantified against a standardised criteria and sensitive areas identified during the field surveys.

The principal goal of the bird surveys was to:

1. *Provide information on avian resources and use of the project site that is useful in evaluating potential impacts from the proposed wind power development;*
2. *Provide information on avian movement over the proposed development area that is useful in evaluating the relative risk of the proposed wind project;*
3. *Provide information on avian sensitive species use of the project site that would help in designing a wind plant that is less likely to expose species to potential collisions with turbines, and;*
4. *Provide recommendations for further monitoring studies and potential mitigation measures,*

These included field surveys for avian species, with a focus on raptors, breeding birds, other medium sized birds considered most vulnerable to similar development projects. Specific objectives of the study were to (1) describe and quantify diurnal bird migration over the proposed project (2) describe and quantify breeding bird use in the proposed project area, (3) describe and quantify resident raptors in the proposed project, (4) identify the presence of any special-status species (e.g., IUCN or National -listed species) that may occur seasonally in the project area.

The survey methods involved vantage point watches and transect surveys. This is based on the recommended survey methodologies (SNH, 2005), *Bird survey methods for use in assessing the impacts of onshore wind farms on bird communities*), adapted to suit to the conditions at the project site. The same methods have been employed in similar projects in Kenya (Lake Tukana Wind Project and Ngong Hills). Following this, the survey methods focused on:

- *Population surveys for all species*
- *Identifying key species vulnerable to wind energy projects*
- *Bird movements at various vantage points proposed for wind turbines*
- *Determine Behavioral aspects of key species especially those that would be impacted upon by the project e.g. breeding, including nest observations etc*
- *Identifying the distribution of the species vis-a-vis the potential locations for the wind turbines*

A summary of the methods are provided below.

2.2 Vantage point (VP) watches

Diurnal Vantage Point Surveys was carried out to estimate spatial and temporal use of the site by resident and migrant raptors and other diurnal passerines. Sampling intensity was designed to document raptor movement throughout the proposed development area. Movement of other resident medium sized non-raptor species was also noted.

Ten vantage points were selected along an approximately east-west transect / North-South though the project area (Figure 1). The survey points were selected to provide good visibility in all directions while sampling different vegetation, topographic features, and portions of the study area without overlap. VP watches were carried out to assess the likelihood of collision with wind turbines vantage point (overlooking the proposed site to assess the usage of the site by overflying birds.

A number of factors listed guided the choice for VP watches;

- Accessibility to allow frequent visits and replication of observations to avoid bias
- Large field of view to monitor raptors in all directions to achieve maximum view
- Landscape aspects to incorporate both hills and valleys to assess movement and behaviour of species along proposed wind farm locations
- Location of wind farms guided by the existing masts to guide in assessing behaviour around the key positions
- Maximum habitat coverage to cover all existing ahbitats

The choice of VPs was mainly to achieve full coverage of the defined area for the proposed wind farm, to assess behaviour of birds on proposed area including their movements and estimates of time spent on habitat (time/activity budget etc.) and also to achieve maximum visibility with the minimum habitats. The choice was also guided by the different micro-habitats (woodland, grasslands) and landscapes (ridges etc.) within the defined area. A consideration of these factors assisted in providing recommendations for different aspects of the project. This data will provide estimates of the probability of collision for potentially susceptible species and in turn the potential impact on such species can be assessed.

Recordings at vantage points focused on larger, less maneuverable species which are known to be at potential risk of collision with wind turbines (target species), these are as follows:

- *All large water birds (plover sized and above), e.g. ducks, storks and cranes;*
- *Birds of prey, including raptors such as vultures, eagles, buzzards, kestrels;*
- *Bustards;*

The vantage point (VP) watches entailed recording target species, bird flights and flight height over a set area of the potential wind turbine locations at a representative number of locations- twelve VPs (see Figure 1). Flight height was measured in different height bands of <10 m, 10-100 m and > 100m for target species corresponding to height of masts on site. Height was classified based on the height bands of existing wind masts at the sites, where wind masts were absent experience from the locations with wind masts guided the estimates. Prior training was undertaken to check observer accuracy and height estimation to reduce bias. The orientation of each VP covered a 360° field of view. Four of these VPs were located at meteorological mast sites and the rest concentrated on potential high wind intensity areas These twelve locations were chosen as a sample to give good spatial coverage across the site to cover regular bird-flight lines and potential migratory movement.

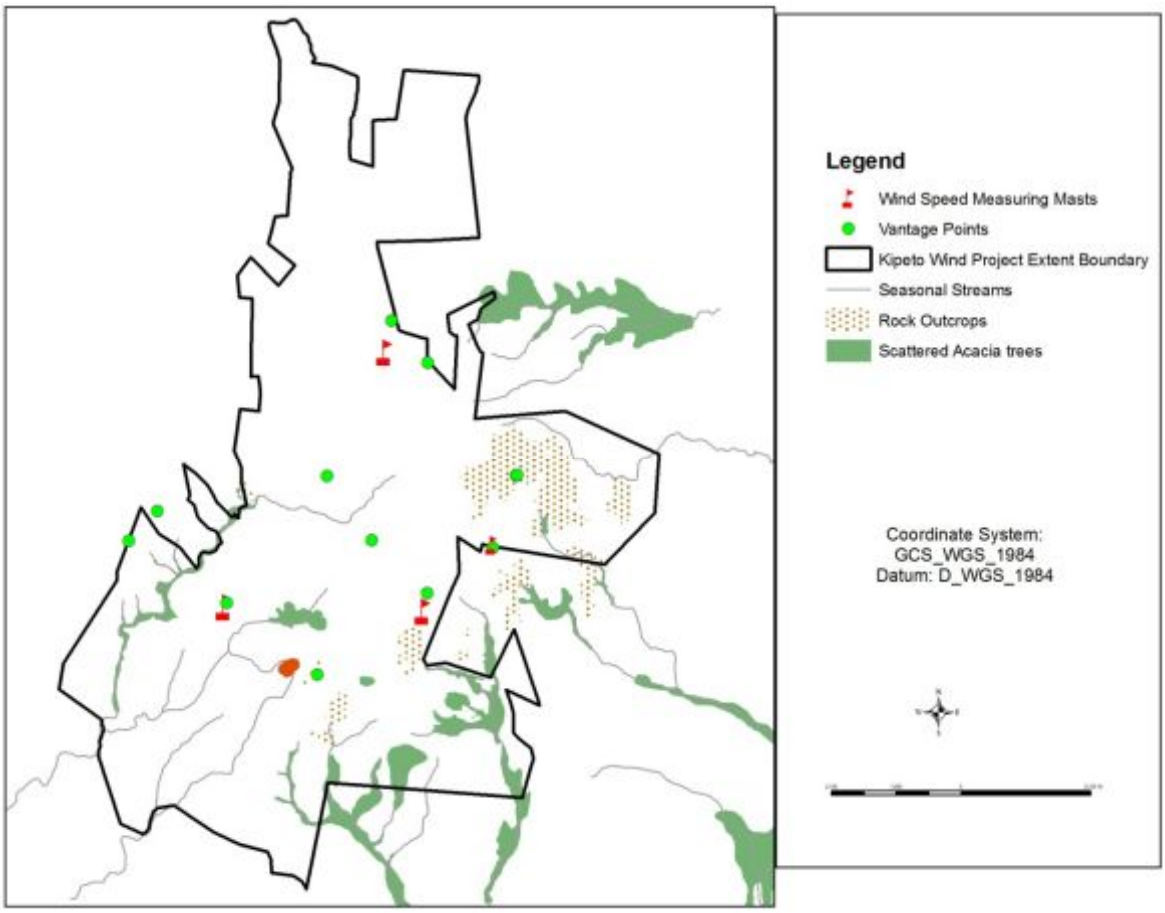


Figure 1 Kipeto Map Showing VP Locations

The following parameters were recorded for each bird flight and entered onto standard recording data forms.

- *Species name and number*
- *Duration of Survey (Time start and end)*
- *Time species observed*
- *Flight Height and direction*
- *Wind speed estimate*
- *Wind direction*
- *Activity of species*
- *Other general observations*

During the April VP surveys VPs were visited four times (2 mornings and 2evenings) for 3hours (4 x 3 hours) while in successive survey each VP was visited twice (1 morning and 1 evening of different days (2 x 3 hours) respectively taking into account different times of the day to capture diurnal movements and activity pattern. Survey effort was intensified in April due to the presence of flocks of migrating raptors. This was done to capture the pattern of movement, their distribution and use of habitat, yet it is also envisaged that these are the species that are most likely to be highly vulnerable.

2.3 Bird Transect Surveys

Bird transects survey were employed to assess the potential for birds being excluded from the wind farm site. This was done to estimate the population size of all of the species encountered within the proposed wind farm. This provided the baseline population of all of the potentially affected species to be assessed so that potential impacts can be established.

Observations along transects focused on all species utilizing the habitat to gain a clear picture of the avifauna in the area.Existing access tracks were used as transects and was surveyed on vehicle. This started from 500 meters south of the site boundary on the main track, and continued within the site boundary en route to the VP watch location on each day. Stops were made when bird species were encountered both flying and on the ground, and details were recorded on the standard data form as used for the VP surveys following distance sampling protocols. This data will be useful in calculating species densities and generating populations within the site.

Transect surveys essentially involved driving between VP locations designed to maximize coverage of the study site and approach to landscape features which may be of potential ornithological importance e.g. ponds, habitat diversity (i.e. in the fashion of a Brown & Shepherd (1993). Periodic scanning for birds and stops to listen for calls formed part of the drive around the survey area. All species within a transect were recorded including distance from transect using a range finder. Activities of species during observations are noted. The transects covered the habitat in all compass directions, crossing north- south, east - west direction. These transects were chosen as a sample to give good spatial coverage across the site, >50% of the area, (based on an average 2km field of view), to cover views of ridgelines and valleys, and the full range of habitats on the site (i.e. from grasslands to woodlands).

3 Description of the Project Environment

3.1 Bird Importance

Extensive field and literature surveys carried out between April and December 2011 show that the proposed area is important for different bird assemblages (Appendix I). The birds utilize the area for daily resource use and most important as:

(i) Passage route for migrants;

(ii) Foraging by local resident species and migrants; and

(iii) Breeding for resident species.

The avifauna of the Kipeto area is typically comprised of a mixture of 'groups of species including woodland birds, grassland specialists and water birds both passerines and raptors either spending part or all of their annual life cycle in the area.

The species richness and distribution in the area is the result of a combination of interactive environmental and physical variables e.g. Physical factors including hilly topography, varied weather condition and vegetation.

3.2 Protected Land Status

The proposed development does not fall within a protected area. Land is privately owned. The nearest protected area and designated IBAs are Nairobi national Park which lies North East and >100km away. Lake Magadi lies >60km to the west of Kipeto and is important for flamingos. However its highly unlikely that other wetland, grassland and shrubland bird species apart from a large number of raptor species with extensive ranges from the two protected areas would use the area either as passage or foraging sites though no studies exist to provide information on the movement of birds along this corridor. However, the development area lies within the rift valley which is considered a major migratory corridor. As an important management recommendation it would be important to monitor these groups of species during construction and operation phases of the project.

3.3 Weather Patterns

Kipeto area presents a varied dryland weather conditions with very cold nights, chilly mornings and hot day temperatures. Wind conditions however varied with season and time of day. Avian use was surveyed for all weather conditions with low cloud cover (between 0 and 25% cloud cover), medium cloud cover (between 25% and 75% cloud cover), and high cloud cover or overcast (between 75 and 100% cover) and for periods with no and some precipitation. Most of the mornings were characterized with misty conditions this resulted in very low or no bird activity. These conditions at times extend until midday when bird activity began to peak. It was windier during the cold season compared to the dry season. However the correlation of species occurrence and wind was not very significant. Bird activities for both passerines and raptors combined, as expected, dropped off during precipitation events, but this difference was not significant. Bird activities also dropped off slightly during periods of high cloud cover, but not significantly so.

There were no correlations between avian use and precipitation or maximum temperature recorded on site during the study period. Raptors however took advantage of warm weather conditions coupled with moderately to high wind conditions that favored their movements. Both temperature and wind conditions are significant factors determining raptor observations and movement in the study site.

3.4 Vegetation Types and Bird Micro habitats

The wide variety of habitat types explains the rich species diversity and distribution in the study area. The study area is a mosaic of habitat types including open grass fields, rocky outcrops, scattered wetlands (dams, ponds and seasonal streams), Short and tall *Acacia drepanolobium* woodland, grass with scattered acacia, residential/developed patches, and cleared corridors of rural roads.

The survey points were established in a fashion that allowed extensive coverage of the habitats and all vegetation types present. Most of the short acacia woodlands occurred in the western portion of the project area. The central portions were dominated by grassland areas. Development/residential also characterized the area. The eastern portion was mainly dominated by medium tall *Acacia drepanolobium* woodland and rocky outcrops. Overall, bird activity was higher in the woodlands along the valleys, the same trend was observed for raptors. Vegetation is therefore a very important determinant of species use and distribution within the site.

The following sensitive micro-habitat types were observed during the site visit:

- Streams / water pans – these are all very important for birdlife as they act as an attractant to many species and this can bring the birds close to the proposed turbines. However these areas mostly hold water during the wet season, however the duration in which they hold this water is unknown.
- Ridges presented important habitat for a number of species. Most relevant to this study are raptors, storks, vultures, swifts and swallows which prefer flying along ridges where there are favorable air currents to provide lift and thereby using less flight energy. The increased wind speed in this ridge areas may also mean that birds have less control of their own flight and are less able to adjust to avoid obstacles such as wind turbines

3.5 Species Diversity

Over 100 species were recorded in the Proposed Kipeto Wind Project site during the survey (Appendix I). The species comprised different groups of birds including raptors which are among our target species and considered most vulnerable under the current situation. Other medium sized birds, water birds were also observed e.g. the Egyptian goose though in low numbers, grassland birds such as larks and pipits dominated the grassland habitats and are also common residents of the area, woodland birds mostly warblers dominated the Acacia woodlands with the riparian habitats.

The study confirmed that the site is an important passage and feeding site for migratory birds both raptors and passerines. The area is used basically as a feeding, flight route and passageway. Some common resident birds were recorded breeding; this included the Rufous sparrows, weaver birds and Kori Bustard. Other birds that showed breeding signs included plovers which are mainly ground dwellers. No raptors were observed to breed and none showed any signs of breeding. Most of the birds occurred within the riparian habitats and most raptor movement followed the same pattern coinciding with the ridges concentrated on the western side.

The most common species during the survey was Lesser Kestrel with counts of at least 500 individual birds/flights per day, followed by Eurasian Hobbies < 20 individuals, Amur falcons arrived just as the field survey and we counted up to 100 individuals. These species of migrants only occurred in April during the migratory period and were not recorded again in subsequent surveys. Other species of significant focus for the proposed project included Steppe buzzard, Tawny eagle, Steppe eagle, Martial eagle, Rüppell's griffon vulture, Lappet face vulture (IUCN Listed as Near-threatened), although this were observed only on one occasion during the monthly surveys, Pallid harrier, Black-shouldered kite. Other non-raptor target species recorded included Kori Bustard also observed nesting with young, White-bellied Bustard, White Storks, Ostrich, Crowned plovers, Egyptian geese. These were recorded in only small numbers. Other small land birds were also recorded.

3.6 Monthly Vantage point observations April to December 2011

Different groups of birds were recorded at different VP watches during the survey months, however there were more groups of birds in April than in subsequent surveys; this is because it coincided with the migratory season. Target species at VPs were wholly restricted to medium sized species e.g. raptors, plovers, cranes, storks, ducks, bustards etc.

Although the data does indicate the majority of species are at relatively low densities outside the migration season, however high density of raptors are likely to be observed during the migration seasons both winter and summer. This is evidenced by the fact only few target species birds were recorded during the subsequent transect and VP surveys, in transects where birds were recorded these were only in low numbers.

Other non- raptor target species recorded included single sightings of Kori bustard, Back-bellied bustard, Grey crowned crane, Egyptian goose, Secretary bird, Marabou and white storks recorded during the April and June transect surveys. However these were rarely recorded during VP surveys. A young of Kori Bustard was recorded on the grasslands west of the project site.

The number of bird flights in subsequent surveys was noticeably lower than was recorded in April with only 92 raptor flights recorded during the 120 hours of watches. Species abundance recorded in subsequent months followed a similar pattern with Augur Buzzard being the most common species and migratory species being absent from the site. A Vantage Point situated close to a ridge produced a higher number of birds of prey flights as compared to those further from the ridge tops.

Low altitude flights peak during early morning and later on in the day when their flight is much lower than during the middle part of the day. During the middle part of the day migrating raptors were generally flying at a great height (well above proposed turbine height).

Additional observations from the VPs indicate that during the April surveys a high concentration of raptors were recorded in all the VPs west of the site, while there was limited activity eastwards. The migratory birds seemed to follow a defined pattern in their movement coming from the Northwest and heading in the South East direction (Figure 2). During the wintering bird survey, however there was less activity and no migratory raptors were observed contrary to the Ornithologist’s expectations. This could imply that the migrants do not use the grounds for wintering but as a passage route to breeding grounds.

If the turbines are located on top of the ridges, this may mean that the majority of migrating raptors using the ridges may not actually come close to any of the turbine blades if turbines are located along ridge tops.

Table 1 Status of target species of Raptors recorded during the Survey

Species common name	*Scientific name*	*IUCN Status*
African Harrier Hawk	*Polyboroidestypus*	*Least Concern*
African White-backed Vulture	*Gyps africanus*	*Near-threatened*
Augur Buzzard	*Buteo augur*	*Least Concern*
Black-shouldered Kite	*Elanuscaeruleus*	*Least Concern*
Eurasian Hobby	*Falco subbuteo*	*Least Concern*
Eurasian Honey Buzzard	*Pernisapivorus*	*Least Concern*
Lanner Falcon	*Falco biarmicus*	*Least Concern*
Lesser Kestrel	*Falco naumanni*	*Least Concern*
Martial Eagle	*Polemaetusbellicosus*	*Near-threatened*
Montagu's Harrier	*Circus pygargus*	*Least Concern*
Pallid Harrier	*Circus macrourus*	*Least Concern*
Ruppell's Griffon Vulture	*Gyps ruepellii*	*Near-threatened*
Steppe Eagle	*Aquila nepalensis*	*Least Concern*
Tawny Eagle	*Aquila rapax*	*Least Concern*

Conservation Status of target species recorded on site: *Populations of **African white-backed vulture, Rüppell's Vulture** have declined. These species are listed with an IUCN Red List status of 'near threatened' and the IUCN predicts that populations of the species will continue to decline. **Martial eagle**are listed as 'near threatened', and all the other target species recorded including the bustards are of 'least concern'.*

3.7 Spatial Use of Habitat and Bird Distribution

Results from surveys showed high bird activities on the western and central portions of the study area and lowest in the eastern portion and area just north of the proposed site. The same pattern was observed for species richness (number of species per survey) mainly concentrating along the riparian habitats. The pattern was consistent both in dry and wet season corresponding to the area with short acacia woodland habitat and valleys on the western portion.

The vantage point with the highest use estimate was located in the western sides corresponding to the riparian habitats. The multiple vegetation types and topography attracting birds of prey increased the diversity of species observed on the western side regardless of vegetation type. In general, the survey points within the tall acacia woodland on the eastern most portions had less species diversity and lower use estimates and did not appear to be a significant location for migrants through the study area. Observations on spatial use of the site showed that the western portions stood out as receiving far greater habitat use by species than others.

3.8 Temporal Use

Surveys were conducted throughout the day and under all weather conditions. With respect to diurnal activities for passerines, mean use of habitat was highest in the morning periods and lowest in the late afternoon and evening. Raptor use showed a distinct peak during early midday, approximately 11:00 am to 3:00 pm. In general, fewer birds were observed during the afternoon/evening surveys and early mornings. Detectability for raptors was very low in poor weather conditions e.g. precipitation and poor visibility. For passerines use remained fairly constant across the dry and wet season with the highest use recorded in April and May. For raptors use fluctuated from June with high activity in April and May when most migrating raptors were on site.

The frequency of occurrence (percent of surveys in which a species/group was recorded) for passerines was high (>90%) throughout the seasons but tended to drop slightly as the dry season progressed (June through October). Raptor frequency of occurrence and habitat use showed similar patterns. Variation in diurnal use across the season was high. There was a slight overall drop in diurnal bird use in the dry season. During the wet season, diurnal use was more variable and there appeared to be several waves of migrants that moved through the area. As would be expected, bird use was lower during surveys with precipitation and heavy cloud cover, though these changes in use were not significant.

The season and daily temporal use patterns for the site do not suggest that any one time period or date receives substantially greater bird use for passerines. However for migrating raptors there is seasonal variation in occurrence and should be considered during construction or operation of the project.

Results from observations also indicate different impacts on different bird species. There will be risks at different stages of the project depending on the group of birds e.g. most raptors and medium sized birds that are constantly flying would be affectedduring the operational phase, while woodland and grassland species would be impacted during the construction phase. Mitigation measures will therefore be specific to species within the different stages of the project considering also the level of significance.

Overall the diurnal avian spatial use information suggests that the western portion would result in greater impacts to birds over other sites within the development area. Avian use in relation to vegetation cover does suggest some variation in potential impacts. Species use and diversity was greatest in the valleys and riparian areas which presumably mean that more birds in these locations would be vulnerable as these sites also present areas of high wind energy levels.

3.9 Flight Direction and Bird Distribution

In this report we present information on bird flights, most of the mapping was undertaken during the April survey as there was more bird activity and hence could easily establish their movements. During the subsequent surveys there was less activity from raptors both resident and migrants.

The shaded areas in Figure 2 present areas of high migratory raptor concentration and arrows indicate the direction of movement. These are therefore key sensitive areas for consideration to be avoided during the implementation of the project. The teamdidn't observe much change during the winter migration season in terms of the direction of movement for the species, however there was more activity during the April surveys. Direction of movement is mainly from the West moving southwards where there was more concentration and later moved further eastwards mainly following the valleys. The lower shaded area however exhibits most sensitive locations as there were more concentration of raptor movements in that direction and they also spent more time in the shaded regions. The migratory birds seemed to follow a defined pattern in their movement coming mainly from the West, moving southwards and heading eastward direction (Figure 2).

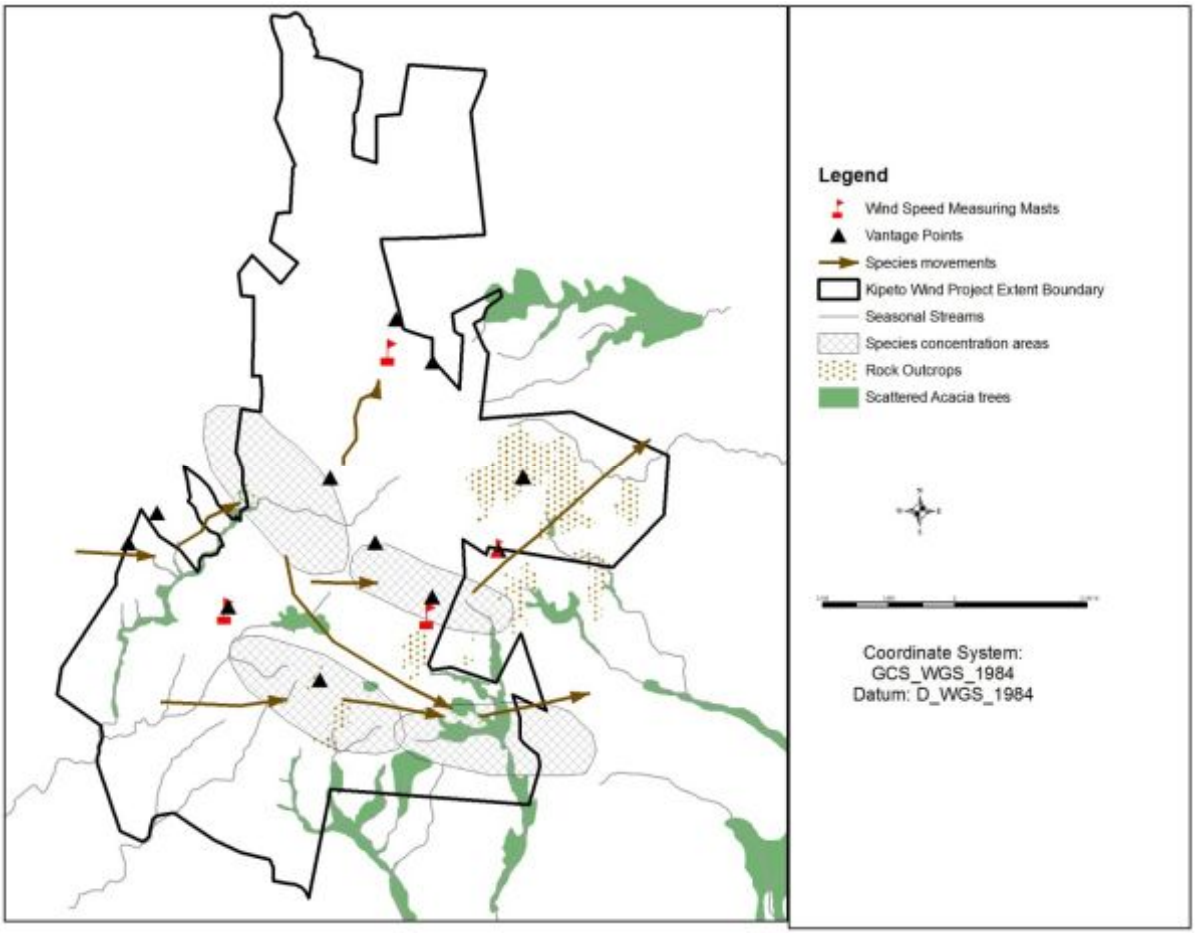


Figure 2 Map showing areas of raptor concentration and movements during Migration Surveys

The shaded sections present areas of high migratory raptor concentration/sensitivity and arrows indicate the general direction of movement.

3.10 Flight Altitudes and Passage Rate

The total number of raptor flights recorded in April vantage point observations was 2310 flights, or just over 50 flight per hour. The most common species involved was Lesser Kestrels. The passage rate varied both during the migration and out of migration. The number of bird flights in consecutive months was noticeably lower than was recorded in April with less than 100 raptor flights recorded during the observations at vantage points. Passage rates also varied in hours of the day with greater movements in Mid-morning hours compare to late afternoons and evenings. Weather conditions also affected passage rates and daily movements. During days with poor visibility passages were recorded from late morning hours.

Species abundance recorded in April was very different to that recorded in consecutive months, with Augur Buzzard being the most common raptor species, The lower numbers of observed raptor flights in later months compared to April, appears to indicate that the raptor migration season may have begun to slow down. This trend was largely due to the fact that the migrant raptors were not recorded in latter months.

The mean flight height was about 300m . Most birds were observed at heights below 100 m especially during the migration period in April. However outside migration most raptor flights were recorded between 101 and 200 m.

4 Potential Ornithological Impacts

The implementation of the Kipeto Wind Power Project will lead to a variety of impacts. The project has the potential to affect the avifauna of the project area from the associated activities. This is mainly through ecological disturbance leading to displacement or exclusion of birds; and collisions of birds with wind turbines. The project activities are likely to cause site-specific negative impacts on the bio-physicalenvironmentof the project area which will affect avifauna in various ways including increased pressure and/or loss of habitat and essential resources for food and nesting for birds.

This section assesses the potential impacts of the proposed Kipeto Wind Farm on birds.

The following potential impacts on birds have been assessed within this section

- The impacts of direct habitat loss due to land take by wind turbine bases, tracks and ancillary structure
- The impacts of habitat modification due to changes in land management
- The impacts of indirect habitat loss due to the displacement of birds as a result of construction, and maintenance activities, or due to the presence of wind turbines, operating close to nesting or feeding sites, or habitual flight routes
- The effects of bird collision with rotating turbine blades (i.e. killing or injury of birds)

The main bird issue appears to be associated with raptors. Raptors can be categorized into three groups, Western Palae-arctic migrants (migrating October/November and again March/April e.g. steppe buzzard, steppe eagle), Resident species (present all year round e.g. martial eagle, vultures.), Wintering species (October to April, possibly small numbers of species such as steppe buzzard may remain on site throughout the winter months). Resident bird of prey species appear to be present in only small numbers resulting in only a small number of flights being recorded during the VP watches.

Overall our observations show that the Kipeto site is mainly used by migrants when returning back to the breeding grounds between March-May. Migrating raptors were absent onsite between October-November as was expected that the birds would be using the area for wintering. However more surveys will still be required to further confirm this with certainty.

The effects of the Kipeto wind farm on birds are highly variable and will depend on a wide range of factors including:

- Specification of the development,
- Topography of the surrounding land,
- Habitats affected
- Number and species of birds present.

The principal areas of concern with regard to effects on birds are as below. Each of these potential effects can interact, either increasing the overall impact on birds or, in some cases, reducing a particular impact (for example where habitat loss causes a reduction in birds using an area which might then reduce the risk of collision).

4.1 Bird Mortality and Collision Risk

The main threat posed by the wind turbines on avifauna is collision with the rotors. Direct mortality or lethal injury of birds may result from collisions with rotors and associated structures such as guy cables, power lines and meteorological masts.

A number of factors influence bird mortality at wind farms. These factors may relate to bird species, numbers and behavior, weatherconditions and topography and the nature of the wind farm itself, including the use of lighting if applicable.

Landscape features can potentially channel birds towards certain areas influencing their flights and foraging behavior. Ridges and slopes such as those observed in Kipeto are important factors in determining flight behavior and hence a function of collision risk.

The number of turbines in a wind farm also influences the risk of collision with more collision expected in areas with more turbines. Lighting of turbines and other infrastructure have the potential to attract birds especially night migrants and nocturnal species thereby increasing the risk of collision with turbines.

The risk is expected to be greater on or near areas regularly used by large numbers of feeding or roosting birds or on migratory flyways or local flight paths (See Fig. 2 for Kipeto flight paths), especially where these are intercepted by the turbines. Large birds with poor maneuverability (such as ducks and geese) will be at greater risk of collision with structures

There is a likely risk of collision with structures when visibility is poor due to fog or rain although this effect will be to some extent offset by lower levels of flight activity in such conditions.Birds that are already on migration, however, cannot avoid poor weather conditions, and will be more vulnerable if forced by low cloud to descend to a lower altitude or land.

As mitigation for collision with turbines it is recommended that tubular designs of towers rather than lattice design of towers be used in order to discourage nesting. Lighting of turbines should be avoided or limited to red beacon lights. Turbine position is the most crucial in mitigating impacts. Figure 2 above already present the key raptor concentration areas during migration and hence considered sensitive areas within which additional monitoring should be concentrated. Pre-construction monitoring should be undertaken prior to final design phase to inform the positioning of the turbines.

4.2 Disturbance

The presence of wind turbines at a site could potentially deter some birds from using that site and its surroundings resulting in a disturbance impact. In addition during the construction phase of the project the human presence on the site will often be increased adding further to potential disturbance effects.

The displacement of birds from areas within and surrounding wind farms due to visual intrusion and disturbance is expected as a result of habitat loss. Displacement may occur during both the construction and operational phases of wind farms, and may be caused by the presence of the turbines themselves through visual, noise and vibration impacts, or as a result of vehicle/tracks and personnel movements related to site maintenance.

Displacement may occur but if there were ample alternative habitat to accommodate the displaced birds it may actually be inconsequential. If important bird populations may be affected, it may be possible to mitigate this by temporal avoidance, restricting potentially disturbing activities to periods when the important bird populations are not using the site.

The effect of birds altering their migration flyways or local flight paths to avoid a wind farm is also a form of displacement. This effect is of concern because of the possibility of increased energy expenditure when birds have to fly further as a result of avoiding a large array of turbines and the potential disruption of linkages between distant feeding, roosting, moulting and breeding areas. The effect is dependenton the species, type of bird movement, flight height, distance to turbines, the layout and operational status of turbines, time of day and wind force and direction.

4.3 Habitat change and loss

This impact comprises the direct loss of habitat that would result from the take by the turbine bases, access track and any other associated construction. Indirect loss of habitat changes as a result of alterations in land use should be expected. The presence of wind turbines may indirectly affect local fauna and bird populations by decreasing the area of habitat available to breeding, feeding, nesting, resting etc. This will mainly be brought about by land taken for the construction of infrastructure including access roads and turbine bases. Birds flying at the same height as the wind turbine rotor blades within the wind farm area will be at some risk of colliding with those blades.

Cumulative impacts of the wind farm installations may be considerable if bird movements are consequently displaced leading to the disruption of ecological links between feeding, breeding and roosting areas. The study has proposed several measures to reduce negative impacts, including noise abatement, waste management, restoration of habitat and biodiversity, In addition, measures have been proposed with regard to the siting of the wind farm in order to reduce collision of birds with turbines (Table 2).

5 Ornithological Impact Assessment

There are concerns about whether this development will have negative impact on the bird population and especially on migrant birds. This ornithological report presents locations of any sensitive areas and bird movements (Fig. 2) and question whether these will not be impacted by the wind turbines and associated infrastructure and propose a monitoring plan (Table 3).

The potential impacts associated with the proposed development have been assessed using the criteria provided below (Fig 3 and Fig. 4).

Figure 3 Criteria for assessing significance of Impacts

CONSEQUENCE

Magnitude of impact	Rating
Negligible	1
Minor	2
Marginal	3
Significant	4
Catastrophic	5

Geographic Extent of impact	Rating
Activity specific	1
Project specific	2
Local area	3
Regional	4
National	5

Duration of impact	Rating
<1 month	1
1 - 12 months	2
13 - 36 months	3
37 - 72 months	4
>72 months	5

LIKELIHOOD

Frequency/duration of activity	Rating
Annually or less	1
6 monthly/temporary	2
Monthly/infrequent	3
Weekly/life of the operation	4
Daily/permanent	5

Frequency of impact	Rating
Almost impossible	1
Highly unlikely	2
Unlikely	3
Possible	4
Definite	5

Definitions	
Activity:	Distinct process or task undertaken by an organization for which a responsibility can be assigned
Frequency of activity:	Refers to how often the proposed activity will take place

Definitions	
Frequency of impact:	Refers to the frequency with which a stressor (aspect) will impact on the receptor
Magnitude of impact:	Refers to the degree of change to the receptor status in terms of reversibility of the impact
Geographic extent of impact:	Refers to the geographical scale of the impact
Impact duration:	Refers to the length of time over which the stressor will cause a change in the resource or receptor

Figure 4: Significance Ranking Matrix

SIGNIFICANCE

	CONSEQUENCE (Magnitude+GeographicExtent+Duration of impact)														
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

POSITIVE/NEGATIVE MITIGATION RATINGS

Significance Rating	Value	Negative impact management recommendation	Positive impact management recommendation
Very High	126-150	Propose mitigation measures	Maintain current management
High	101-125	Propose mitigation measures	Maintain current management
Medium - High	76-100	Propose mitigation measures	Maintain current management
Low - Medium	51-75	Maintain current management	Propose mitigation measures
Low	26-50	Maintain current management	Propose mitigation measures
Very Low	1-25	Maintain current management	Propose mitigation measures

5.1 Assessment of the Avifaunal Impacts

The various impacts before and after mitigation were quantitatively assessed against the set criteria as presented in the figures above. A general discussion of the impacts and mitigation follows on from the tables.

5.1.1 Construction Phase

General activities associated with the project during construction will involve; Delivery of tower components to construction sites Construction of access roads, site grading, Installation of tower foundations.

5.1.1.1 Habitat Loss

Bird habitats are expected to be affected through various processes and activities as outlined below.

- Construction activities will result in destruction of habitats in paths leading to the turbine sites. Installation of wind turbines will result in habitat removal
- Both human and increased vehicle traffic along local roads and trampling on vegetation will have negative effects on ground dwelling birds, including effects on their habitat and nests due to trampling
- Limited amounts of field habitat removal for access roads and, to a lesser extent, turbine footprints have the potential to fragment habitat, and make it less attractive to area-sensitive grassland species such as Larks and pipits. Fragmentation could also result in increased rates of nest parasitism and predation.
- Construction activity, such as increased traffic, noise, or dust, also has the potential to indirectly disturb birds and bird habitats. Disturbance of birds may occur during all phases of the project as a result of increased on-site human activities (e.g. site preparation, turbine assembly, maintenance activities). However, a certain level of disturbance to wildlife resources in the Study Area already exists from ongoing agricultural, rural, and domestic activities.

Unmitigated Impact : Habitat Loss caused by construction of turbines	
Magnitude of Impact	4
Geographic Extent	2
Duration of Impact	2
Frequency of Activity	3
Frequency of Impact	4
Result	-56 (Low-Medium)
Comment/Mitigation	
Good site practices and procedures should reduce the environmental effects identified. These practices may include • Specifications regarding disposal, dust control, artificial drainage system maintenance and soil compaction control. • All disturbed areas of the construction site should be stabilized immediately and re vegetated as soon as conditions allow after construction, to replicate the habitat	

• Maximizing use of existing tracks for access roads to minimize removal of vegetation • Avoid disturbance to wet grassland areas onsite. • Habitats subjected to temporary loss will be re-vegetated as soon as possible • If possible, construction works should be avoided during wet/rainy conditions in all situations Through the implementation of the afore mentioned protection measures adverse effectswould be both spatially and temporally limited, no significant net effects are anticipated to bird habitat. Any adverse effects on the habitat are expected to be short-term (i.e. less than one year) and do not require any special mitigation measures Although increased activity at localized spots may result in some avoidance, no appreciable adverse effects are anticipated to the species on passage since the area under consideration is limited and there exists other suitable habitat for this species within the proposed turbines.

Mitigated Impact : Habitat Loss	
Magnitude of Impact	1
Geographic Extent	1
Duration of Impact	2
Frequency of Activity	1
Frequency of Impact	1
Result	-8 (Low)

5.1.1.2 Habitat Modification from associated project activities

There will be short-term disruption to traffic patterns along local roads and the potential for short-term inconvenience (e.g., displacement, noise and dust) to birds. The small areas of land around each one of the turbines and lands required for access roads will also be removed from their present use for the life of the Project. Temporary increase in environmental noise and dust is expected to indirectly affect birds.

Unmitigated Impact : Habitat modification	
Magnitude of Impact	2
Geographic Extent	1
Duration of Impact	2
Frequency of Activity	2
Frequency of Impact	2
Result	-20 (Very Low)
Comment/Mitigation: Minor impact is expected since the area under consideration is limited and there exists other suitable habitat for this species within the proposed turbine footprint area. All construction vehicles should be equipped with mufflers and silencers. Dust control measures should be put in place where necessary.	
Mitigated Impact : Habitat Loss	
Magnitude of Impact	1

Geographic Extent	1
Duration of Impact	2
Frequency of Activity	1
Frequency of Impact	1
Result	-8 (Very Low)

5.1.1.3 Disposal of Waste Materials

Waste Disposal Sites may attract scavenging species like Marabou storks and egrets to the site; this is a potential risk of collision with turbines. Spills from machines may contaminate surface waters and streams which are crucial habitats for birdlife

Unmitigated Impact : Waste materials from project activities	
Magnitude of Impact	2
Geographic Extent	1
Duration of Impact	2
Frequency of Activity	2
Frequency of Impact	3
Result	-25 (Very Low)
Comment/Mitigation: A site-specific waste collection and disposal management plan should be in place to include good site practices such as: • Systematic collection of waste • Providing the appropriate spill kits (e.g., containing absorbent cloths and disposal containers) on-site during construction • Prohibition of dumping or burying wastes within the project site • Implementation of an on-going waste management program consisting of reduction, reuse, and recycling of materials • Temporary on-site storage of waste should not create any adverse effect provided mitigation measures are implemented	
Mitigated Impact : Waste materials from project activities	
Magnitude of Impact	1
Geographic Extent	1
Duration of Impact	2
Frequency of Activity	2
Frequency of Impact	2
Result	-16 (Very Low)

5.1.1.4 Environmental Noise

It is anticipated that short-term construction-related noise from heavy equipment and vehicle traffic will indirectly affect avifauna. Because birds communicate mainly by sound, loud environments interfere with their communications and reduces pairing by almost 15 percent. recent studies suggest that loud ambient noise affects the sex lives of birds. There is a concern that noise produced during the construction and operation of turbines may have an impact on bird behavior and physiology. Exposure to turbine noise may have little or no impact on birds, have minor or trivial biological impact as in very small changes in the location or size of a breeding or feeding site relative to the turbines, or have more substantial impacts including interference with breeding by individuals and populations which threatens the survival of individuals or species (e.g., Brumm and Slabbekoorn 2005). The acoustic mechanisms of these effects of highway noise most likely involve altering conspecific acoustic communication, masking of detection and recognition of biological relevant signals, hindering detection of sounds of predators and/or prey, decreasing hearing sensitivity temporarily or permanently, and/or altering stress and reproductive hormone levels as birds adapt to increased background noise levels. Advances in turbine technology and design have resulted in reduced noise emissions. Aerodynamic refinements that have combined to make turbines quieter include the change from lattice to tubular towers, the use of variable speed operations, and the switch to 3 blade turbine designs

Unmitigated Impact : Noise from construction	
Magnitude of Impact	2
Geographic Extent	1
Duration of Impact	2
Frequency of Activity	2
Frequency of Impact	3
Result	-25 (Very low)
Comment / Mitigation: All engines associated with construction equipment should be equipped with mufflers and/or silencers in accordance NEMA guidelines and regulations. Application of the recommended mitigation measures during construction should limit noise emissions to the general vicinity of the work areas. Any net effects are expected to be limited and short-term	
Mitigated Impact : **Noise from construction**	
Magnitude of Impact	4
Geographic Extent	1
Duration of Impact	1
Frequency of Activity	1
Frequency of Impact	1
Result	-12 (Very low)

5.1.1.5 Disturbance to Bird Habitats

There is some potential for disturbance of natural features, habitats, and species during construction of the Project as a result of the limited removal of vegetation and increased human activity. Loss, clearing, fragmentation and/or disturbance of flora and fauna habitat are expected. Other resulting impacts include increased rates of parasitism and predation in grassland bird nests. This will cause displacement of species sensitive to particular habitats.

Unmitigated Impact : Disturbance to Bird Habitats	
Magnitude of Impact	4
Geographic Extent	2
Duration of Impact	2
Frequency of Activity	3
Frequency of Impact	4
Result	-56 (Low-Medium)
Comment / Mitigation: • Infrastructure such as access roads should be limited to existing paths; • Tree clearing (if required) should be minimized by locating access roads outside the natural habitats e.g. woodlands and wetlands; • Tree and/or bush clearing should be completed prior to or after the core breeding season for woodland and grassland birds; • Should clearing be required during the breeding bird season prior to construction, surveys should be undertaken to identify the presence/absence of nesting birds or breeding habitat; • The work areas should be restored to pre-construction conditions following construction; • Disturbed areas of the construction site should be stabilized immediately and re-vegetated as soon as conditions allow; • Construction should be done outside main breeding season. A pre-operation survey should be conductedfor breeding birds and nest locations.Theeffects are expected to be short-term in duration and spatially limited to the work areas and immediately adjacent areas. Additionally, avoidance of the sensitive periods for breeding birds will eliminate impacts to these species during these times • With the implementation of the mitigation measures including siting turbines outside woodlands and their adjacent lands, the effects are anticipated to be minimal	
Mitigated Impact :Disturbance to Bird Habitats	
Magnitude of Impact	2
Geographic Extent	1
Duration of Impact	4
Frequency of Activity	2
Frequency of Impact	2
Result	-28 (Low-Medium)

5.1.2 Operation Phase

5.1.2.1 Bird Collision from Turbine operation

Collision with turbines is one of the biggest single threats expected from the project during the operation phase. The risk of collision varies between species and will depend on their abundance and behavior.

Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy bodied with limited maneuverability making it difficult for them to evade collisions.

Certain turbine tower structures may provide suitable perching space to certain bird species, thereby increasing the chances of collision as birds leave or enter a perch.

The effects of wind turbines on breeding bird species could be direct, through collision, or indirect, through loss, alteration, or fragmentation of habitat and disturbance. Nocturnal migratory passerines are also at risk as they make up a considerable proportion of fatalities at installed wind facilities. The Study Area is located in a migratory corridor area, and as a result the numbers of migratory passerines potentially exposed is high.

The risk of collision could also be increased in poor weather conditions such as poor visibility. It is worth noting that during our services we observed mornings with very poor visibility sometimes extending until mid-day. The impacts of this on the movement of birds cannot be underestimated and as such it would be important to monitor such conditions at all phases of the project. Many studies have shown that poor weather conditions increase the occurrence of collisions with turbines (Case *et al.* 1965, Seets& Bohlen 1977, Elkins 1988, Still et al 1994). Even in poor weather conditions, however, it is worth noting that there has never been a mass kill recorded at any wind turbine in the world (Winkleman 1992). Despite this fact, it is not surprising that, at some sites, the rate of collision with towers increases during fog events. Most losses in may occur during poor visibility as migrants move around the turbines.

Lighting of turbines and other infrastructure are expected to modify the natural habitats for birds. Lighting has the potential to attract migrant birds especially those moving at night, thereby increasing the risk of collisions with turbines. Nocturnal migrants navigate using stars and mistake light for stars. Lights may also attract insects, which in turn attract birds. Changing constant lighting to intermittent lighting has been shown to reduce attraction and mortality and changing white flood light to red floodlights could result in significant reduction in mortalities.

Unmitigated Impact : Bird Collision from Turbine operation	
Magnitude of Impact	4
Geographic Extent	2
Duration of Impact	5
Frequency of Activity	4
Frequency of Impact	4
Result	-88 (Medium high)
Comment / Mitigation: Devices defined as critical, such as the rotor, generator, gearbox, and cooling system, should be equipped with protection systems to ensure safe and proper shutdown of the equipment in sensitive periods. The operation of the turbines and maintenance vehicle traffic may result in disturbance to the breeding habitat of grassland bird species, including some of those in the Study Area.	

Appropriate wind turbine design, considering turbine height, number of turbines and positioning to be considered outside these natural features, a certain level of disturbance to wildlife resources in the Study Area already exists from ongoing agricultural, rural, and domestic activities and species inhabiting these areas are relatively tolerant to human activity appropriate turbine coloring and lighting should reduce the extent of this effect.	
Mitigated Impact : Bird Collision from Turbine operation	
Magnitude of Impact	2
Geographic Extent	1
Duration of Impact	3
Frequency of Activity	1
Frequency of Impact	3
Result	-24 (Very Low)

5.1.2.2 Improper Waste Disposal

The proposed project will generate waste lubricants and hydraulic oils associated with turbine maintenance and operation and unless appropriately disposed of, may result in contamination to surface water, which is crucial for birdlife. Fluids, containers, cleaning materials, etc., unless appropriately disposed of may result in contamination to surface water resources both on and off the Project site which may affect vegetation and existing water points which are used by some birds.

Unmitigated Impact : Improper Waste Disposal	
Magnitude of Impact	2
Geographic Extent	2
Duration of Impact	2
Frequency of Activity	1
Frequency of Impact	3
Result	-24 (Very Low)
Comment / Mitigation: Systematic collection of waste with any associated on-site storage inweather-protected areas, labeling and proper storage of liquid wastes (e.g., used oil, drainedhydraulic fluid, and spent solvents) in a secure area that will ensure containment of the material in the event of a spill. Implementation of an on-going waste management program consisting of reduction, reuse, and recycling of materials. During operation, the temporary on-site storage of waste should not create any negative effect given the mitigation measures to be implemented Standard design controls should be implemented provided maintenance vehicles are maintained in good condition.Net effects will be limited to emissions that are localized and limited to periods of operation only Labeling and proper storage of liquid wastes in a secure area that will ensure containment of the material in the event of a spill. No significant net effects to surface water quality or quantity or bird habitat are anticipated as a result of the operation of the Project. During operation, the temporary on-site storage of waste should not create any negative	

effect given the mitigation measures to be implemented. The impact is expected to be low since most of the birds are not water dependent only a few Egyptian goose were encountered and only use the habitat as passage to feeding sites and the existing small water points which are dry most of the year as stop over	
Mitigated Impact : Improper Waste Disposal	
Magnitude of Impact	1
Geographic Extent	1
Duration of Impact	1
Frequency of Activity	1
Frequency of Impact	2
Result	-9 (Very Low)

5.1.2.3 Impact on bird communication and response (inter-specific communication)

Limited off-site environmental noise effects from mechanical and aerodynamic noise emitted from the wind turbinesare expected to occur. Environmental noise effects from the simultaneous operation of all wind turbines could affect birds.Because birds communicate mainly by sound, loud environments interference with their communications and reduces pairing by almost 15 percent.recent studies suggest that loud ambient noise affects the sex lives of birds (Goudarzi 2006). There is a concern that noise produced during the construction and operation of turbines may have an impact on bird behavior and physiology. Exposure to turbine noise may have little or no impact on birds, have minor or trivial biological impact as in very small changes in the location or size of a breeding or feeding site relative to the turbines, or have more substantial impacts including interference with breeding by individuals and populations which threatens the survival of individuals or species. The impacts of noise could result in interference with conspecific acoustic communication, masking of detection and recognition of biological relevant signals, hindering detection of sounds of predators and/or prey, decreasing hearing sensitivity temporarily or permanently, and/or altering stress and reproductive hormone levels as birds adapt to increased background noise levels. Advances in turbine technology and design have resulted in reduced noise emissions. Aerodynamic refinements that have combined to make turbines quieter include the change from lattice to tubular towers, the use of variable speed operations, and the switch to 3 blade turbine designs

Unmitigated Impact : Noise Effects	
Magnitude of Impact	3
Geographic Extent	2
Duration of Impact	4
Frequency of Activity	4
Frequency of Impact	2
Result	-54 (Low-Medium)
Comment / Mitigation: Mechanical and aerodynamic noise will be emitted from the wind	

turbines;environmentalnoiseeffect from the project should not exceed the most restrictive	
Mitigated Impact : Noise Effects	
Magnitude of Impact	2
Geographic Extent	1
Duration of Impact	2
Frequency of Activity	1
Frequency of Impact	2
Result	-15 (Very Low)

5.1.2.4 Disturbance to birds and their habitat

Disturbance due to the maintenance of vehicle traffic are expected during operation. Operation of the turbines and maintenance vehicle traffic may result in disturbance to the breeding habitat of grassland birds,

Unmitigated Impact : **Disturbance to birds and their habitat**	
Magnitude of Impact	4
Geographic Extent	2
Duration of Impact	3
Frequency of Activity	1
Frequency of Impact	3
Result	-36 (Low-Medium)
Comment / Mitigation: A post-construction monitoring study for birds should be developed. Considering the limited extent of permanent works, and the periodic nature of maintenance activities, it is likely that resident birds will adapt to the Project. Thorough post-construction monitoring should be completed to allow the identification of any effect and application of appropriate additional mitigation measures. A certain level of disturbance to birds in the Study Area already exists from ongoing agricultural, rural, and domestic activities and species inhabiting these areas are relatively tolerant of human activity	
Mitigated Impact : Disturbance to birds and their habitat	
Magnitude of Impact	2
Geographic Extent	1
Duration of Impact	2
Frequency of Activity	1
Frequency of Impact	2
Result	-15 (Very Low)

6 Ornithological mitigation measures

Mitigation measures involve best-practice measures which is adopted by any wind farm development and additional measures aimed at reducing an impact specific to a particular development.

Among powerful methods to reduce the negative impacts on birds of wind energy use are:

- choice of the right site for wind farms (avoidance of wetlands, woodlands, important sites for sensitive non-breeding birds and ridges with high numbers of raptors and vultures) (Refer to Figure 2),
- measures to reduce the attraction of wind farm sites for potential collision victims,
- configuration of turbines within wind farms (placement of turbines parallel to and not across the main migration or flight directions of birds) (Refer to Figure 2),,

Examples of best practice measures are:

- Ensuring that key areas of conservation importance and sensitivity are avoided (Figure 2) Implementing appropriate working practices to protect sensitive habitats;
- Providing adequate briefing for site personnel and, in particularly sensitive locations, employing an on-site ecologist during construction;
- Implementing an agreed post-development monitoring programme through planning
- Siting turbines close together to minimize the development footprint
- Grouping turbines to avoid alignment perpendicular to main flight paths
- Increasing the visibility of rotor blades –might help reduce collision risk
- Marking overhead cables using deflectors and avoiding use over areas of high bird concentrations, especially for species vulnerable to collision;
- Timing construction to avoid sensitive periods such as breeding and migration
- Implementing habitat enhancement for species using the site

A number of specific mitigation measures discussed in Table 2 in relation to the different phases of the project. Turning to more site-specific mitigation, it may be necessary to prepare a site environmental management plan (Table 3) designed to reduce or prevent harmful habitat changes following construction, and to provide habitat enhancement as appropriate.

Other measures which may be suitable in some circumstances include the relocation of proposed or actual turbines responsible for particular problems, halting operation during peak migration periods, or reducing rotor speed. Maximize the use of existing tracks in order to minimize habitat loss and disturbance to known breeding areas.

Construction work for the turbines and access roads should be conducted outside the main breeding season (April to July) where possible. Where construction work is required in the breeding season, this should be undertaken following prior consultation with ornithologists who should be responsible to monitor nests on the site. Should works need to proceed during the breeding season a breeding bird survey should be conducted for ground nesting species on any area proposed for works and all nests identified and protected. Post-construction monitoring is essential in order to test the effectiveness of such mitigation measures and research is needed to provide more information on specific impacts and novel mitigation measures that might reduce impacts.

Table 2: Ornithological Impact Statement: Summary Of Potential Effects And Mitigation Measures

Project Activity	Environmental features Affected	Potential Impacts	Mitigation measures	Magnitude/Extent	Significance of Impact
Construction Phase activities					
General activities associated with the project • Delivery of turbine components to construction site • Construction of access roads • Site grading • Installation of tower foundations • Tower/turbine erection	Bird Habitats (Habitat Loss)	• Construction activities will result in destruction of habitats in paths leading to the turbine sites. • Both human and increased vehicle traffic along local roads will have negative effects on migratory birds, including effects on their habitat due to trampling • Installation of wind turbines will result in habitat removal • Limited amounts of field habitat removal for access roads and, to a lesser extent, turbine footprints have the potential to fragment habitat, and make it less attractive to area-sensitive grassland species such as Larks and pipits. Fragmentation could also result in increased rates of nest parasitism and predation. • Construction activity, such as increased traffic, noise, or dust, also has the potential to indirectly disturb birds and bird habitats. • Disturbance of birds may occur during all phases of the project as a result of increased on-site human	Good site practices and procedures to be implemented to reduce the environmental effects identified. These practices may include: • Specifications regarding disposal, dust control, artificial drainage system maintenance and soil compaction control. • All disturbed areas of the construction site should be stabilized immediately and re-vegetated as soon as conditions allow; • Maximize use of existing tracks for access roads • Minimize removal of vegetation • Avoid disturbance to wet grassland areas onsite. • Habitats subjected to temporary loss will be re-vegetated as soon as possible after construction, to replicate the habitat	Through the implementation of the afore mentioned protection measures adverse effects would be both spatially and temporally limited, no significant net effects are anticipated to bird habitat.	Minor Any adverse effects on the habitat are expected to be short-term (i.e. less than one year) and do not require any special mitigation measures Although increased activity at localized spots may result in some avoidance, no appreciable adverse effects are anticipated to the species on passage since the area under consideration is limited and there exists other suitable habitat for this species within the proposed turbines.

Project Activity	Environmental features Affected	Potential Impacts	Mitigation measures	Magnitude/Extent	Significance of Impact
		activities (e.g. site preparation, turbine assembly, maintenance activities). However, a certain level of disturbance to wildlife resources in the Study Area already exists from ongoing agricultural, rural, and domestic activities. • All disturbed areas of construction site will be stabilized immediately and re-vegetated as soon as conditions allow • All Works should be avoided during wet/ rainy conditions in all situations			
	Land Use	Temporary increase in environmental noise and dust is expected to indirectly affect birds	• All construction vehicles should be equipped with mufflers and silencers • Dust control measures should be put in place where necessary	There will be short-term disruption to traffic patterns along local roads and the Potential for short-term inconvenience (e.g., displacement noise and dust) to birds. The small areas of land around each one of the turbines and lands required for access roads will also be removed from their present use for the life of the Project.	Minor Since the area under consideration is limited and there exists other suitable habitat for this species within the proposed turbines.
	Disposal of Waste Materials	Waste Disposal Sites may attract scavenging species like Marabou storks and egrets to the site, this is a potential risk of collision with turbines	Site-specific waste collection and disposal management plan should be in place to, include good site practices such	The temporary on-site storage of waste should not create any adverse effect provided mitigation measures are	low

Project Activity	Environmental features Affected	Potential Impacts	Mitigation measures	Magnitude/Extent	Significance of Impact
		Spills from machines to existing wetlands / ponds used by birds	as: • Systematic collection of waste • Providing the appropriate spill kits (e.g., containing absorbent cloths and disposal containers) on-site during construction • prohibition of dumping or burying wastes within Project sites • implementation of an on-going waste management program consisting of reduction, reuse, and recycling of materials	implemented.	
	Air Quality	Temporary increase in dust, odor, from construction vehicle emissions indirectly affect avifauna	• Dust will be controlled by watering where necessary • • All combustion engine equipment should be appropriately maintained to meet emission standards	Application of mitigation measures should limit dust and odor emissions to the work areas and limit combustion emissions. Any net effects are expected to be short-term and localized.	Minor
	Environmental Noise	Short-term construction-related noise from heavy equipment and vehicle traffic indirectly affect avifauna	All engines associated with construction equipment should be equipped with mufflers and/or silencers in accordance with NEMA guidelines and regulations	Application of the recommended mitigation measures during construction should limit noise emissions to the general vicinity of the work areas. Any net effects are expected to be	Negligible

Project Activity	Environmental features Affected	Potential Impacts	Mitigation measures	Magnitude/Extent	Significance of Impact
				limited to short-term	
	Habitat for Birds (Disturbance)	There is some potential for disturbance of natural features, habitats, and species during construction of the Project as a result of the limited removal of vegetation and increased human activity. • Loss, clearing, fragmentation and/or disturbance of flora and fauna habitat is expected. Other resulting impacts include • Introduction or spread of invasive flora species • Increased rates of parasitism and predation in grassland bird nests • No adverse effects are anticipated on species on passage as the area under consideration is limited	• Infrastructure such as access roads should be limited to existing paths • Tree clearing (if required) should be minimized by locating access roads outside the natural habitats e.g. woodlands and wetlands • Tree and/or bush clearing should be completed prior to or after the core breeding season for woodland and grassland birds • Should clearing be required during the breeding bird season prior to construction, surveys should be undertaken to identify the presence/ absence of nesting birds or breeding habitat. • The work areas should be restored to pre-construction conditions following construction • Disturbed areas of the construction site should be stabilized immediately and re-vegetated as soon as	Effects are expected to be short-term in duration and spatially limited to the work areas and immediately adjacent areas. Additionally, avoidance of the sensitive periods for breeding birds will eliminate impacts to these species during these times With the implementation of the mitigation measures, including siting turbines outside woodlands and their adjacent lands, the effects are anticipated to be minimal	Minor

Project Activity	Environmental features Affected	Potential Impacts	Mitigation measures	Magnitude/Extent	Significance of Impact
			conditions allow • Construction to be done outside main breeding season • Conduct pre-operation survey for breeding birds and nest locations		
Operation Phase Activities					
General activities associated with Project operation	Surface Water Quality and Bird Habitat	Project will generate waste lubrication and hydraulic oils associated with turbine / track maintenance and operation unless appropriately disposed of, may result in contamination to surface water – ponds used by birds	Labeling and proper storage of liquid wastes in a secure area that will ensure containment of the material in the event of a spill.	No significant net effects to surface water quality or quantity, or bird habitat are anticipated as a result of the operation of the Project. During operation, the temporary on-site storage of waste should not create any negative effect given the mitigation measures to be implemented.	Negligible Since most of the birds are not water dependent only a few Egyptian goose were encountered and only use the habitat as passage to feeding sites and the existing small water points which are dry most of the year as stop over
General activities associated with Project operation	Turbine Sites	The effects of wind turbines on breeding bird species could be direct, through collision, or indirect, through loss, alteration, or fragmentation of habitat and disturbance. The risk of direct collision varies between species and will depend on abundance and behavior Nocturnal migratory passerines are also at risk as they make up a considerable proportion of fatalities at installed wind	Devices defined as critical, such as the rotor, generator, gearbox, and cooling system, should be equipped with protection systems to ensure safe and proper shutdown of the equipment in sensitive periods. the operation of the turbines and maintenance vehicle traffic may result in disturbance to the breeding habitat of grassland bird species,	Outside these natural features, a certain level of disturbance to wildlife resources in the Study Area already exists from ongoing agricultural, rural, and domestic activities and species inhabiting these areas are relatively tolerant of human activity.	Minor

Project Activity	Environmental features Affected	Potential Impacts	Mitigation measures	Magnitude/Extent	Significance of Impact
		facilities. The Study Area is located in a migratory corridor area, and as a result the numbers of migratory passerines potentially exposed is high.	including some of those in the Study Area Appropriate wind turbine design, considering turbine height, number of turbines and positioning to be considered		
Disposal of Waste Materials	Waste Disposal Sites	Project will generate waste lubricants and hydraulic oils associated with turbine maintenance and operation Fluids, containers, cleaning materials, etc., unless appropriately disposed of, may result in contamination to soil, groundwater, and/or surface water resources or both on and off the Project site and this may affect vegetation and existing water points which are used by some birds	• Systematic collection of waste with any associated on-site storage in weather-protected areas • Labeling and proper storage of liquid wastes (e.g., used oil, drained hydraulic fluid, and spent solvents) in a secure area that will ensure containment of the material in the event of a spill. • Implementation of an on-going waste management program consisting ofreduction, reuse, and recycling of materials	During operation, the temporary on-site storage of waste should not create any negative effect given the mitigation measures to be implemented.	Negligible
General activities associated with Project operation	Air Quality	Operation of maintenance vehicles	standard design controls,	Provided maintenance vehicles are maintained in good condition net effects will be limited to emissions that are localized and limited to periods of Operation only.	Negligible
General activities associated	Environmental	Limited off-site environmental noise effects from mechanical	Environmental noise effects from the	Mechanical and aerodynamic noise will be	Negligible

Project Activity	Environmental features Affected	Potential Impacts	Mitigation measures	Magnitude/Extent	Significance of Impact
with Project operation	Noise •	and aerodynamic noise emitted from the distribution stations	simultaneous operation of all wind turbines	emitted from the wind turbines; environmental noise effect from the Project should not exceed the most restrictive	
	Birds Species and Habitat	• Loss, removal, fragmentation and/or disturbance of habitat • Collision with turbines – birds and • Operation of the turbines and maintenance vehicle traffic may result in disturbance to the breeding habitat of grassland birds • Disturbance due to the motion and noise of turbine blades and due to maintenance vehicle traffic	There is no evidence that bird mortality is influenced by turbine lighting (Arnett et al., 2008). Lights with the shortest allowable flash durations and the longest allowable pause between flashes are preferred A post-construction monitoring study for birds should be developed	Considering the limited extent of permanent works, and the periodic nature of maintenance activities, it is likely that resident birds will adapt to the Project. Thorough post-construction monitoring should be completed to allow the identification of any effect and application of appropriate additional mitigation measures. A certain level of disturbance to birds in the Study Area already exists from ongoing agricultural, rural, and domestic activities and species inhabiting these areas are relatively tolerant of human activity	Negligible
General activities associated with Project operation	Land scape	• Visibility of the turbines and related infrastructure, • Increase in light in night sky	• Vegetation clearing associated with the Project will be minimized to extent • Wind turbines should be the same make and model • Disturbance to land	The installation and operation of the wind turbines will permanently alter the existing views cape for the life of the Project; appropriate turbine coloring and lighting should reduce the	Marginal

Project Activity	Environmental features Affected	Potential Impacts	Mitigation measures	Magnitude/Extent	Significance of Impact
			will be minimized during construction, which will in turn reduce the effects to aesthetics of the Project areas during the operation phase	extent of this effect.	
Decommissioning activities: Above activities and mitigations will apply during the decommissioning stage					

Meanings of Level of Significance: Catastrophic, *Potential effect could threaten sustainability of the resource and should be considered a management concern. Research, monitoring, and/or recovery initiatives should be considered.* ***Marginal,*** *Potential effect could result in a decline in resource to lower-than-baseline, but stable levels in the Study area after project closure and into the foreseeable future. Regional management actions such as research, monitoring,and/or recovery initiatives may be required.* ***Negligible,*** *Potential effect may result in a slight decline in resource in Study Area during the life of the project. Research, monitoring, and/or recovery initiatives may be required.* ***Minimal,*** *Potential effect may result in a slight decline in resource in Study Area during construction phase, but the resource should return to baseline levels.*

7 Environmental Management Plan

The aim of the management plan (Table 3) is to ensure the proposed operation of the wind project does not have unforeseen impacts in the environment and to ensure that all impacts are monitored and necessary corrective action taken in all cases. It will be important to operate the wind energy facility in a way that;

- Ensures that operation activities are properly managed in respect of environmental aspects and impacts
- Enables the operation activities to be undertaken without significant disruption to other land uses in the area
- Minimizes impacts on birds using the site
- Monitors and evaluates the impacts of the wind energy facilities on birds that frequent the area in particular monitoring bird strikes, bird nesting activities

Table 3: A summary of the environmental monitoring commitments during the construction and operation phases of the Project

Project Phase	Environmental Impact	Monitoring Aspect	Parameter(s) to be Monitored	Details	Responsible Party	Duration and Frequency of Monitoring
Construction		Avifaunal habitats	Installation of Turbines and establishment of access tracks Ongoing inspection of rehabilitated areas	Ensure that preconstruction breeding bird and nest survey is completed prior to commencement of construction work and conditions are restored to preconstruction conditions following completion of the construction activities	Construction Manager	Pre and post construction for 1-2yr period
Construction		Access Roads	Road conditions	Ensure activities are not undertaken in wet season, any road expansion should be outside breeding season	Construction Manager	Throughout construction phase
Construction	Air quality and environmental noise	Noise and emissions from construction equipment		Ensure all equipment and vehicles brought onto the work sites are in proper working order with functioning mufflers and emission control systems.	Construction Manager	Throughout construction phase
Operation		Birds	Bird usage and collision rates	Multi-season surveys, Designate ornithologist to provide input on monitoring of bird collisions on monthly basis	Project Manager and Contractors	Post construction, breeding and migratory periods
Operation	Environmental Noise	Noise emissions from the Project		Complete an acoustic audit of the Project to ensure the noise emissions meet the requirements of the NEMA noise guidelines	Project Manager and Contractors	To be determined

8 Conclusions

With the implementation of the mitigation measures described above, the effects are anticipated to be minimal. There is some potential for disturbance of natural features, habitats, and species during construction of the Project as a result of the limited removal of vegetation and increased human activity. However, these effects are expected to be short-term in duration and spatially limited to the work areas and immediately adjacent areas. Additionally, avoidance of the sensitive periods for breeding birds will eliminate impacts to these species during these times.

The marginal increase in traffic from maintenance vehicles is not expected to have an appreciable disturbance effect. Once the Project is operating, human activity around the facilities will decrease, thus allowing movement patterns to re-establish. Disturbance to local habitats will be spatially restricted to the operating areas. The main effect of the proposed facility will be limited bird mortality, with aerial foragers, nocturnal migrant passerines, and birds with aerial flight displays at greatest risk. Post-construction mortality studies should be conducted to determine if the operational turbines result in collisions with birds and if so, to what extent. Additionally, post-construction point counts for breeding birds, including targeted point counts should be conducted to identify any disturbance effects.

The effect of installing the various Project components is anticipated to have limited effect on the species and their habitats during construction and operation of the facilities. Given that the Project is generally sited in areas already cleared for domestic use and away from any sensitive environmental areas such as wetlands and woodlots the level of impact after protection and mitigation measures are implemented is rated as low. Considering the composition of avifauna, temporary nature of construction effects, the limited extent of permanent works, and the periodic nature of maintenance activities, it is likely that resident species will adapt to the Project. Thorough post-construction monitoring should be completed to allow the identification of any effect and application of appropriate additional mitigation measures.

Bird interactions with wind energy in Kenya are unknown due to the limited experience of the industry in the country. A post-construction monitoring study should therefore be implemented to further our understanding of avifaunal impacts and wind energy facilities on the site. Elements of the post-construction monitoring program should include; Mortality monitoring for birds at turbines during migration for a period of one year and development of a point count-based study to assess disturbance effects to breeding birds, for a period of one year. Point count surveys should include both morning and evening surveys. Point count surveys should use the same protocols as the pre-construction surveys. In addition developers should consider the use of radar technology in assessing bird impacts as this can be used accurately to assess bird flights over proposed site.

9 Gaps in the Study

During the period of study a number of factors affected the avifauna study as outlined below.

- Daily observations were mainly affected by unpredictable changes in diurnal weather conditions (i.e. poor visibility, rains, and chilly mornings). Therefore, observations began mid-morning on most days.
- Nocturnal birds were not observed due to unfavourable night weather conditions (chilly, strong winds); additionally, the ornithology team lacked specialised equipment for night viewing.
- It would be prudent to undertake additional bird surveys to establish with certainty whether the site is primarily used as passage route to the breeding grounds or also for wintering. Such additional surveys would confirm whether or not birds use the project area for migration or wintering.
- Migrating raptors were absent from the site during the October/November 2011 surveys which was unexpected by the ornithology team.

Appendix 1: List of Species Observed during Bird Surveys in Proposed Kipeto Wind Power Site

Common Name	*Scientific Name*	*Conservation Status*
African Citril	*Crithagracitrinelloides*	*Least Concern*
African Dusky Flycatcher	*Muscicapaadusta*	*Least Concern*
African Firefinch	*Lagonostictarubricata*	*Least Concern*
African Goshawk***	*Accipiter tachiro*	*Least Concern*
African Grey Flycatcher	*Bradornismicrorhynchus*	*Least Concern*
African Hawk Eagle***	*Aquila spilogaster*	*Least Concern*
Augur Buzzard***	*Buteo augur*	*Least Concern*
Beautiful Sunbird	*Cinnyrispulchellus*	*Least Concern*
Black-faced Sandgrouse**	*Pteroclesdecoratus*	*Least Concern*
Black-headed Oriole	*Orioluslarvatus*	*Least Concern*
Blacksmith Plover**	*Vanellusarmatus*	*Least Concern*
Brimstone Canary	*Crithagrasulphurata*	*Least Concern*
Bronze Sunbird	*Nectariniakilimensis*	*Least Concern*
Brown-crowned Tchagra	*Tchagraaustralis*	*Least Concern*
Cape Rook	*Corvuscapensis*	*Least Concern*
Cattle Egret	*Bubulcus ibis*	*Least Concern*
Chestnut Sparrow	*Passer eminibey*	*Least Concern*
Chin-spot Batis	*Batismolitor*	*Least Concern*
Cinnamon-breasted Bunting	*Emberizatahapisi*	*Least Concern*
Cinnamon-chested Bee-eater	*Meropsoreobates*	*Least Concern*
Collared Sunbird	*Hedydipnacollaris*	*Least Concern*
Common Bulbul	*Pycnonotusbarbatus*	*Least Concern*
Common Drongo	*Dicrurusadsimilis*	*Least Concern*
Common Kestrel***	*Falco tinnunculus*	*Least Concern*
Common Sandpiper	*Actitishypoleucos*	*Least Concern*
Common Stonechat	*Saxicolatorquatus*	*Least Concern*
Common Swift***	*Apusapus*	*Least Concern*
Common Waxbill	*Estrildaastrild*	*Least Concern*
Crowned Plover**	*Vanelluscoronatus*	*Least Concern*
Dusky Turtle Dove	*Streptopelialugens*	*Least Concern*
Eastern Chanting Goshawk***	*Melieraxpoliopterus*	*Least Concern*
Eastern Double-collared Sunbird	*Cinnyrismediocris*	*Least Concern*
Egyptian Goose***	*Alopochenaegyptiaca*	*Least Concern*
Eurasian Hobby ***	*Falco subbuteo*	*Least Concern*
European Honey Buzzard***	*Pernisapivorus*	*Least Concern*

Common Name	*Scientific Name*	*Conservation Status*
Fan-tailed Raven	*Corvusrhipidurus*	*Least Concern*
Fawn-coloured Lark**	*Mirafraafricanoides*	*Least Concern*
Fischer's Sparrowlark**	*Eremopterixleucopareia*	*Least Concern*
Gabar Goshawk***	*Melieraxgabar*	*Least Concern*
Grassland Pipit	*Anthuscinnamomeus*	*Least Concern*
Great Sparrowhawk	*Accipiter melanoleucus*	*Least Concern*
Greater Blue-eared Starling	*Lamprotornischalybaeus*	*Least Concern*
Grey Crowned Crane**	*Balearicaregulorum*	*Least Concern*
Grey Heron	*Ardeacinerea*	*Least Concern*
Grey-backed Camaroptera	*Camaropterabrachyura*	*Least Concern*
Grey-capped Social Weaver	*Pseudonigritaarnaudi*	*Least Concern*
Grey-capped Warbler	*Eminialepida*	*Least Concern*
Grey-headed Bushshrike	*Malaconotusblanchoti*	*Least Concern*
Hadada Ibis	*Bostrychiahagedash*	*Least Concern*
Hamerkop	*Scopus umbretta*	*Least Concern*
Helmeted Guineafowl**	*Numidameleagris*	*Least Concern*
Hildebrandt's Starling	*Lamprotornishildebrandti*	*Least Concern*
House Sparrow	*Passer domesticus*	*Least Concern*
Kittlitz's Plover	*Charadriuspecuarius*	*Least Concern*
Klaas's Cuckoo	*Chrysococcyxklaas*	*Least Concern*
Kori Bustard	*Ardeotiskori*	*Least Concern*
Lanner Falcon***	*Falco biarmicus*	*Least Concern*
Laughing Dove	*Streptopeliasenegalensis*	*Least Concern*
Lesser Honeyguide	*Indicator minor*	*Least Concern*
Lesser Kestrel***	*Falco naumanni*	*Least Concern*
Lilac-breasted Roller	*Coraciascaudatus*	*Least Concern*
Little Bee-eater	*Meropspusillus*	*Least Concern*
Little Stint	*Calidrisminuta*	*Least Concern*
Little Swift***	*Apusaffinis*	*Least Concern*
Long-billed Pipit**	*Anthussimilis*	*Least Concern*
Malachite Sunbird	*Nectariniafamosa*	*Least Concern*
Marabou Stork***	*Leptoptiloscrumeniferus*	*Least Concern*
Martial Eagle***	*Polemaetusbellicosus*	*Near-Threatened*
Montagu's Harrier***	*Circus pygargus*	*Least Concern*
Mottled Swift***	*Tachymarptisaequatorialis*	*Least Concern*
Northern Wheatear	*Oenantheoenanthe*	*Least Concern*
Nubian Woodpecker	*Campetheranubica*	*Least Concern*

Common Name	*Scientific Name*	*Conservation Status*
Olive Thrush	*Turdusolivaceus*	*Least Concern*
Ostrich**	*Struthiocamelus*	*Least Concern*
Pale Flycatcher	*Bradornispallidus*	*Least Concern*
Pallid Harrier***	*Circus macrourus*	*Nearthreatened*
Pectoral-patch Cisticola	*Cisticolabrunnescens*	*Least Concern*
Pied Crow	*Corvusalbus*	*Least Concern*
Pin-tailed Whydah	*Viduamacroura*	*Least Concern*
Plain Martin	*Ripariapaludicola*	*Least Concern*
Plain Nightjar	*Caprimulgusinornatus*	*Least Concern*
Plain-backed Pipit**	*Anthusleucophrys*	*Least Concern*
Purple Grenadier	*Granatinaianthinogaster*	*Least Concern*
Rattling Cisticola**	*Cisticolachiniana*	*Least Concern*
Red-billed Firefinch	*Lagonostictasenegala*	*Least Concern*
Red-billed Quelea	*Queleaquelea*	*Least Concern*
Red-capped Lark**	*Calandrellacinerea*	*Least Concern*
Red-cheeked Cordon-bleu	*Uraeginthusbengalus*	*Least Concern*
Red-chested Cuckoo	*Cuculussolitarius*	*Least Concern*
Red-eyed Dove	*Streptopeliasemitorquata*	*Least Concern*
Red-faced Crombec	*Sylviettawhytii*	*Least Concern*
Red-fronted Barbet	*Tricholaemadiademata*	*Least Concern*
Red-fronted Tinkerbird	*Pogoniuluspusillus*	*Least Concern*
Red-headed Weaver	*Anaplectesrubriceps*	*Least Concern*
Red-rumped Swallow	*Cecropsisdaurica*	*Least Concern*
Red-winged Lark	*Mirafrahypermetra*	*Least Concern*
Red-winged Starling	*Onychognathusmorio*	*Least Concern*
Reichenow's Seedeater	*Crithagrareichenowi*	*Least Concern*
Ring-necked Dove	*Streptopeliacapicola*	*Least Concern*
Rock Martin	*Ptyonoprognefuligula*	*Least Concern*
Rufous-naped Lark**	*Mirafraafricana*	*Least Concern*
Ruppell'sGriffonVulture	*Gyps ruepellii*	*Near-threatened*
Rüppell's Robin Chat	*Cossyphasemirufa*	*Least Concern*
Sacred Ibis	*Threskiornisaethiopicus*	*Least Concern*
Sand Martin	*Ripariariparia*	*Least Concern*
Secretary bird**	*Sagittarius serpentarius*	*Least Concern*
Short-tailed Lark**	*Pseudalaemonfremantlii*	*Least Concern*
Singing Bush Lark**	*Mirafracantillans*	*Least Concern*
Singing Cisticola	*Cisticolacantans*	*Least Concern*

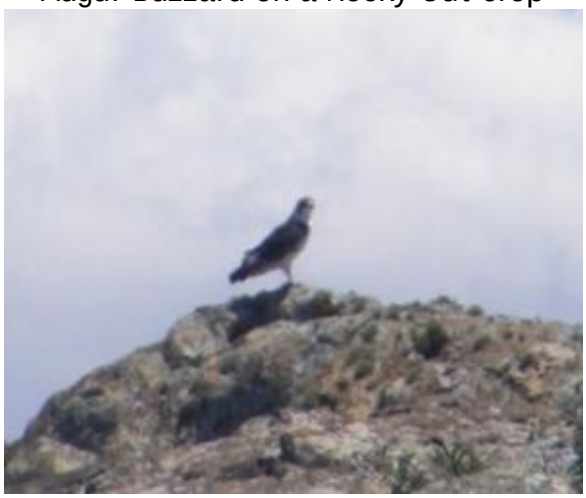
Common Name	*Scientific Name*	*Conservation Status*
Slate-colouredBoubou	*Laniariusfunebris*	*Least Concern*
Speckled Mousebird	*Coliusstriatus*	*Least Concern*
Speckled Pigeon	*Columba guinea*	*Least Concern*
Speke's Weaver	*Ploceusspekei*	*Least Concern*
Steppe Eagle***	*Aquila nipalensis*	*Least Concern*
Streaky Seedeater	*Crithagrastriolata*	*Least Concern*
Superb Starling	*Lamprotornissuperbus*	*Least Concern*
Tawny Eagle***	*Aquila rapax*	*Least Concern*
Tawny-flanked Prinia	*Priniasubflava*	*Least Concern*
Temminck's Courser**	*Cursoriustemminckii*	*Least Concern*
Tropical Boubou	*Laniariusaethiopicus*	*Least Concern*
Variable Sunbird	*Cinnyrisvenustus*	*Least Concern*
Wahlberg's Eagle***	*Aquila wahlbergi*	*Least Concern*
White Stork***	*Ciconiaciconia*	*Least Concern*
White-backed Vulture***	*Gyps africanus*	*Nearthreatened*
White-browed Scrub Robin	*Cercotrichasleucophrys*	*Least Concern*
White-browed Sparrow Weaver	*Plocepassermahali*	*Least Concern*
White-eyed Slaty Flycatcher	*Dioptrornisfischeri*	*Least Concern*
White-tailed Lark**	*Mirafraalbicauda*	*Least Concern*
Wing-snapping Cisticola	*Cisticolaayresii*	*Least Concern*
Wire-tailed Swallow	*Hirundosmithii*	*Least Concern*
Yellow Bishop	*Euplectescapensis*	*Least Concern*
Yellow-bellied Eremomela	*Eremomelaicteropygialis*	*Least Concern*

** Risk from habitat loss/Destruction/Displacement

***Risk of Collisions with turbines

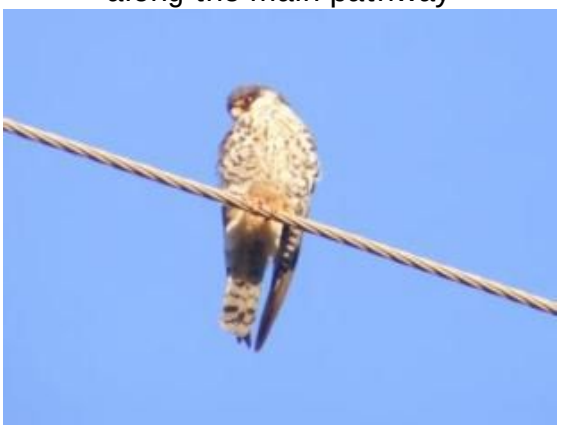
Plate 1 Plates of target species observed on proposed wind power project site

Augur Buzzard on a Rocky Out crop



Augur Buzzard in Flight

Lesser Kestrel perched on power lines along the main pathway



Lesser Kestrel in Flight

Lesser Kestrel flocks migrating

Kori Bustard, resident species on site

A juvenile Kori Bustard in the Nest within the project site to the West

A pair of Ostrich, observed before start transect away project area

Secretary Bird observed within the project area on the grassland Habitat, resident species

A pair of White Stork was observed twice at the boundary of the project, are common palae-arctic migrants on grasslands and grain fields

One of VP, where we observed high concentration of migrating species