# Uganda Electricity Transmission Company Limited (UETCL)

# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF THE 400 KV TRANSMISSION LINE FROM WOBULENZI TO MASAKA AND ONWARDS TO MUTUKULA

## Volume 3 –Biodiversity Management Plan

Prepared for:

## Uganda Tanzania Interconnector Project (P171243)

## BMP Content

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## Acronyms Used in the Text

| | |
|---|---|
| AEFI | African–Eurasian Flyways Initiative |
| AEWA | Agreement on the Conservation of African–Eurasian Migratory Waterbirds |
| APLIC | Avian Power Line Interaction Committee (USA) |
| AZE | Alliance for Zero Extinction |
| BFD | Bird Flight Diverter |
| BMU | Biodiversity Management Unit |
| BMP | Biodiversity Management Plan |
| BNG | Biodiversity Net Gain |
| CHA | Critical Habitat Assessment |
| CR | Critically Endangered (IUCN category) |
| E&S | Environmental and Social |
| EHS | Environmental, Health, and Safety |
| EIA / ESIA | Environmental (and Social) Impact Assessment |
| ENDESA | *Empresa Nacional de Electricidad S.A.* (Spain) |
| EN | Endangered (IUCN category) |
| ERA | Electricity Regulatory Authority (Uganda) |
| ESF | Environmental and Social Framework (World Bank) |
| ESMS | Environmental and Social Management System |
| ESS6 | Environmental and Social Standard 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources) |
| EWT | Endangered Wildlife Trust (South Africa) |
| GIS | Geographic Information System |
| GoU | Government of Uganda |
| IBAT | Integrated Biodiversity Assessment Tool |
| IBA | Important Bird Area |
| ICE | *Instituto Costarricense de Electricidad* (Costa Rica) |
| IUCN | International Union for Conservation of Nature |
| IAS | Invasive Alien Species |
| IWT | Illegal Wildlife Trade |
| KETRACO | Kenya Electricity Transmission Co. |
| KPI | Key Performance Indicator |
| LoO | Likelihood of Occurrence |
| MoU | Memorandum of Understanding |
| NBSAP | National Biodiversity Strategy and Action Plan |
| NEMA | National Environment Management Authority (Uganda) |
| NGO | Non-Governmental Organization |
| NNL | No Net Loss |
| NU | Nature Uganda |
| OPGW | Optical Ground Wire |
| PGCIL | Power Grid Corporation of India Ltd |
| PMU | Project Management Unit |
| RoW | TL Right of Way |
| SOP | Standard Operating Procedure |
| TL | Transmission Line |
| UAV | Unmanned Aerial Vehicle (drone) |
| UETCL | Uganda Electricity Transmission Company Limited |
| UTIP | Uganda–Tanzania Interconnector Project |
| VU | Vulnerable (IUCN category) |
| WB / WBG | World Bank / World Bank Group |
| WCS | Wildlife Conservation Society, Uganda |

# 1 EXECUTIVE SUMMARY

The Uganda Electricity Transmission Company Limited (UETCL), with World Bank support, is implementing the Uganda–Tanzania Interconnector Project (UTIP) to construct a 258 km, 400 kV transmission line linking Wobulenzi to Masaka (166 km) and onward to Mutukula (92 km) at the Tanzanian border. The project will enhance cross-border electricity trade within the Eastern Africa Power Pool and contribute to regional energy security and economic growth.

This Biodiversity Management Plan (BMP) is compiled in line with the World Bank Environmental and Social Framework (ESF), and particularly its biodiversity standard ESS6, to implement requirements of the Critical Habitat Assessment (CHA) and complement the project Environmental and Social Impact Assessments (ESIAs). The BMP defines the mitigation, monitoring, and institutional measures necessary to ensure compliance with ESS6, achieve No Net Loss, and where feasible, Net Gain of biodiversity.

The transmission corridor traverses mainly modified agricultural landscapes, interspersed with wetlands of high ecological value, particularly papyrus swamps that support globally significant populations of threatened and migratory waterbirds. The CHA identified 14 Critically Endangered (CR) and Endangered (EN) species and five migratory bird species potentially affected by the project, most notably vultures, cranes, raptors, and wetland-dependent birds such as the Shoebill (*Balaeniceps rex*) and Gray Crowned Crane (*Balearica regulorum*).

The BMP applies the mitigation hierarchy and introduces several specialized measures including adoption of avian-safe transmission line design, wetland and habitat protection, strict contractor environmental management requirements, and wildlife-sensitive construction practices such as fauna rescue protocols, speed restrictions, and invasive alien species control.

To achieve measurable biodiversity enhancement, the BMP incorporates a Biodiversity Net Gain (BNG) Strategy, which rests on five pillars:

i. Greening Old Transmission Lines through retrofitting with Bird Flight Diverters;
ii. Conservation Partnerships with Nature Uganda (NU) and Wildlife Conservation Society (WCS) for monitoring and data management;
iii. UETCL Capacity Building through establishment of a Biodiversity Management Unit (BMU);
iv. Avifaunal Impact Monitoring involving community participation; and
v. Collaboration with African Power Utilities through the African–Eurasian Flyways Initiative (AEFI).

Monitoring will track the effectiveness of wetland restoration, IAS infestations, bird and bat mortality, and the performance of mitigation measures. Data will be entered into UETCL's Biodiversity Net Gain (BNG) database and dashboard to support adaptive management and transparent reporting to ERA, NEMA, and the World Bank.

UETCL, as the Executing Agency, will manage the BMP through its Project Management Unit (PMU) and a dedicated Biodiversity Management Unit (BMU). Contractors will implement site-level mitigation, while landscape-level conservation and Biodiversity Net Gain measures will be executed through a formal Conservation Partnership between UETCL, WCS and NU.

The total estimated budget for BMP implementation is approximately US $1,750,000, covering project-phase mitigation oversight (US $80,000), Greening Old Transmission Lines (US $500,000), Conservation Partnerships (US $120,000), Capacity Building (US $470,000), Avifaunal Impact Monitoring (US $500,000), and Collaboration with African Utilities (US $80,000).

Expected outcomes include compliance with ESS6 and achievement of No Net Loss or Net Gain for critical habitat species, measurable reduction in avian collisions (>30%), strengthened national capacity for biodiversity monitoring, and establishment of UETCL as a regional leader in biodiversity-positive energy infrastructure.

# 2 INTRODUCTION

Uganda Electricity Transmission Company Limited (UETCL) plans to construct a 166 km long Transmission Line (TL) with 400 kV capacity to connect the proposed Wobulenzi substation to the proposed Kakunyu substation (Masaka) and connect to the Tanzanian grid at Mutukula with an additional 92 km length (Figure 1). The Wobulenzi-Masaka-Mutukula TL is part of the regional Uganda Tanzania Interconnector Project (UTIP) that will supply power to interconnect the electricity grids of the Eastern African Power Pool. The project is aimed at sharing and maximizing the utilization of electric energy in the region through the planned interconnections, monitoring and control of electric power flow from one member state to another with the aim of boosting economic growth.

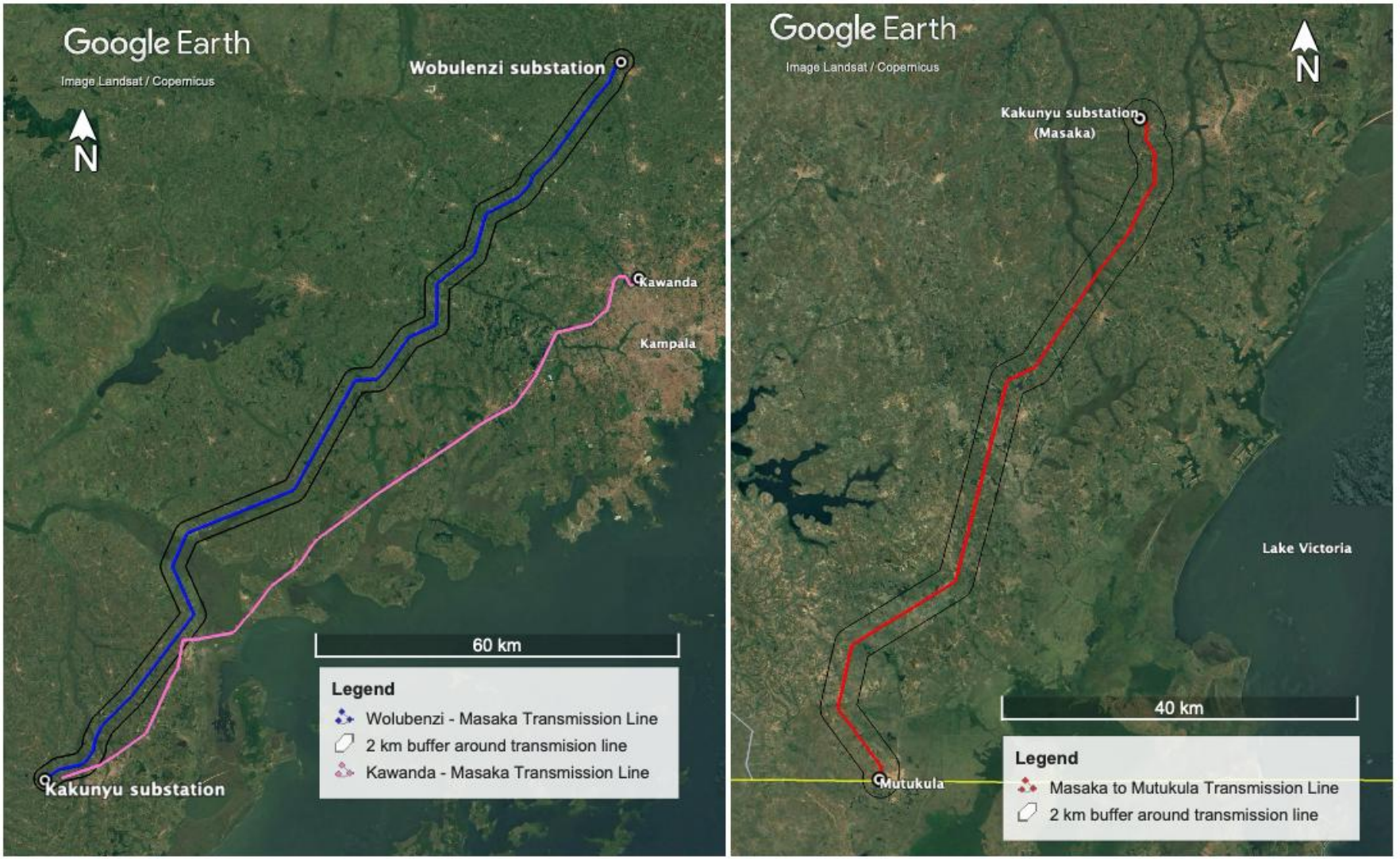
## 2.1 Purpose and Scope of this Report

Two ESIA documents have been compiled for the project, for the Wobulenzi-Masaka route and the Masaka-Mutukula route, dated Nov-2024 and May-2025 respectively. A Critical Habitat Assessment (CHA) has been compiled to identify sensitive biodiversity associated with the Project. This Biodiversity Management Plan (BMP) is compiled to implement requirements of the CHA and complement to ESIA documents towards meeting requirements of Environment and Social Standard 6 (ESS6) of the ESF. This report presents the BMP for the full UETCL TL from Wobulenzi to Mutukula.

### 2.1.1 Structure of this Document

This BMP document is structured to align with the indicative content of a BMP provided in Appendix A of the ESS6 Guidance Notes, which requires a separation between mitigation needed to achieve BMP objectives, and mitigation to address Project Requirements. The Biodiversity Net Gain (BNG) Strategy (Chapter 6) of this BMP is structured to address BMP Objectives, while Chapter 5 of this BMP presents the mitigation to address project impacts.

Figure 1 Transmission line alignments from Wobulenzi to Masaka (left, blue), and Masaka to Mutukula (right, red) with associated 2 km buffer zones, also showing the Kawanda-Masaka TL (left, pink)



# 3 OBJECTIVES

The Transmission Line (TL) project will be implemented in accordance with the ESF. The ESF comprises 10 ESSs with ESS6 addressing Biodiversity Conservation and Sustainable Management of Living Natural Resources.

ESS6 has the following objectives:

- To protect and conserve biodiversity and habitats.
- To apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity.
- To promote the sustainable management of living natural resources.
- To support livelihoods of local communities, including Indigenous Peoples, and inclusive economic development, through the adoption of practices that integrate conservation needs and development priorities.

The primary purpose of this BMP is to mitigate project impacts on biodiversity to meet the requirements of ESS6. The specific objectives of this BMP are:

1. To develop and implement measures to achieve No Net Loss, and where feasible, preferably a net gain of biodiversity through appropriate measures put in place in accordance with the mitigation hierarchy in response to impacts to natural habitat.
2. To present a mitigation strategy to achieve net gains for the biodiversity features for which critical habitat is designated through an approach that is proportional to the project impacts.

# 4 BACKGROUND INFORMATION

## 4.1 Project Description

The above-mentioned ESIA documents provide detailed descriptions of the project. A brief description of technical aspects relevant to biodiversity management is provided below.

### Transmission Line Route

The Government of Uganda proposes to develop a 400kV TL to provide additional capacity to support the region and connect with a similar TL through northwestern Tanzania. The voltage is planned at 400 kV but will initially be operated at 220kV. The TL will start at the proposed Wobulenzi substation (an associated facility that will be constructed under another financing arrangement), to feed into the proposed Masaka substation, located at Kakunyu, from where it will interconnect with the Tanzanian grid at Mutukula. Extension of the substation bays at Kakunyu to accommodate the incoming and outgoing lines will be part of the project, as well as clearing of the right-of-way (RoW), which is 10 meters for a 400/220 kV TL (entire wayleave is 60 meters for a 400 kV line).

The TL has a total length of 258 km and comprises the following segments:

- Wobulenzi to Masaka: 166 km
- Masaka to Mutukula: 92 km

The above route alignments have been selected based on an assessment of alternatives provided in the ESIAs as required by the Ugandan laws and the ESF. Spatial data (kml files) for the above segments have been provided for this assessment, which Google Earth estimates the lengths to be 165 km and 89.6 km respectively. This spatial data is considered sufficiently accurate for biodiversity assessment purposes.

### Design Characteristics

All construction activities will be undertaken within the RoW for the safe operation of the TLs, considering minimum clearances as indicated in Government Regulations (60 m RoW, 10 m cleared vegetation).

- For construction, the TL route will be marked by wooden pegs in the ground in accordance with the line design.
- Pit marking will be done for the legs of each tower with foundation dimensions of approximately 3 m x 3 m x 3 m depending on the ground conditions and slope at each tower location. The excavated soils will be stored appropriately and used for backfilling with no need for soil to be imported. At the tower sites, all vegetation within the base footprint and

approximately 2 m beyond the base will be cleared to ground level. Each tower will have a base footprint of 5 m x 5 m = 25 m².

Once backfilling is completed, the surface of the towers will be graded to ensure that water drains away from the tower supports and the surface is smooth. All excess construction materials and debris will be removed from the site and disposed at the nearest municipal disposal site. Biomass residues will be left on site for use by the local land users.

Clearing of the RoW will involve a variety of techniques, including the use of heavy equipment, and selective hand-clearing. The choice depends upon topography, current growth, land use, and plant species on the way leave adjacent property and the presence of sensitive environments. In sensitive areas, hand-clearing may be used to minimize environmental disturbance.

The minimum set of specifications for Transmission towers are the materials of construction, type or geometry, span between towers, weight, number of circuits, and circuit configuration. The options are lattice, pole (or monopole), H-frame, guyed-V, or guyed-Y designs. The number of towers will range from 2 to 4 towers per mile (1.6 km). The specific tower geometry is site-dependent, and, for any given conditions, multiple options are likely to exist. The circuit configuration refers to the relative positioning of conductors for each of the phases. Generally, the options are horizontal, vertical, or triangular. The vertical orientation allows for a more compact RoW but it requires a taller tower.

The following activities form part of the pre-construction phase to be done by UETCL design engineers:

- Walkover survey to identify the TL corridor;
- Detailed survey for fixing the alignment; and
- Soil investigation of important tower locations to ascertain the type of foundation to be adopted.

### Access Roads

Access roads will be required along the entire route except where the line is moving along main roads. Access tracks will avoid crossing wetlands and water courses to the full extent possible. No permanent access roads shall be constructed through wetlands, any temporary access roads created will be installed by hard core and culverts to allow unimpeded flow of water in the wetland system. These temporary roads will be decommissioned after construction and wetlands reinstated to their original state as much as possible. However the need for additional access roads is currently unknown and the RPF prepared for the project will address any E&S concerns.

### Construction Camps

Temporary construction camps will be established by each contractor, and will involve clearing the vegetation, fencing and the construction of houses, workshops, fuel storage, vehicle washing area, storerooms and vehicle parking areas. The number and location of camps are yet to be determined but will be guided by this CHA and Environmental and Social Management Plans (ESMP), including those developed by contractors.

## 4.2 Biodiversity Baseline Summary

### 4.2.1 Modified and Natural Habitat

A core requirement of ESS6 is the classification of modified and natural habitats, whereby all habitats are categorized as either one or the other. This classification is necessary to address the ESS6 requirement for No Net Loss of biodiversity (NNL)[1] in response to impacts to natural habitat. ESS6 provides clear definitions of modified and natural habitats (Table 1), which guide the approach to classification of habitats.

Table 1 ESS6 Definitions of Modified and Natural Habitat

| Modified Habitat | Natural Habitat |
|---|---|
| *ESS6 paragraph 19*: Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. | *ESS6 paragraph 21*: Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition. |

Results reveal that both sections of the TL are dominated by modified habitats. Satellite imagery indicates the Wobulenzi-Masaka TL section is extensively wooded, but ground truthing revealed that much of the wooded habitat is comprised of coffee, banana and Eucalyptus plantations, which represent modified habitat. The majority of the natural habitat is represented by wetlands, many of which are dominated by *Papyrus*. Ground truthing has revealed the non-wetland areas of natural habitat are fragmented and in a degraded state due to livestock grazing and do not sustain effective ecological functions.

[1] NNL is defined by ESS6 (footnote 8) as the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale (e.g., local, landscape-level, national, regional).

The Project Description states that a 10 m central strip of the RoW will be reserved for access roads and permanently cleared on vegetation. These areas will become modified habitat. Vegetation within the remainder of the RoW (50 m width) with capacity to grow above 2 meters height will be pruned on a regular basis throughout the TL operational phase. The pruned (cropped) vegetation will retain much of its prevailing floral species composition. The Wobulenzi substation and Kakunyu substations (Masaka) are located in modified habitats and their development will not lead to the loss of natural habitats.

The TL cannot avoid crossing many wetlands. These wetlands will be exposed to temporary disturbance during the construction process, but no permanent access roads will be created within wetland habitats. Papyrus recovers rapidly from disturbance and no loss of natural habitat is expected due to construction through wetlands. A field assessment of recently constructed TL through a Papyrus grove revealed no evidence of construction activity in the recent past.

The assessment of modified and natural habitats provided in the CHA Report has revealed that the maximum loss of natural habitat is estimated at 7.3 ha which is considered not significant and does not trigger No Net Loss requirements.

### 4.2.2 Protected Areas

ESS6 recognizes both legally protected and internationally recognized areas of high biodiversity value, which are defined as:

- Legally protected areas: “A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.” This includes areas proposed by governments for such designation.

- Internationally recognized areas of high biodiversity value include Natural World Heritage Sites, Biosphere Reserves, Ramsar Wetlands of International Importance, Key Biodiversity Areas (KBA), Important Bird Areas (IBA), and Alliance for Zero Extinction (AZE) Sites, among others.

Protected areas were identified based on IBAT (Integrated Biodiversity Assessment Tool) reports generated for each section of the TL route, which revealed 172 protected areas within a 50 km buffer of the TL routes.

The TL route avoids all legally protected areas, with the exception of two plantation forest reserves (Luwawa and Wabinyomo) where natural forest has been converted to cropland. These

two areas are not considered ecologically sensitive, and do not require mitigation to protect sensitive biodiversity.

Thirteen internationally recognized areas of biodiversity importance occur within the area covered by IBAT reports. The TL route avoids all of the internationally recognized areas with the exception of the Lake Wamala Catchment KBA. This water catchment is recognized for three fish species, a dragonfly and a plant species. The TL passes through the higher-lying ground of eastern-most edge of the catchment where there is no aquatic habitat, and the TL will not impact the fish or damselfly (aquatic-associated) species. The plant species (*Dracaena newtoniana*) is not evaluated on either the IUCN or national red lists and little is known about its rarity or distribution. No impacts are expected or can be described for this KBA.

### 4.2.3 Critical Habitat

ESS6 recognizes areas supporting biodiversity of exceptional value as critical habitat. Critical habitat is defined by any of the following five criteria provided in ESS6 (paragraph 23):

(a) Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of Threatened Species or equivalent national approaches;
(b) Habitat of significant importance to endemic or restricted-range species;
(c) Habitat supporting globally or nationally significant concentrations of migratory or congregatory species;
(d) Highly threatened or unique ecosystems;
(e) Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

The approach used for interpretation of the above criteria (Critical Habitat Assessment, or CHA) follows an ESS6-specific approach developed in 2022 and has been applied in South Asia, East Asia and the Pacific Regions of the World Bank. The CHA is applied to an area, referred to as the Area of Analysis (AoA). The CHA approach is presented as the following four steps:

#### Step 1 - Generate a List of Threatened and Range-restricted Species

Criteria (a) and (c) require at least two key data sources, namely the global IUCN Red List and a national red list, which are supplemented from other sources as appropriate. Lists of species classified as CR or EN on IUCN Red List data (provided by IBAT) and the National Red List of Threatened Species of Uganda 2018 has been used. Restricted range species were determined from IBAT and Uganda National Red List reports.

### Step 2 - Screening based on Likelihood of Occurrence

The list of species generated by Step 1 were screened for Likelihood of Occurrence (LoO) based on a knowledge of species occurrence in the area and the known ecological state of habitats within the AoA. Species are classified into LoO categories, namely Possible, Unlikely and Not Present (Table 8). Species with a possible presence are assessed in Step 3 below, but their status needs to be confirmed through future field surveys.

### Step 3 - Determination of Critical Habitat Status

Reliable secondary data on a species' population size, extent of occurrence, other relevant information and expert opinion will be used to assess species retained after Step 2. The following six guidelines are used for the interpretation and analysis of critical habitat:

(i) Recognized areas of high biodiversity value (such as legally protected and internationally recognized areas), and importantly the reasons for which they are designated can provide useful indicators of potential critical habitat. A review of protected areas is therefore included as a preparatory step for the assessment of critical habitat.

(ii) ESS6 Criterion (a) requires an assessment against both global (IUCN) and national red list ratings. ESS6 footnote 13 states that where the threatened status of a species is listed differently on the (global) IUCN Red List and national/regional lists, assessment of the impact of net reduction should be based on the national/regional population. This is interpreted as a requirement to follow a precautionary approach and to prioritize assessment of species reduction (project impact) to the lesser population of a species (i.e. the national assessment) over the global assessment.

(iii) By definition, Critically Endangered (CR) species face an extremely high risk of extinction and their continued survival in the wild is in a critical state. Therefore, if a surviving population of a CR species is present in the AoA, the habitat should be considered to have significant importance for the species under ESS6 Criterion (a).

(iv) Where a significant proportion of the national, regional or global population of a species is present or has a likely presence within the AoA, the habitat is considered to have significant importance for the species under ESS6 Criterion (a), (b) or (c). Each project is encouraged to develop its own measurement of significance. For this CHA, the presence (or likely presence) of ±1% of the global or national population within the AoA is considered an appropriate level of significance considering the extent of the Project AoA.

(v) ESS6 Criterion (b) can additionally be achieved for range-restricted species where the full extent of the AoA overlaps a significant proportion of a species' distribution range (±1% is considered an appropriate level of significance for this CHA). For terrestrial species, restricted range status is recognized for an Extent of Occurrence (EoO) of approx. 50,000 km².

(vi) ESS6 Criteria (d) and (e) must be assessed on a case-by-case basis using reliable data sources with consideration given to the presence of conservation initiatives, legally protected areas and internationally recognized areas of high biodiversity value and the reasons for which they are designated.

### Step 4 - Identify Critical Habitat Features of Relevance to the Project

This final step of the CHA assesses the relevance of critical habitat features to the Project. ESS6 requires the project's mitigation strategy to achieve net gains of the biodiversity values for which a critical habitat is designated. Those features that are not impacted by a project do not present a risk that the project will fail to meet ESS6 requirements. For critical habitat features that are potentially impacted, the CHA needs to demonstrate how net gain requirements will be addressed, and feasibility thereof needs to be investigated. ESS6 also requires an appropriately designed, long-term biodiversity monitoring and evaluation program aimed at assessing the status of the critical habitat, and effectiveness of mitigation to conserve those species. The emphasis of the CHA developed for this Project was therefore on Step 4.

## 4.3 Summary of the Critical Habitat Assessment

Lists of species potentially present within the Project area were sourced from IBAT and the National Red List of Threatened Species of Uganda 2018. Consolidation of these data sources yielded 2,898 floral and faunal species. For each species, the highest threatened status was determined from the IUCN Red List and the National Red List of Uganda.

The assessment has yielded 14 CR and EN species for which the project site likely presents habitat of significant importance and five migratory waterbird species that likely congregate in significant numbers and are potentially impacted by the project (Table 2). These species are considered critical habitat features in need of mitigation to address impacts.

Table 2 Critically Endangered and Endangered species with possible LoO that are potentially impacted by the Project

| English Name (Species Name) | Threatened Status | | Vulnerability to Impacts |
|---|---|---|---|
| | IUCN | National | |
| **Criterion (a): Critically Endangered and Endangered Species** | | | |
| **Mammals** | | | |
| Spotted-necked Otter (*Hydrictis maculicollis*) | NT | EN | Wetland disturbance |
| **Birds** | | | |
| White-backed Vulture (*Gyps africanus*) | CR | EN | Collision with TL wires |
| Rüppell's Vulture (*Gyps rueppelli*) | CR | EN | |

| English Name (Species Name) | Threatened Status | | Vulnerability to Impacts |
|---|---|---|---|
| | IUCN | National | |
| Hooded Vulture (*Necrosyrtes monachus*) | CR | EN | |
| Egyptian Vulture (*Neophron percnopterus*) | EN | CR | |
| Lappet-faced Vulture (*Torgos tracheliotos*) | EN | CR | |
| White-headed Vulture (*Trigonoceps occipitalis*) | CR | CR | |
| Bateleur (*Terathopius ecaudatus*) | EN | - | |
| Steppe Eagle (*Aquila nipalensis*) | EN | - | |
| Shoebill (*Balaeniceps rex*) | VU | EN | Wetland disturbance, TL collision, Induced access and IWT |
| Gray Crowned Crane (*Balearica regulorum*) | EN | EN | |
| Malagasy Pond Heron (*Ardeola idae*) | EN | EN | Wetland disturbance and TL collision |
| White-backed Night-heron (*Gorsachius leuconotus*) | LC | EN | |
| **Plants** | | | |
| Waterwheel Weed (*Aldrovanda vesiculosa*) | EN | EN | Wetland disturbance |
| **Criterion (c): Migratory and Congregatory Species** | | | |
| White Stork (*Ciconia ciconia*) | LC | LC | Wetland disturbance and TL collision |
| Abdim's Stork (*Ciconia abdimii*) | LC | LC | |
| African Openbill (*Anastomus lamelligerus*) | LC | LC | |
| Goliath Heron (*Ardea goliath*) | LC | VU | |
| Great White Egret (*Ardea alba*) | LC | LC | |

# 5 PROJECT MITIGATION REQUIREMENTS

## 5.1 Overview of Biodiversity Impacts

The Project ESIAs provide an assessment of the significance of impacts to biodiversity, based on four primary impacts (Table 3).

Table 3 Overview of the significance of biodiversity impacts assessed within the Project ESIA documents

| Biodiversity Impacts | Significance of Impacts | |
|---|---|---|
| | Construction | Operations |
| Impact on Terrestrial Habitats and Associated Flora | Moderate | Moderate |
| Impact on Aquatic Habitats and Associated Fauna | Moderate | Moderate |
| Impact on Terrestrial Fauna | Moderate | Minor |
| Impact on Avifauna | Moderate | Major |

## 5.2 Mitigation Measures to be addressed Preconstruction

This section of the BMP presents mitigation to address these impacts, which builds on the biodiversity-related mitigation presented within the ESIA documents. Mitigation presented within the BMP assumes that all environmental and social measures outlined in the Project ESMP will be fully implemented.

### 5.2.1 Avian-Safe Transmission Line Design (400 kV Systems)

This section outlines a risk-based guidance for engineering design of a 400 kV transmission lines to reduce bird collisions and bird risks associated with substations. The focus of mitigation is on collision avoidance, visibility enhancement, and reliability of mitigation devices.

The specific objectives are:

1. Collision minimization: To enhance visibility on all high-risk spans using proven diverter technologies to minimize the incidence of bird-TL collisions.
2. Substation avifauna safety: Insulate jumpers and maintain safe nesting control.
3. Performance verification: Establish post-energization monitoring and adaptive management.

Development of mitigation follows a stepwise sequence addressing line geometry, line visibility marking, and substation measures:

**Step 1 — Structure Geometry and Configuration:**

- Use tall lattice suspension towers with >5 m phase-to-structure clearance.
- Minimize shield wires (prefer single OPGW where feasible).

- Maintain ≤1 m vertical separation between twin shield wires.
- Apply non-reflective conductors and perch deterrents.

**Step 2 — Collision-risk Marking:**

- Mark uppermost shield wires on all High risk and Substantial risk spans.
- Install a variety of BFD designs including spiral markers, dynamic flappers, reflective devices, LED devices and marker balls to increase the effectiveness for different bird species, and effectiveness during both daylight and nocturnal hours. *Refer to Table 6 for types of BFDs*.
- Spacing: 20 m (normal), 10–15 m (high risk areas).
- Verify installation by drone imagery; devices must withstand corona and tropical weather.
- Technical specifications for BFDs:
  - Diverter visibility ≥200 m at 80 km/h flight.
  - UV/weather resistance ≥10 years (ISO 4892-2 / ASTM G154).
  - Corona inception voltage ≥450 kV RMS.
  - Attachment to line must be non-metallic attachment, and live-line applicable.
  - Mechanical strength ≥250 N pull, 100,000 vibration cycles.
  - Temperature range –10°C to +70°C.

**Step 3 — Substation-level Measures:**

- Insulate jumpers and install wildlife covers.
- Provide safe nesting structures in the vicinity, such as platform raised on a high pole (see Table 7).
- Avoid aggressive deterrents, devices or methods that pose an injury risk to birds or cause unnecessary stress. Table 4 provides examples of deterrents to be avoided.

Table 4 Bird-unfriendly measures to be avoided for development of substations

| Type | Example | Reasons to be avoided |
|---|---|---|
| Devices causing physical injury | Metal or hard anti-perching spikes, barbed wire, razor wire, or sharp rotating rods | Can impale or entangle birds, especially large raptors or storks attempting to perch or land. |
| Electrostatic deterrents | Electrified deterrent strips, electroshock tracks | Deliver painful shocks; cause panic flights or mortality if malfunctioning in wet conditions. |
| Chemical repellents | Sticky gels, polybutene-based coatings, chemical sprays | Adhere to feathers, leading to loss of waterproofing, flight impairment, and toxic ingestion during preening. |
| Acoustic cannons | Propane gas bird bangers, ultrasonic distress-call systems | Ineffective for most birds long-term; cause chronic stress, disturbance, and public nuisance near substations. |
| Laser deterrents | Continuous or pulsed green/red laser systems | Can cause retinal damage and panic in low-light conditions; unsafe for maintenance crews. |

| Type | Example | Reasons to be avoided |
|---|---|---|
| Predator decoys (persistent use) | Fixed owl or hawk effigies left indefinitely | Quickly lose deterrent effect and may mislead birds into unsafe approach patterns. |

**Operations and Monitoring**

- BFDs are to be installed on 100% of high-risk spans within 1 month of stringing.
- Conduct bi-annual inspections (can be done using drone technology).
- Replace BFDs when >2 devices are lost per 100 m span, or augment existing BFDs when >2 collision events per year.
- Maintain a GIS-linked incident log and adaptive response plan.
- It is anticipated that avifaunal impact monitoring data (Section 6.4) will demonstrate ≥30% reduction in collision indicators post-BFD fitting.

### Indicative Budget

An indicative budget is presented in Table 5, although these costs are considered a component of the EPC budget and not incorporated into the BMP budget (Section 8).

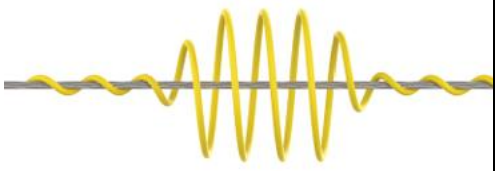
This indicative budget is structured to reflect design development, equipment procurement, and installation. The largest cost driver is BFD procurement, noting that costs can vary from USD 25 to 60 per unit depending on type (spiral vs. LED). Installation is UAV-based which is cost effective and strengthens UETCL's biodiversity performance credentials. Monitoring costs are estimated in (Section 6.4).

Table 5 Indicative budget calculated for developing an Avian-Safe Transmission Line Design

| Cost Component | Description | Basis of Estimate / Assumptions | Estimated Cost (USD) |
|---|---|---|---|
| Engineering & Design Development | Development of avian-safe tower geometry, insulator specification, and substation wildlife-proofing layouts | 2–3 months design consultancy; includes integration with electrical design standards | 60,000 |
| Bird Flight Diverters (BFDs) Procurement | Purchase of diverters (spiral, flapper, LED) for approx. 30 % of spans (≈ 75 km high risk) | ~20 diverters per 100 m; avg USD 30 per unit | 440,000 |
| Diverter Installation (Live-Line or Stringing Phase) | Installation using UAV or live-line crews; includes drones, safety, and equipment | USD 1,500 per km for 75 km of high-risk spans | 110,000 |
| Substation-Level Bird-Safe Measures | Insulation covers for jumpers, nesting deterrents, and installation of 4–6 nesting platforms at each substation | Two main substations | 30,000 |

| Cost Component | Description | Basis of Estimate / Assumptions | Estimated Cost (USD) |
|---|---|---|---|
| Raptor / Waterbird Nesting Platforms | Design, fabrication, and installation of 10 platforms near substations/wetlands | USD 3,000–3,500 per unit (materials + installation) | 30,000 |
| Drone-Based Verification and QA | Post-installation imagery, compliance audit, corona inspection | USD 1,000 per day × 30 days | 30,000 |
| | | **Total Cost estimate** | **700,000** |

Table 6 Overview of various types of bird flight diverters

| Details of Bird Flight Diverters | Illustrated Example |
|---|---|
| **Static (Fixed) Diverters** | |
| **Spiral / Helical Diverters**<br>**Examples:** Swan-Flight Diverter, Preformed Line Products (PLP) helical markers<br>**Mechanism:** Increases wire visibility and provides continuous profile contrast.<br>**Advantages:** Low wind resistance and minimal vibration, long lifespan, easy to install (live-line possible)<br>**Limitations:** Low movement or flash; less effective in low-light or fog<br>**Best suited for:**<br>• Large, strong-flying birds (e.g., storks, cranes, herons, vultures) that require early detection of the line in daylight.<br>• Open country and wetland areas with consistent visibility. |  <br>Swan-Flight Diverter |
| **Marker Balls / Aerial Spheres**<br>**Examples:** Standard aviation marker balls (orange/white/red, 60–90 cm diameter)<br>**Mechanism:** Provide bold color contrast and shape recognition from distance.<br>**Advantages:** Excellent daytime visibility, dual benefit for aviation safety (helicopters, small aircraft).<br>**Limitations:** Heavy; can induce extra line vibration on long spans, not suitable for all wind conditions or small conductors.<br>**Best suited for:**<br>• Large diurnal birds (storks, cranes, pelicans)<br>• Major river or wetland crossings and high-visibility spans |  <br>Standard aviation marker ball |

| Details of Bird Flight Diverters | Illustrated Example |
|---|---|
| **Dynamic (Moving or Rotating) Diverters** | |
| **Swinging / Flapper-Type Diverters**<br>**Examples:** Bird Flapper, Power Line Bird Flapper, FireFly FF<br>**Mechanism:** Movement and flash increase wire detectability under variable light conditions.<br>**Advantages:** Highly visible in low-light, dawn/dusk, or fog; Effective for nocturnal and crepuscular species.<br>**Limitations:** Higher mechanical wear and maintenance needs.<br>**Best suited for:**<br>• Waterbirds, ducks, geese, cranes, ibises (especially in wetlands or estuaries).<br>• Migratory corridors with variable weather and lighting. |  <br>*FireFly FF* |
| **Rotating or Reflective Devices**<br>**Examples:** LumoDome, BirdMark LED Diverter, EcoReel<br>**Mechanism:** Provide motion cues and light reflection detectable even in dim or overcast conditions.<br>**Advantages:** High visibility under low-light, fog, or night conditions; Some variants include LED or UV-reflective materials visible to birds but not humans.<br>**Limitations:** Higher cost; may require more frequent inspection.<br>**Best suited for:**<br>• Nocturnal migrants (ducks, waders, nightjars),<br>• Fog-prone or low-visibility environments,<br>• High-voltage 220–400 kV lines where corona effects are a consideration. |  <br>*BirdMark LED Diverter* |
| **Illuminated or Light-Emitting Diverters** | |
| **LED or UV-Light Diverters**<br>**Examples:** BirdMark LED, LightLine, FireFly UV<br>**Mechanism:** Enhances visibility in darkness using UV wavelengths detectable by birds but minimally visible to humans.<br>**Advantages:** Effective at night and during poor weather; Proven reduction in collisions for nocturnal migrants and waterfowl.<br>**Limitations:** Higher procurement cost, limited availability, power source (photovoltaic or kinetic) needed.<br>**Best suited for:**<br>• Nocturnal migratory birds (waders, ducks, night-flying passerines).<br>• Wetland and coastal transmission corridors. |  <br>*Hawk Eye™* |

| Details of Bird Flight Diverters | Illustrated Example |
|---|---|
| **Hybrid / Composite Diverters**<br>**Examples:** FireFly Reflector (combines rotation, reflection, and color contrast).<br>**Mechanism:** Integrates movement, color, and reflection for multi-species effectiveness.<br>**Best suited for:**<br>• Mixed-habitat or multi-species corridors where both diurnal and nocturnal species occur. |  <br>AviaLED |

## Table 7 Guidance for design and installation of raptor and large waterbird nesting platforms

Erection of nesting platforms is a low-cost mitigation that, when appropriately applied can reduce the incidence of birds nesting in substations. Platforms should primarily target large fish-eating and raptor species, which are both conservation-relevant and infrastructure-sensitive, such as Gray-crowned Crane, African Fish Eagle, Long-crested Eagle, Augur Buzzard, Palm-nut Vulture, Martial Eagle (where territories exist near large wetlands). Other birds that could potentially use nesting platforms include various vultures, Marabou stork, Yellow-billed Stork, Saddle-billed Stork, African Openbill, Black Kite and Pied Crow.

The following criteria are proposed as a basis for experimenting to find an optimal design:

- Nesting platforms should have a diameter of approx. 1.2 to 1.5 meters to allow the birds to construct their own large, stable nests.
- Platforms require a permeable base, and/or a small central hole to drain rain water.
- Platforms mounted on a steel pole with sufficient load-bearing capacity to support the weight of heavier birds and the bulkier nests they build.
- Platforms to be mounted at a height of 15 to 25 meters (average height of ~ 18 meters) above ground or water, matching the natural preference of these birds for elevated, secure nesting sites.
- Poles will be firmly anchored to a concrete foundation appropriate to the soil conditions (e.g. a square 0.8 m x 1 m deep).
- The nesting platform will feature a deeper frame with 20 to 25 centimeters of raised edges to securely hold a bulk of nesting material.
- Firm branches will be installed to extend outwards from the corners of a platform to provide easy landing and perching for the birds, which is important for some species' nesting behavior.
- Each platform will be pre-loaded with small dry sticks (with ~0.5 – 2.5 cm diameter), grasses, and leaves to mimic natural nesting conditions and encourage adoption (during the pre-breeding monitoring).

Conservation Partners must be involved in the design, siting and monitoring the use of platforms by birds.

### 5.2.2 Requirements on Contractors

This BMP includes many specific requirements outlined below for which the Contractor will need to demonstrate the appropriate capacity.

#### Personnel Skill Requirements

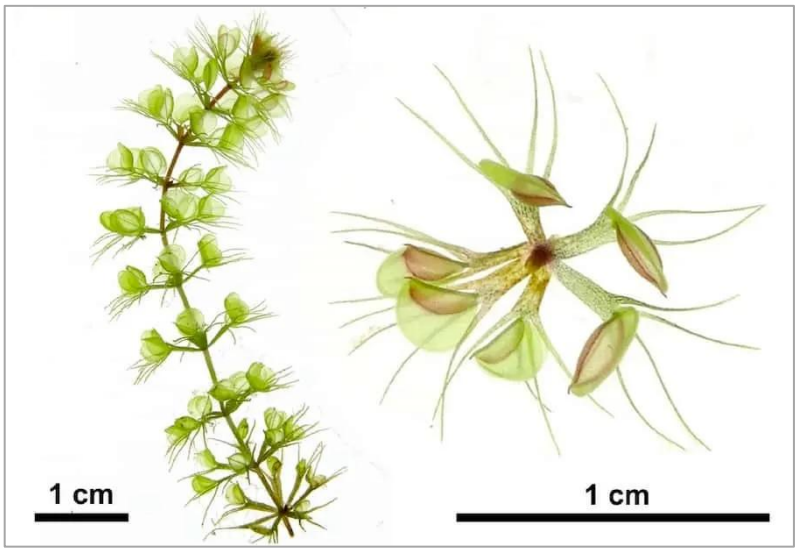
The Contractor shall engage the services of qualified and experienced ecologists to support project implementation and ensure compliance with this BMP. The following skills and competencies will be required within the Contractor's team:

- **Botanical Expertise:** Ability to classify sites according to the ESS6 definitions of modified and natural habitat, identify plant species of conservation concern, guide site restoration activities, and detect the presence of *Aldrovanda vesiculosa* (the waterwheel plant, Figure 2), a critical habitat species occurring in papyrus wetlands.

- **Ornithological Expertise:** Capacity to perform pre-construction wetland inspections to verify that no critical-habitat bird species are nesting or temporarily using wetlands within a 50-meter buffer of the proposed works.

- **Wildlife Handling and Safety:** At least one team member must be trained and certified in the safe capture and translocation of venomous snakes and small fauna, ensuring animal welfare and staff safety.

Figure 2 Botanical drawing of *Aldrovanda vesiculosa*, referred to as Waterwheel Weed



The Contractor shall ensure that the appointed lead ecologist (with botanical competence) attends specialized, hands-on training at Makerere University prior to construction. This training will focus on the field identification and safe translocation of *Aldrovanda vesiculosa* should this plant be encountered along the transmission line alignment.

### Locating Construction Facilities

The locations for construction camps, quarries, material laydown areas, and any other sites to be disturbed beyond the direct project footprint must be identified prior to construction. All such locations must avoid natural habitats.

The Critical Habitat Assessment (CHA) distinguishes between modified and natural habitats, indicating that wetlands largely represent natural habitats, while terrestrial natural habitats are limited, occurring only in small, fragmented patches. Many of these represent small pockets of indigenous forest.

Accordingly, construction facilities must not be located within or near wetlands, rivers, streams, or natural drainage systems, and a minimum buffer of 50 meters must be maintained around these features. Small patches of natural forest must also be avoided, with an equivalent 50-meter buffer.

The Contractor will submit a construction layout plan for approval, supported by documentation of site inspections conducted by an experienced ecologist. These inspections will confirm that the proposed sites meet the ESS6 definition of modified habitat (refer to the CHA report) and that forests, wetlands, rivers, and drainage systems are fully avoided.

### Planning of Access Roads

The Project ESIAs require that the development of new access roads be kept to an absolute minimum, with preference given to using existing roads and tracks wherever possible. The Contractor will identify and map all existing access routes within the project area and indicate any sections where new roads are unavoidable in the construction layout plan submitted for approval. Any proposed new access routes must be carefully designed to avoid forests, wetlands, rivers, and drainage systems to the greatest extent practicable.

### Invasive Alien Species Control Plan

Before commencing construction, the Contractor shall prepare and submit an Invasive Alien Species (IAS) Control Plan for approval. The plan will identify all known IAS present within the project area and describe the specific control and disposal methods to be implemented. This BMP

prohibits the use of herbicides or chemical treatments for vegetation control. All removed IAS material shall be safely collected and incinerated, except within wetland areas, where burning is strictly prohibited to prevent further ecological damage.

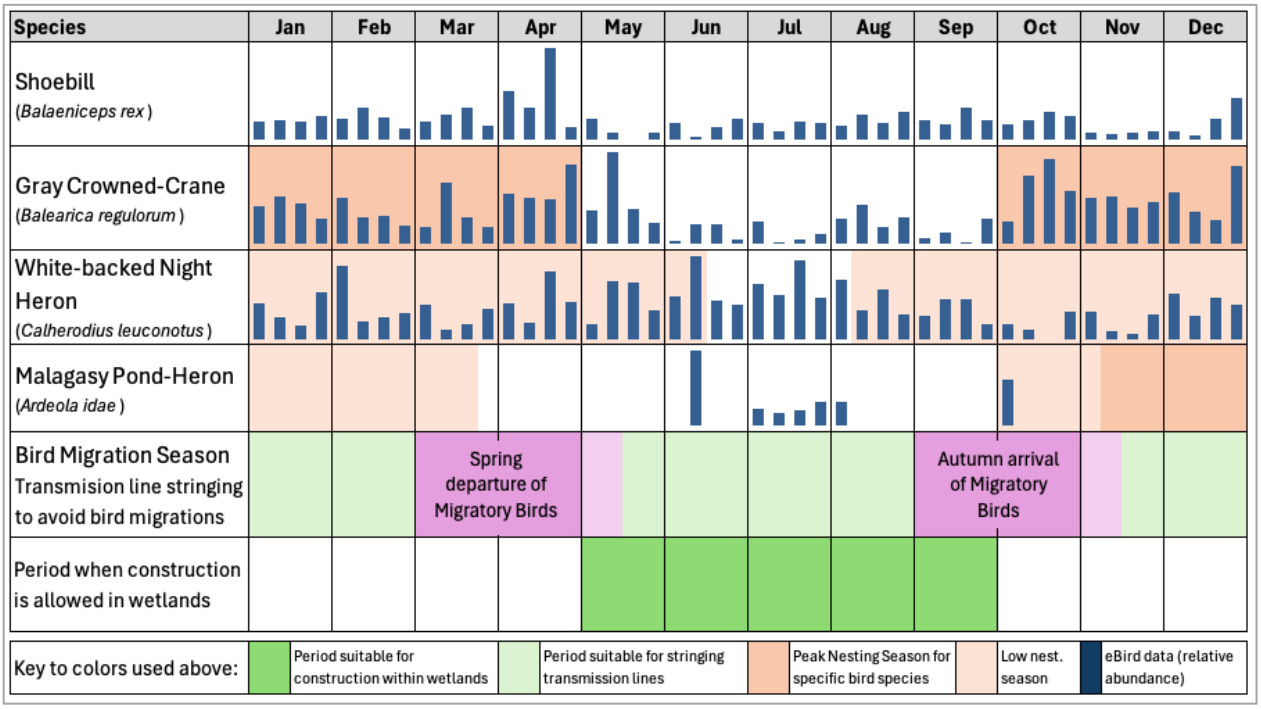
### Wetland Restoration Capacity

The Project description requires that all affected wetlands be restored to their original condition following construction. Mitigation measures outlined in the BMP emphasize the use of floating construction platforms and rapid pace of construction to minimize wetland disturbance. The Contractor must demonstrate technical capacity and experience in both minimizing construction-related disturbance and conducting effective wetland restoration upon completion of works.

### Seasonality of Construction Schedule

The BMP mandates that the construction schedule be aligned with ecological seasonality to avoid sensitive periods. Specifically, works within wetlands must be avoided during the breeding season of birds identified as critical habitat species (Table 2), and stringing of new transmission line wires must be avoided during peak bird migration periods. Figure 3 provides a seasonality chart highlighting restricted periods. The Contractor shall submit a detailed construction schedule that adheres to these seasonal constraints for approval prior to mobilization.

Figure 3 Seasonality chart identifying safe periods for construction within wetlands and avoidance of bird migrations



### Combat Illegal Wildlife Trade

Several critical-habitat bird species occurring in the project area are known to have a high value in the illegal wildlife trade (IWT). Construction activities could inadvertently facilitate such activities if not properly managed. The Contractor shall therefore prepare and submit a plan for preventing and managing IWT risks, consistent with the World Bank Good Practice Note on Managing the Risks of Illegal Wildlife Trade in Projects. The plan shall outline staff awareness measures, enforcement coordination, and incident-reporting procedures to ensure full compliance with biodiversity protection commitments.

## 5.3 Mitigation Measures for Construction and Operations

Table 8 presents the mitigation required to address biodiversity impacts identified in the ESIA documents (Table 3).

Table 8 Mitigation measures to address Project Impacts during the Construction and Operations Phases

| Mitigation Measure | Project Phase | | Responsibility for Implementation |
|---|---|---|---|
| | Construction | Operations | |
| **Impact on Terrestrial Habitats and Associated Flora** | | | |
| **Terrestrial Habitats - AVOIDANCE MEASURES** | | | |
| **Reduce the Project Footprint**<br>• Keep within the footprint of access road and works sites to reduce encroachment on natural habitats.<br>• Prior to clearing, identify and mark the vegetation to be preserved along sections of the ROW.<br>• Clearly demarcate the ROW at regular intervals. | Yes | Yes | Contractor |
| **Avoid the need for new Access Roads**<br>• Use existing roads and tracks to the full extent possible to minimize access road construction to reach the ROW. Reduce the size of constructed roads to minimum requirements.<br>• Optimize access road construction to minimize the need for access roads. | Yes | | Contractor |
| **Terrestrial Habitats - MINIMIZATION MEASURES** | | | |
| **Minimize Natural Vegetation Loss during Clearing**<br>• Undertake a selective cutting of the vegetation in the ROW, to retain native herbaceous and scrubby plants that are not a risk for the TL.<br>• Perform tree cutting manually.<br>• Initial vegetation clearing must be supervised by a botanist. If any plant species of conservation concern needs to be cut, the details will be fully documented, with data integrated into planning the reforestation program.<br>• Make chopped woody resources and residues available to local people to reduce additional pressures on natural resources. | Yes | Yes | Contractor |

| Mitigation Measure | Project Phase | | Responsibility for Implementation |
|---|---|---|---|
| | Construction | Operations | |
| **Control Invasive Alien Species (IAS)**<br>• Implement an IAS control program to prevent the establishment and propagation of such species.<br>• Burn residues of invasive alien species to reduce the risk of propagation to other areas. Burning only allowed away from wetlands.<br>• Prohibit the use of herbicides or other chemicals for vegetation clearing or maintenance of the ROW.<br>• Refer to IAS control for wetlands described below. | Yes | Yes | Contractor |
| **Terrestrial Habitats - RESTORATION MEASURES** | | | |
| **Restoration of Bare and Degraded Areas**<br>• Areas of bare and disturbed soils must be revegetated with native species as soon as possible.<br>• Botanist must validate species chosen and guide timing for restoration.<br>• Collect and use seeds from local plants where possible. | Yes | | Contractor |
| **Impact on Aquatic Habitats and Associated Fauna** | | | |
| **Aquatic Habitats - AVOIDANCE MEASURES** | | | |
| **Botanical Inspections prior to Construction**<br>• Wetlands must be inspected for the presence of *Aldrovanda vesiculosa*, an aquatic water plant (Figure 2) that floats within the water column.<br>• If this plant is present, it is to be safely moved to appropriate parts of the wetland that are not impacted.<br>• Samples are to be returned during wetland restoration, to avoid any residual impacts to these plants. | Yes | | |
| **Construction Access and in Wetlands and River Banks**<br>• Avoid equipment and vehicle movements in wetlands, floodplains and rivers to the extent possible.<br>• No permanent access roads will be constructed in wetlands, along river banks or in areas covered by hydromorphic soils.<br>• Acquire a NEMA wetland user permit prior to development of access roads or construction activities within or adjacent to wetlands.<br>• Avoid aquatic vegetation cutting and along stream shores to the extent possible. | Yes | Yes | Contractor |

| Mitigation Measure | Project Phase | | Responsibility for Implementation |
|---|---|---|---|
| | Construction | Operations | |
| **Aquatic Habitats - MINIMIZATION MEASURES** | | | |
| **Vegetation Clearing in Wetlands and River Banks**<br>• Undertake a selective cutting of the vegetation to retain low scrubby and herbaceous species that is not a risk for the transmission line.<br>• Prohibit the use of fire and open burning for vegetation clearing within wetlands. | Yes | Yes | Contractor |
| **Minimize the Construction Disturbance**<br>• Set and implement strict in-water works rules for activities in wetlands and/or affecting rivers and floodplains.<br>• Restrict all equipment movements to temporary access roads while working within wetlands.<br>• Apply a fast construction pace to minimize the duration of impact.<br>• Favor use of floating devices and manual maintenance.<br>• Only excavate the lower third of ditches during drainage ditch maintenance in order to maintain ditch slope stability.<br>• Maintain hydrologic connectivity with free flow of water between upstream and downstream in the work areas to maintain viable fish habitat.<br>• Strictly respect sound waste management practices. Do not throw any debris or waste into wetland or aquatic habitats. Remove any debris introduced accidentally into the aquatic environment as soon as possible. | Yes | | Contractor |
| **Control Invasive Alien Species (IAS)**<br>• Implement an IAS control program<br>• Clean construction equipment properly after working in areas known to be infested with IAS.<br>• Prohibit the use of herbicides or other chemicals for vegetation clearing or maintenance of the ROW. | Yes | Yes | Contractor |
| **Aquatic Habitats - RESTORATION MEASURES** | | | |
| **Wetland Restoration**<br>• Restore natural conditions of wetlands and river banks (minor bed, natural obstacles, etc.) immediately after completion of construction works.<br>• Backfill and restore all diversion canals once construction is over. | Yes | | Contractor |

| Mitigation Measure | Project Phase | | Responsibility for Implementation |
|---|---|---|---|
| | Construction | Operations | |
| • Properly manage waste and hazardous materials. | | | |
| **Impact on Terrestrial Fauna** | | | |
| **Terrestrial Fauna - AVOIDANCE MEASURES** | | | |
| **Management of the Workforce**<br>• Implement a biodiversity protection awareness program with workers.<br>• Implement the WBG Good Practice Note on mitigating Illegal Wildlife Trade (IWT), which involves the following tasks:<br>o Conduct appropriate risk assessments to determine the potential for illegal trade/wildlife crime and apply measures to detect and monitor the existence of such risks.<br>o Report and track incidences of illegal trade, project grievances, independent monitoring and informal discussions with Government authorities and civil society organizations.<br>o Provide anonymous and safe reporting mechanisms that are accessible to all staff, contract workers, authorities and communities, and promote awareness of these mechanisms.<br>o Ensure that actions taken against illegal trade are appropriately communicated to project workers, communities and other stakeholders as this greatly encourages further reports of illegal activity.<br>o Ensure that contractors and workers are signing off on the workers code of conduct that will expressly prohibit poaching and illegal wildlife trade.<br>o The PMU needs to partner with conservation authorities and organizations so that activities are coordinated with conservation efforts and initiatives in the nearby protected areas. | Yes | Yes | Contractor |
| **Fire Management**<br>• Develop and implement a fire management plan that:<br>o Prohibits the use of fire for clearing vegetation, including in wetlands.<br>o Minimizes the risk of fire arising from construction sites and camp sites. | Yes | Yes | Contractor |
| **Terrestrial Fauna - MINIMIZATION MEASURES** | | | |

| Mitigation Measure | Project Phase | | Responsibility for Implementation |
|---|---|---|---|
| | Construction | Operations | |
| **Manage Dangerous and Sensitive Fauna**<br>• Inform the environmental supervisor when dangerous or endangered fauna species are observed in or close to project sites.<br>• Handling Venomous Snakes: A trained and capable snake handler must be present or on call during vegetation clearing and excavation works to safely capture and translocate any snakes without harm. | Yes | Yes | Contractor |
| **Minimize Loss of Fauna during Construction**<br>• Opportunities to Escape from Trenches: Open trenches must include escape ramps or sloped ends at least every 50 m to allow large and small trapped fauna to exit safely. Trenches must be inspected daily and covered where feasible.<br>• Flush Areas Prior to Construction: An ecologist shall inspect and gently flush vegetation and surface depressions before site clearance to displace fauna and prevent accidental injury or mortality.<br>• Safely Relocate Any Fauna from Site: Any wildlife encountered during construction shall be captured and relocated by qualified personnel to suitable nearby habitat under the supervision of an ecologist.<br>• Limit Vehicle Speeds: Enforce a maximum vehicle speed limit of 20 km/h within work areas and 40 km/h on access roads to minimize collision risks to wildlife. | Yes | | Contractor |
| **Impact on Avifauna** | | | |
| **Avifauna - AVOIDANCE MEASURES** | | | |
| **Timing of Construction in Wetlands**<br>• Avoid construction within wetlands during breeding seasons for critical habitat waterbirds (see Figure 3). During such periods, construction will be done in non-wetland areas. | Yes | Yes | Contractor |
| **Timing of Transmission Line stringing**<br>• Line stringing of TLs will be scheduled to occur outside of the bird migration seasons, which occur from Mar to May, and Aug to Nov (see Figure 3). | Yes | | Contractor |
| **Wetland Inspection for Bird Nesting Activity**<br>• Prior to construction within wetlands, a competent ecologist will search each wetland for nesting activity by any of the critical habitat bird species (Table 2) within a 50-meter radius of the TL alignment. | Yes | | Contractor |

| Mitigation Measure | Project Phase | | Responsibility for Implementation |
|---|---|---|---|
| | Construction | Operations | |
| • Construction should be delayed if any of the birds in Table 2 show evidence of breeding. Alternatively all birds will be gently flushed from the wetlands prior to construction. | | | |
| **Avifauna - MINIMIZATION MEASURES** | | | |
| **Install Bird Flight Diverters to TL Wires**<br>• Mainstream measures into TL design to reduce bird collisions<br>• Available options include:<br>  o Design features: Bundle wires, Tower design with vertical rather that horizontal spread of lines; fit anti-perching and anti-nesting devices to towers; underground cabling (where possible) through sensitive sites.<br>  o Line marking with Bird Flight Diverters (BFD) to improve visibility<br>  - Devices must be suitable for affected bird species and local conditions. Some examples of BFDs, their advantages, limitations and suitability are provided in Table 6.<br>  - Install BFDs at spacing intervals of 5 to 10 m depending on species risk and habitat sensitivity.<br>  - BFDs are to be installed on 100% of high-risk spans within 1 month of stringing | Yes | Yes | UETCL and Conservation Partners (see Section 6.2)<br><br>Contractor |
| **Minimize Impacts to Nesting Birds**<br>• Complete tree and/or brush cutting prior to the main bird nesting season which is during Spring and Early Summer. | Yes | | Contractor |

## 5.4 Monitoring the effectiveness of Project Mitigation

Monitoring activities will be implemented through construction and operation to evaluate the effectiveness of biodiversity mitigation measures and to ensure that residual impacts remain within acceptable thresholds. The monitoring program will focus on key biodiversity values identified within the Project footprint and transmission corridor and will be implemented under the supervision of UETCL with support from the Contractor's Ecologist and Conservation Partners (NU and WCS).

### 5.4.1 Wetland Restoration Monitoring

Monitoring will assess the effectiveness of wetland restoration following construction activities and reinstatement of access routes, tower pads, and stringing areas. Parameters will include vegetation regeneration, hydrological recovery, and evidence of recolonization by wetland fauna. Permanent monitoring plots and photographic reference points will be established to track recovery over time. Performance will be measured against baseline conditions and restoration objectives outlined in the Wetland Management Plan. Any sites failing to demonstrate satisfactory regeneration will be targeted for adaptive restoration interventions.

### 5.4.2 Monitoring of Invasive Alien Species (IAS)

Regular inspections will be conducted along the TL route, access roads, and construction laydown areas to detect and control Invasive Alien Species (IAS). Surveys will be carried out quarterly during the first two years and biannually for the next 5 years. The monitoring will document IAS presence, abundance, and the effectiveness of applied control measures. Data will be recorded using a standardized mobile form and mapped in the Project's GIS database. Where infestations are identified, the Contractor will implement mechanical removal and safe disposal in accordance with the IAS Control Plan, ensuring no herbicides are used and that residues are disposed of without contaminating wetlands or watercourses.

### 5.4.3 Avifaunal Impact Monitoring Program

An avifaunal monitoring program will be established along the transmission corridor to quantify collision and electrocution incidents, evaluate the effectiveness of installed mitigation (e.g., Bird Flight Diverters), and identify any new hotspots. Monitoring will be conducted in partnership with trained community monitors and coordinated by NU as outlined and budgeted in Section 6.4.

### 5.4.4 Bat Mortality Monitoring Program

A complementary bat mortality monitoring program will be conducted to assess potential interactions between transmission infrastructure and bat populations, particularly near wetlands and forest fragments. Monitoring will be implemented by Conservation Partners and will build on the avifaunal monitoring outlined in Section 6.4. Findings will be used to identify high-risk

spans and to evaluate the need for targeted mitigation measures (e.g., installation of additional diverters or line marking). Results will be incorporated into a BNG performance database and reviewed annually as part of the Project's biodiversity audit.

### 5.4.5 Reporting and Adaptive Management

Monitoring results will be summarized in quarterly progress reports and supported by analysis in an Annual Biodiversity Monitoring Report. Results will inform adaptive management by identifying where mitigation measures are performing effectively and where corrective actions are needed. The findings will feed into UETCL's BNG accounting system and dashboard, ensuring continuous improvement and transparent reporting to ERA, NEMA, and World Bank.

# 6 BIODIVERSITY NET GAIN STRATEGY

## 6.1 Greening Old Transmission Lines

The "Greening Old Transmission Lines" initiative operationalizes the ESS6 Net Gain requirements through upgrading existing UETCL infrastructure to reduce ongoing biodiversity risks. Many existing TLs in Uganda, such as the 220 kV Kawanda–Masaka TL (commissioned 2018), lack bird-flight diverters (BFDs) or other avian-safe features. Retrofitting devices to these lines provides measurable additional biodiversity benefits that can offset residual impacts of the proposed 400 kV TL while improving system reliability and public perception of UETCL's environmental performance. This approach converts an operational liability (unmarked legacy lines) into a conservation asset that yields tangible (quantified) Biodiversity Net Gains (BNG) for sensitive bird species.

The specific objectives of this component are:

1. Demonstrate measurable Net Gain through reduced avian collision risk for critical habitat bird species (vultures, raptors, Shoebill, Gray Crowned Cranes, and various other large migratory waterbirds) along existing high-risk TL corridors, such as crossings of wetlands, rivers and known bird flyways.
2. Introduce retrofitting and innovation (e.g., UAV-based installation) within UETCL's maintenance framework.

This activity will yield measurable direct benefits for the critical habitat and other bird species. Additional benefits include establishing a precedent for greening old transmission lines, increased stakeholder confidence and the capacity for UETCL to achieve net gain for biodiversity without relying on setting aside offsets.

### Scope and Priority Corridors

A priority TL corridor for retrofitting bird protective devices is the Kawanda–Masaka 220 kV TL (ESDP, 2018), as this line crosses same wetlands as Wobulenzi–Masaka TL mitigation will improve the conservation of the same birds protected by Project mitigation.
Other TL candidates for retrofitting include:

- Tororo–Opuyo 132 kV TL — near Lake Kyoga wetland complex.
- Jinja–Nalubaale 132 kV TL — proximity to riverine roosts and crane foraging grounds.

### Technical Approach

a) Initial Planning

Identify specific lengths of operational TLs presenting high risk to critical habitat bird species where net gain benefits can be achieved through retrofitting BFDs. UETCL will establish conservation partnership with NU and WCS (Section 6.2), and initial planning for greening old TLs will present an initial task under those partnerships. Specific actions include:

- Compile a GIS overlay of existing TLs vs. bird-sensitivity layers using available data.;
- Define retrofit targets (number of BFD per span per km) and identify baseline monitoring points.

b) Diverter Specification, Technology Testing and Capacity Building

Technical specifications for improving avian safety will follow details provided in Section 5.2.1, although there is a challenge associated with retrofitting BFDs. Manual installation of BFDs to an existing TL is a laborious task, has inherent safety risks, and requires temporary shutdown of the TL operation, leading to a substantial loss of power supply and associated loss of income. However BFDs can be fitted using drone technology with an estimated 70% cost saving over traditional techniques. The skills required for retrofitting BFDs are not available in Uganda. Pilot fitting of BFDs should partner with experienced operators, a robotics lab in Switzerland is proposed for testing equipment, alternatively EWT South Africa. Specific actions include:

- Use drone-assisted live-line installation to avoid shutdowns and safety risks; pilot UAV retrofitting with EWT South Africa or robotics labs in Switzerland.
- Maintain QA/QC via drone imagery and as-built database.
- Procure or lease UAV systems; conduct field validation with ERA and AEFI.
- Train UETCL maintenance engineers in UAV operation, safety, and maintenance.
- Develop SOPs for national replication.

c) Monitoring and Evaluation

Implement Before-&-After Control (BAC) monitoring to quantify reduction in collision indicators (refer to and integrate results into NU/WCS biodiversity monitoring database. Section 6.4 outlines details of a monitoring program, which will gather quantifiable data for BAC monitoring.

**Governance and Partnerships**

- UETCL Environmental & Social Directorate with the Transmission Maintenance Department will take responsibility to lead this activity.
- Partners will include a Swiss robotics lab and potentially Endangered Wildlife Trust (EWT South Africa), and Conservation partners (Section 6.2).
- Reporting: A “Greening Old Lines” report will be generated as an output of the Conservation Partnerships, detailing km retrofitted, diverters installed, and cost- benefit analysis based on net gains achieved through collision-rate reduction. UETCL can use this report to showcase achievements through collaboration with other power utilities (Section 6.5).

### Indicative Budget

An estimate of BFD procurement and installment cost is presented in Table 5 for estimating the design cost of an avian safe TL, which reveals a BFD procurement cost of USD 5866/km. The budget presented in Table 9 is able to cover approx. 45 km of high risk. Although cost savings achieved through lessons learned from installation on the Wobulenzi-Masaka-Mutukula TL potentially allows extended greening of old TLs beyond a 45 km length.

Table 9 Cost estimation for greening old transmission lines

| Item | Description | Estimated Cost (USD) |
|---|---|---|
| Equipment testing & piloting | Import/lease of UAV systems + training | 75,000 |
| Bird Flight Diverter (BFD) procurement | BFD units + mounting hardware (3 to 6 m spacing) | 260,000 |
| Field logistics | Vehicles, travel, safety gear, permits | 100,000 |
| External expert review | EWT and Conservation Partners | 25,000 |
| Data & monitoring | Baseline + post-retrofit surveys, analysis | 40,000 |
| | **Total** | **500,000** |

### Next Steps

1. Prepare detailed Pilot Retrofit Plan (Phase 1) for 10 to 20 km of high-risk spans on the Kawanda–Masaka TL.
2. Launch UAV testing and training program with international partners.
3. Document lessons learned and update the Avian-Safe Corporate Policy for future integration into all O&M contracts.

## 6.2 Conservation Partnerships

Achieving lasting biodiversity net gain outlined within this BNG Strategy requires collaboration beyond UETCL's internal systems. A strategic Conservation Partnership Program will allow UETCL to leverage national and international expertise, data networks, and on-the-ground conservation capacity. An active partnership program can also strengthen Uganda's conservation infrastructure through the use and development of advanced skills.

Partnership is proposed with both Nature Uganda (NU, BirdLife affiliate) and Uganda Wildlife Conservation Society (WCS). These organizations can contribute expertise, provide scientific rigor, access to existing monitoring programs. A partnership program has the potential to build continuity in biodiversity monitoring to generate long term and measurable ecological improvements beyond project timelines.

The specific objectives of the Conservation Partnership program are:

1. Establish a long-term mechanism for collaboration between UETCL and national conservation NGOs for ecological monitoring, research, and policy alignment.
2. Implement joint avian-collision and electrocution monitoring, carcass searches, and mitigation verification along priority electrical infrastructure corridors.
3. Provide technical advisory services on species management, mitigation design, and ecological data standards.
4. Develop a national biodiversity data-sharing protocol that aligns with international ornithological standards, reports to NEMA and ERA, and contributes data to Uganda's National Biodiversity Strategy and Action Plan (NBSAP).

The partnership program will operate across five thematic pillars structured to utilize the expertise of each conservation partner, as outlined in Table 10.

Table 10 Thematic Pillars on which Conservation Partnerships should be established

| Thematic Pillar | Focus Activities | Key Partners |
|---|---|---|
| 1. Avian Collision and Electrocution Monitoring | Conduct standardized carcass searches, bias-correction trials, data validation, with reporting to a UETCL BNG dashboard. | Nature Uganda (NU, with BirdLife International guidance) |
| 2. Biodiversity Research and Data Management | Joint development of Uganda BNG avian database; species mapping; remote-sensing validation. | WCS Uganda |
| 3. Community Engagement and Citizen Science | Training of community monitors; awareness campaigns; participatory habitat restoration. | NU (with BirdLife/Wetlands International support) |
| 4. Technical Advisory and Policy Support | Expert review of design and mitigation; alignment with ERA and NEMA policies. | BirdLife International / AEFI (African-Eurasian Flyways Initiative) |
| 5. Capacity Building and Exchange (see Section 6.3) | South–South knowledge exchange with ESKOM–EWT (Endangered Wildlife Trust) partnership; regional workshops. | WCS / EWT / UETCL |

An implementation framework is required for establishment and operation of conservation partnerships. An initial framework is presented based on the following points, although this framework is expected to evolve as the partnership program develops:

1. Memorandum of Understanding (MoU): UETCL will negotiate and formalize partnerships with WCS and NU defining scope, deliverables, and data-ownership terms.
2. Annual Work Plan and Budget: Developed jointly and approved by UETCL Environmental & Social Directorate.

3. Technical Steering Committee: Comprising UETCL, NEMA, and PMU to review progress and approve monitoring protocols.
4. Field Coordination: Partner NGOs to deploy field teams for data collection, verification, and training.
5. Reporting: Quarterly technical briefs and an annual 'Biodiversity Partnership Report' integrated into a UETCL BNG Dashboard.

### Expected Outcomes of the Partnership Program

- Established UETCL–WCS–NU partnership delivering high-quality biodiversity data.
- Operational avian-monitoring network across major transmission corridors.
- Enhanced community participation and improved awareness of avian-safe practices.
- Shared national biodiversity datasets contributing to Uganda's conservation reporting.
- Documented Net Gain contributions verified by independent experts and recognized by ERA and World Bank.

### Indicative Budget

A budget is proposed for establishing and core maintenance of conservation partnerships (Table 11). The main task of these partnerships is the implementation of an avifaunal monitoring program (Section 6.4), which is budgeted separately.

Table 11 Indicative budget for establishing Conservation Partnerships

| Item | Description | Estimated Cost (USD) |
|---|---|---|
| Partnership framework & MOU | Legal drafting, consultations, and stakeholder inception | 20,000 |
| Partnership capacity building & South–South exchange | Study visits, workshops with ESKOM/EWT | 65,000 |
| Independent evaluation & reporting | Mid-term and final audits, lessons learned | 35,000 |
| | Total | 120,000 |

### Next Steps

1. Finalize and sign MOU with WCS and NU defining roles and deliverables.
2. Establish the Partnership Steering Committee and approve Year 1 Work Plan.
3. Launch pilot joint monitoring program along the Wobulenzi–Masaka–Mutukula 400 kV corridor.
4. Develop and populate the BNG Data Dashboard shared with NEMA and ERA.
5. Publish the first Annual Conservation Partnership Report summarizing results and lessons learned.

## 6.3 UETCL Capacity Building and Institutional Strengthening

UETCL's institutional capacity for biodiversity management is a necessity for effective management of conservation partnerships which will require considerable collaboration. UETCL require capacity to oversee biodiversity risk management, ensure data quality, and adaptively manage mitigation throughout the asset lifecycle. This component establishes a structured, multi-year capacity-building and institutional-strengthening program that embeds biodiversity competence across UETCL's technical, environmental, and operations teams.

The specific objectives are defined as:

1. Institutionalize biodiversity and avian-safe practices within UETCL's ESMS.
2. Build cross-departmental capacity (Engineering, O&M, PMU, and Procurement) to integrate biodiversity safeguards into project design, construction, and operation.
3. Establish standardized training curricula and competency frameworks for staff and contractors.
4. Develop long-term data-management, monitoring, and reporting systems for implementation of this BNG Strategy.
5. Create a knowledge-exchange mechanism linking UETCL with peer African utilities and global biodiversity platforms (see Section 6.5).

UETCL will strengthen its institutional framework for biodiversity management through several complementary measures. A dedicated Biodiversity Management Unit (BMU) will be required within the Environmental and Social (E&S) Directorate to coordinate all BNG-related actions and ensure consistent implementation across projects. Biodiversity performance indicators will be integrated into UETCL's corporate Key Performance Indicators (KPIs) and reflected in annual sustainability reporting to enhance accountability and transparency. To improve data management and efficiency, environmental workflows will be digitized through centralized GIS and data-analytics platforms, allowing real-time tracking of biodiversity metrics and incident reports. The utility will also develop Standard Operating Procedures (SOPs) for biodiversity risk screening, incident response, and adaptive management to standardize internal practices. In addition, formal partnerships and Memoranda of Understanding (MoUs) will be established with the Wildlife Conservation Society (WCS), NU, and BirdLife International for ongoing technical support and capacity building. Finally, the system will ensure that ESS6 requirements are fully aligned with UETCL's Environmental and Social Management System (ESMS) and associated standards, creating a unified institutional framework for biodiversity governance.

Table 12 presents six themes to be targeted through capacity building, which are structured to build capacity to lead the implementation of this BMP and specifically this BNG Strategy.

Table 12 Additional Capacity Building themes proposed for UETCL Institutional Strengthening on Biodiversity

| Capacity Theme | Focus Topics | Target Groups |
|---|---|---|
| 1. Avian Collision & Electrocution Monitoring | Field methods, carcass-search protocols, bias-correction trials, QA/QC of datasets | PMU staff, Environmental Officers, Community Field Monitors |
| 2. Community Engagement & Citizen Science | Participatory monitoring, awareness campaigns, benefit-sharing models | Field Supervisors, NGO Liaisons |
| 3. GIS & Data Analytics | Sensitivity mapping, mobile data workflows, AVISTEP-Uganda tool (future use). | GIS team, Supervising Engineers |
| 4. Biodiversity Net Gain Accounting | Bird risk quantification, baseline vs post-mitigation tracking, dashboard operation | E&S Directorate, Monitoring Unit |
| 5. Wetland Restoration and Habitat Management | Interaction between hydrology, vegetation, and transmission corridors; mitigation design | Engineers, Environmental Planners, Contractors |
| 6. Occupational Health & Safety in Field Ecology | Safe access protocols, UAV use, climbing/inspection safety, first-aid | Field Technicians, Contractors |

A three-phased Training Plan is proposed according to the following structure:

- Phase 1 (Year 1–2): Foundation Training – Introductory modules on ESS6, biodiversity monitoring, data standards, and safe-design principles; delivered with PMU, NU/WCS and BirdLife International.
- Phase 2 (Year 2–4): Specialist Certification – Advanced workshops on GIS, biodiversity accounting, and UAV-based inspections; staff certified as internal trainers.
- Phase 3 (Year 5 onwards): Institutionalization – Integration of biodiversity competencies into job descriptions, performance appraisals, and contractor pre-qualification requirements.

### Expected Outcomes

Specific outcomes expected from the Capacity Building and Institutional Strengthening program are:

- Operational Biodiversity and Ecosystem Management Unit within UETCL.
- Staff across engineering and environmental divisions trained to international biodiversity-management standards.
- Unified digital biodiversity-monitoring platform linked to UETCL's Corporate BNG Dashboard.
- Enhanced compliance and reporting capability under ESS6, and ERA requirements.
- Institutional resilience and reduced reliance on short-term consultants.

### Indicative Budget

Table 13 Indicative budget for Capacity Building and Institutional Strengthening

| Item | Description | Estimated Cost (USD) |
|---|---|---|
| Support a Biodiversity Manager to the BMU | Planned as a single person role supported for 6 years | 185,000 |
| Logistical support to BMU | General equipment budget | 160,000 |
| Training modules and curricula development | Course design, materials, translation, trainers | 20,000 |
| Field equipment and software | Tablets, UAVs, GPS, licenses, PPE | 50,000 |
| Staff training & certification workshops | Annual multi-disciplinary training cycles | 35,000 |
| Monitoring & evaluation | Program audits, feedback, continuous improvement | 20,000 |
| | Total | 470,000 |

### Next Steps

1. Approve the institutional-strengthening plan and allocate budget lines within the E&S Directorate's FY2025/26 Work Plan.
2. Sign partnership MoU with NU/WCS for joint training delivery and mentoring.
3. Initiate Phase 1 foundation training for PMU and field teams.
4. Develop and deploy the UETCL BNG Dashboard integrating monitoring data and KPIs.
5. Review progress annually and update the capacity-building plan every three years.

## 6.4 Avifaunal Impacts Monitoring Program

Monitoring bird interactions with electricity transmission infrastructure is fundamental to verifying the effectiveness of avoidance, minimization, and net gain measures covered in the BMP. A structured, science-based monitoring program enables UETCL to quantify residual impacts, track performance of mitigation measures (e.g., diverters, insulation covers), and provide the evidence base for adaptive management, regulatory compliance, and corporate Net Gain accounting.

Monitoring avifaunal impacts to transmission lines is challenging due to the often remote and extensive nature of power corridors, making systematic surveys logistically difficult and costly. Carcass detection biases from scavenger removal, vegetation cover, wetland inaccessibility, and observer error can lead to underestimation of bird collision and electrocution rates. Accurate species identification and cause-of-death attribution require skilled ornithologists and consistent

field protocols. In addition, data standardization and long-term funding constraints frequently limit continuity and comparability across projects and regions.

Table 16 presents an overview of known countries with effective and developing protocols for monitoring avifaunal impacts with transmission lines.

A monitoring program is proposed that aligns with ESS6 critical habitat requirements and applies methods from BirdLife International, the Endangered Wildlife Trust (EWT), and AEWA flyway monitoring protocols. The monitoring program must achieve the following five specific objectives:

1. Detect and record bird collisions, electrocutions, and nesting incidents (including attempted nesting) across all high- and medium-risk TL spans.
2. Evaluate the effectiveness of avian-safe design measures and diverter installations.
3. Establish a long-term dataset to inform future design improvements and cumulative-impact assessments.
4. Strengthen local capacity through participatory monitoring and citizen-science engagement.
5. Integrate monitoring outcomes into a UETCL BNG dashboard to quantify Net Gain achievements.

### Avifaunal Monitoring Program

Monitoring Framework

An initial approx. 5-year monitoring framework for is presented in Table 14, although the complexity of this framework is expected to evolve as it is implemented.

Table 14 Proposed framework for building an Avifaunal Impact Monitoring Program

| Project Phase | Key Activities | Frequency | Responsibility |
|---|---|---|---|
| Construction Phase | Planning and identification of high-risk TL spans for "greening" as outlined in Section 6.1. | Once off | Conservation Partnerships – UETCL/NU/WCS |
| | Weekly inspections in sensitive areas (wetlands, roosting zones); 24-hour incident reporting; stop-work triggers for endangered species incidents | Weekly / continuous during critical works | PMU Environmental Team, Contractor E&S staff |
| Early Operation (Years 1–2) | Stratified carcass searches across ≥ 10–15 km of spans; substation inspections; carcass persistence & search-efficiency trials; drone surveys of diverter integrity | Monthly during migration (Mar to May, Sep to Nov); Quarterly otherwise | Conservation Partnerships – UETCL/NU/WCS |

| Project Phase | Key Activities | Frequency | Responsibility |
|---|---|---|---|
| Long-Term (Years 3+) | Reduced-frequency surveys in hotspots; remote monitoring via UAVs and sensors; annual trend analysis | Bi-annual / Annual | UETCL E&S Directorate / ERA (Electricity Regulatory Authority) |

Actual details of the monitoring activities need to be developed to suit the field conditions in which they will be implemented and to meet the capacity and equipment availability of persons involved in their implementation. A detailed monitoring program therefore needs to be developed by the implementing partners, although the following methodology, use of citizen science and data analysis points provide an initial brief overview of the expected structure.

Methodology

1. Sampling Design: Stratified-random design selecting representative spans across risk strata (wetlands, ridges, plains).
2. Data Collection: Standardized mobile phone-based datasheets that record GPS, species ID, carcass condition, cause of mortality, tower ID, and photo evidence.
3. Bias Correction: Application of carcass persistence and searcher-efficiency factors to adjust raw mortality estimates.
4. Species Identification: Verification by NU/WCS ornithologists; voucher photos archived in UETCL's biodiversity database.
5. Data Storage: All records entered into a UETCL BNG monitoring database, that is GIS-linked with data analysis that supports dashboard presentation.
6. Adaptive Feedback: Results to be reviewed quarterly to adjust diverter density, maintenance intervals, or routing where high collision clusters occur.

Citizen Science and Community Participation

Regular routine monitoring is required which can be facilitated through community participation. UETCL will train and engage community monitors living near sensitive areas, such as wetlands, roosts, and transmission corridors to support field surveys. Participants will receive training, mobile data-collection tools, and stipends. This participatory approach has been successfully used by Wetlands International in Egypt and Tanzania, and promotes local ownership, enhances detection coverage, and builds public awareness of avian-safe practices.

Data Analysis and Reporting

- Key Performance Indicators:
  - Collision rate (# incidents / km / month)
  - Electrocution rate (# per substation / quarter)
  - Diverter integrity (% devices intact)

- Species diversity and threat status of incidents
- Performance Thresholds:
  - ≤ 2 bird fatalities per 100 km-month (after mitigation)
  - ≥ 98% diverters are intact at inspection cycle
  - Reduction ≥ 30 % in collision indicators vs baseline
- Reporting requirements:
  - Quarterly internal briefs and Annual Avian Interaction Report.
  - Shared with ERA, NEMA, and World Bank as part of ESS6 compliance.
  - Summary dashboards publicly disclosed through UETCL's website and partner networks.

### Expected Outcomes

- Reliable, bias-corrected dataset on bird collisions and electrocutions.
- Quantitative metrics feeding into a Net Gain accounting mechanism.
- Verified effectiveness of diverters, insulation covers, and avian-safe designs.
- Enhanced transparency through participatory, open-data reporting.
- Regional contribution to AEWA flyway knowledge and African Power Utility biodiversity platforms.

### Indicative Budget

Table 15 Indicative budget for establishing an Avifaunal Impact Monitoring Program

| Item | Description | Estimated Cost (USD) |
|---|---|---|
| Monitoring equipment | GPS units, binoculars, camera traps, drones | 100,000 |
| Training & capacity building | Field methods, data collection, QA/QC | 100,000 |
| Community monitor support | Stipends, communication tools, awareness materials | 75,000 |
| Data management systems | Mobile apps, GIS database, dashboard maintenance | 100,000 |
| External verification & audits | Independent ornithologist reviews, report validation | 50,000 |
| Logistics & travel | Vehicles, fuel, PPE for field teams | 75,000 |
| | Total | 500,000 |

### Next Steps

1. Finalize monitoring protocol and mobile forms through NU/WCS partnerships.
2. Procure monitoring equipment and train field teams.
3. Launch baseline surveys before energization of the 400 kV line.
4. Implement quarterly monitoring and adaptive management review.
5. Publish Annual Avian Interaction Reports and integrate findings into a UETCL BNG dashboard.

## 6.5 Collaboration with Other African Power Utilities

Biodiversity challenges related to transmission infrastructure, such as bird collisions, electrocutions, and habitat fragmentation, are shared across the African continent. Structured South–South collaboration can enable UETCL to exchange technical knowledge, build staff capacity, and fast-track adoption of proven solutions without duplicating costly trials. Partnering with established utilities like ESKOM (South Africa), ENDESA (Spain), KenGen (Kenya), and ICE (Costa Rica) will provide UETCL with real-world models of avian-safe design, monitoring, and corporate biodiversity governance aligned with ESS6. Many utilities have already developed mature avian-safe programs and biodiversity frameworks that UETCL can learn from (Table 16).

Table 16 Overview of various power utilities with partnerships for implementing avifaunal impact monitoring programs

| Country - Power Utility | Program Type | Collaboration Partners | Monitoring Maturity |
|---|---|---|---|
| South Africa - ESKOM | Long-term, national | EWT | Advanced |
| Spain - ENDESA / IBERDROLA | Legal & corporate | SEO/BirdLife | Well established |
| USA - PG&E, APLIC members | Industry-wide | USFWS, APLIC | Well established |
| Namibia - NamPower | Long-term | BirdLife Namibia | Well established |
| Germany - TenneT, 50Hertz | Legal mandate | NABU | Well established |
| Kenya - KETRACO | Pilot to national | Nature Kenya | Getting established |
| India - PGCIL | Pilot with research | BNHS | Getting established |
| Morocco/Egypt - ONÉE / EEHC | Flyway focus | AEWA / BirdLife | Developing |
| Tanzania - TANESCO | New (AEFI-supported) | BirdLife Africa | Early stage |

The following specific objectives are proposed for establishing collaboration with other African power utilities:

1. Facilitate peer-to-peer learning on avian-safe design, maintenance, and biodiversity monitoring.
2. Sharing best practices and SOPs on BFD installation, inspection, and reporting.
3. Participate in joint research and innovation on avian-friendly technologies, such as UAV installation, illuminated diverters, and AI-based incident detection.
4. Strengthen institutional credibility and regional leadership in biodiversity-positive energy infrastructure.
5. Build a long-term network of African utilities supporting cross-border conservation along shared migratory flyways.

Collaborations with other power utilities will evolve and each will establish its own cultural flavor of engagement and exchange of benefits, although Table 17 presents an overview of potential scope and activities with African utilities and conservation bodies.

Table 17 Proposed scope and activities for establishing collaboration with other African Power Utilities

| Focus Area | Description | Proposed Partners |
|---|---|---|
| Technical Exchanges | Study tours, webinars, and site visits to utilities with established biodiversity programs (e.g., ESKOM–EWT partnership). | ESKOM, ENDESA, EDF, KenGen, TANESCO |
| Joint Research and Pilots | Field trials of new bird diverters, insulated fittings, and UAV-based monitoring technologies. | BirdLife Africa, AEFI, regional NGOs |
| Data Sharing and Standardization | Adoption of regional data standards for avian collision and electrocution incidents; contribution to Africa-wide biodiversity datasets. | BirdLife International, AEFI, ERA |
| Training and Knowledge Transfer | Train-the-trainer programs on avian-safe practices, biodiversity accounting, and adaptive management. | EWT, NU, WCS |
| Policy and Regulatory Dialogue | Regional workshops to promote consistent biodiversity safeguards across African utilities. | World Bank and other MDBs |

### Implementation Framework

1. Framework Agreements: Establish MoUs with leading utilities and conservation organizations to formalize collaboration, technical exchange, and data sharing.
2. Regional Knowledge Platform: Participate in or co-host an African Avian-Safe Energy Forum to coordinate actions across flyways and grid corridors.
3. Joint Projects: Pilot transboundary initiatives focused on migratory birds (e.g., Rift Valley and Albertine Rift flyways).
4. Annual Exchange Program: Send UETCL staff to short-term attachments or workshops hosted by partner utilities (EWT/ESKOM, ENDESA, EDF).
5. Documentation and Dissemination: Publish annual “South–South Collaboration Report” as part of UETCL’s Corporate BNG reporting.

### Expected Outcomes

- Established network of African and global power utilities sharing avian-safe design standards.
- Measurable improvements in biodiversity management and incident reporting systems within UETCL.
- Enhanced technical capacity through participation in regional innovation pilots.
- Recognition of UETCL as a regional leader in biodiversity-positive infrastructure.
- Strengthened alignment between African power utilities on biodiversity safeguards and flyway conservation.

### Indicative Budget

A budget is proposed in Table 18 based on 6 areas of collaboration, although this budget will need to be refined and needs to be supplemented from other sources, and refined annually.

Table 18 Indicative budget for developing a collaboration with other African Power Utilities

| Item | Description | Estimated Costs (USD) |
|---|---|---|
| Framework MoUs & coordination | Legal agreements, travel, facilitation | 5,000 |
| Regional workshops and study visits | Peer learning, site demonstrations, seminars | 30,000 |
| Staff exchanges and mentoring | Attachments, training, virtual sessions | 35,000 |
| Documentation and reporting | Case studies, publications, dissemination | 5,000 |
| Contingency | Adaptive and unforeseen costs | 5,000 |
| | Total | 80,000 |

### Next Steps

1. Identify potential collaboration partners (ESKOM, ENDESA, TANESCO, EDF, BirdLife International).
2. Draft and sign framework MoUs outlining objectives and mutual commitments.
3. Organize the first Regional Avian-Safe Utilities Workshop hosted by UETCL in collaboration with NU/WCS.
4. Initiate exchange visits for UETCL engineers and environmental staff to partner utilities.
5. Integrate lessons learned into the UETCL Corporate BNG Implementation Plan (2025 - 2030).

# 7 INSTITUTIONAL RESPONSIBILITIES

This BMP forms an integral component of the Project ESMP, and its institutional structure aligns with that described therein.

UETCL will act as the Executing Agency for the Project. A Project Management Unit (PMU), established within UETCL and supported by technical and administrative staff, will hold overall responsibility for Project management, supervision, and compliance with all E&S safeguards, including the implementation of this BMP.

To ensure effective oversight of biodiversity-related measures, UETCL will establish a dedicated Biodiversity Management Unit (BMU). The BMU will provide coordination, technical oversight, and quality assurance for all biodiversity commitments under the Project. Its responsibilities will include:

- Supervising ecological monitoring programs and reviewing biodiversity plans prepared by Contractors (see Section 5.2.2);
- Ensuring alignment of all biodiversity actions with the BNG Strategy and ESS6 requirements;
- Managing partnerships with WCS, NU, and BirdLife International;
- Maintaining the BNG database and monitoring dashboard; and
- Compiling quarterly and annual biodiversity performance reports for submission to ERA, NEMA, and development partners.

Through these functions, the BMU will serve as the central mechanism for adaptive management, ensuring that biodiversity risks are effectively managed and that measurable Net Gain outcomes are achieved across all project phases.

While most of the risk and impact mitigation measures described in this BMP will be implemented by the Contractor and its subcontractors, the PMU will remain accountable for monitoring, verification, and enforcement. The PMU will supervise the Contractor's compliance, conduct periodic inspections, and require corrective actions where implementation is deemed inadequate.

The BNG Strategy will be implemented outside the Contractor's scope through a Conservation Partnership between UETCL and WCS/NU (see Section 6.2). This partnership will ensure that long-term biodiversity outcomes and monitoring commitments are sustained beyond the construction period.

# 8 COST ESTIMATE

Table 19 presents a forecast of the budget required for to implement this BMP. This budget addresses mitigation to address project impacts, and additional measures encompassed within the BNG Strategy. The BNG Strategy includes many sub-level budgets with breakdown of costs per component.

Table 19 Budget estimate for BMP implementation

| **BMP Component** | | **Amount (USD)** |
|---|---|---|
| **Project Preconstruction Planning and Preparation** | | |
| Adopting avian safe TL design ***Note (a)*** | | EPC Costs |
| Requirements on Contractors (staff, facilities, IAS, wetlands, seasonality, IWT) | | |
| **Project Mitigation for Construction and Operation Phases** ***Note (b)*** | | 80,000 |
| Terrestrial Habitats and Flora | • Reduce the Project Footprint and Access Roads<br>• Minimize Natural Vegetation Loss during Clearing<br>• Control Invasive Alien Species (IAS)<br>• Restoration of Bare and Degraded Areas | |
| Aquatic Habitats and Associated Fauna | • Botanical Inspections prior to Construction<br>• Vegetation Clearing in Wetlands and River Banks<br>• Minimize the Construction Disturbance<br>• Control Invasive Alien Species (IAS)<br>• Wetland Restoration | |
| Terrestrial Fauna | • Management of the Workforce<br>• Fire Management<br>• Manage Dangerous and Sensitive Fauna<br>• Minimize Loss of Fauna during Construction | |
| Avifauna | • Timing of Construction in Wetlands and TL Stringing<br>• Install Bird Flight Diverters to TL Wires<br>• Minimize Impacts to Nesting Birds | |
| **BIODIVERSITY NET GAIN STRATEGY** | | |
| 1. Greening old electrical transmission lines | | 500,000 |
| 3. Conservation Partnerships | | 120,000 |
| 2. UETCL Capacity Building and Institutional Strengthening | | 470,000 |
| 4. Avifaunal Impact Monitoring Program | | 500,000 |
| 5. Collaboration with other African Power Utilities | | 80,000 |
| **Total Budget** | | **1,750,000** |

**Note (a):** An indicative budget of USD 700,000 is estimated for developing an Avian Safe TL Design (Table 5). Activities require involvement of UETCL Conservation Partners, with costs allocated under the BNG Strategy.

**Note (b):** Contractor's costs are not included. The "Project Mitigation for Construction and Operation Phases" budget is provided for PMU supervision and oversight of implementation.